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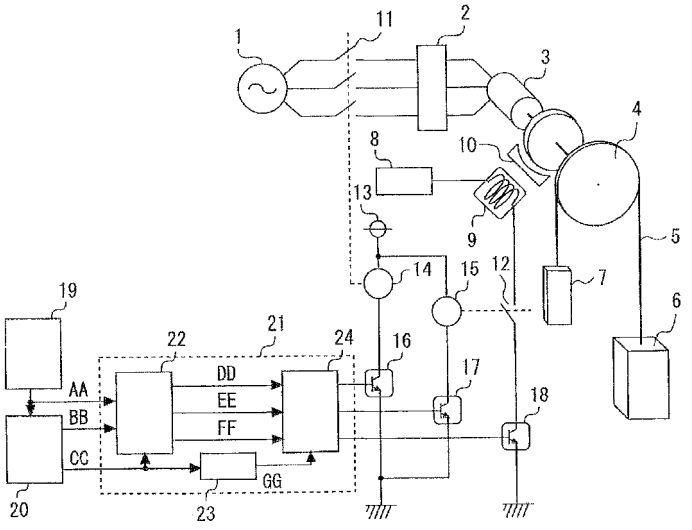
(54) **ELEVATOR DEVICE**

(57) There is provided an elevator apparatus that can control a motor power supply relay or the like even if a brake control device fails. To this end, the elevator apparatus includes: a relay having a function of blocking supply of electric power to a motor or a brake of an elevator; a driver that drives the relay; an operation control device that outputs a control signal to the driver; a brake control device that outputs a control signal according to a control signal output from the operation control device in normal time, and outputs a control signal independent of the control signal output from the operation control device in an emergency stop of the elevator; and a switching device that receives as an input the control signal output from the operation control device and the control signal output from the brake control device, and that switches the control signal to be output to the driver from the control signal output from the brake control device to the control signal output from the operation control device when the brake control device fails.

FIG. 1

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## Description

Technical Field

**[0001]** The present invention relates to an elevator apparatus.

Background Art

**[0002]** A conventional elevator apparatus controls a motor power supply relay or a brake power supply relay using a brake control device without following a command from an elevator control device in an emergency stop. With such an elevator apparatus, the brake control device can control the motor power supply relay or the like to move a car to an evacuation floor or the like (for example, see Patent Literature 1).

Citation List

Patent Literature

**[0003]**

Patent Literature 1: International Publication No. WO 2007/060733

Summary of Invention

Technical Problem

**[0004]** However, for the apparatus described in Patent Literature 1, when the brake control device fails and cannot control the motor power supply relay or the brake power supply relay, the car cannot be moved to the evacuation floor or the like. Thus, a user may be trapped in the car in an emergency stop.

**[0005]** The present invention is achieved in view of the above problem, and has an object to provide an elevator apparatus that can control a motor power supply relay or the like even if a brake control device fails.

Means for Solving the Problems

**[0006]** An elevator apparatus of the present invention includes a relay having a function of blocking supply of electric power to a motor or a brake of an elevator, a driver that drives the relay, an operation control device that outputs a control signal to the driver, a brake control device that outputs a control signal according to the control signal output from the operation control device in normal time, and outputs a control signal independent of the control signal output from the operation control device in an emergency stop of the elevator and a switching device that receives as an input the control signal output from the operation control device and the control signal output from the brake control device, and that switches the control signal to be output to the driver from the control signal output from the brake control device to the control signal output from the operation control device when the brake control device fails.

Advantageous Effect of Invention

**[0007]** According to the present invention, a motor power supply relay or the like can be controlled even if a brake control device fails.

Brief Description of the Drawings

**[0008]**

Figure 1 is a configuration diagram of an elevator apparatus according to Embodiment 2.
Figure 2 is a configuration diagram of an elevator apparatus according to Embodiment 2.

Description of Embodiments

**[0009]** Embodiments of the present invention will be described with reference to the accompanying drawings. In the drawings, the same or corresponding parts are denoted by the same reference numerals, and overlapping descriptions thereof will be simplified or omitted.

Embodiment 1

**[0010]** Figure 1 is a configuration diagram of an elevator apparatus according to Embodiment 1.
In Figure 1, reference numeral 1 denotes a motor power supply. Reference numeral 2 denotes a power conversion device. Reference numeral 3 denotes a motor. The motor 3 is rotated by electric power supplied from the motor power supply 1 via the power conversion device 2.

**[0011]** Reference numeral 4 denotes a sheave. The sheave 4 is rotated with rotation of the motor 3. Reference numeral 5 denotes a main rope. The main rope 5 is wound around the sheave 4. Reference numeral 6 denotes a car. The car 6 is connected to one end of the main rope 5. Reference numeral 7 denotes a counterweight. The counterweight 7 is connected to the other end of the main rope 5.

**[0012]** Reference numeral 8 is a brake power supply. Reference numeral 9 is a brake coil. Reference numeral 10 is a brake shoe. The brake shoe 10 provides a braking force to the motor 3 on the basis of a biasing force of a spring (not shown) and an electromagnetic force generated by a current flowing through the brake coil 9.

**[0013]** Reference numeral 11 is a motor power supply relay contact. The motor power supply relay contact 11 is constituted by a normally open contact. The motor power supply relay contact 11 is provided on a wire between the motor power supply 1 and the power conversion device 2. Reference numeral 12 denotes a brake power supply relay contact. The brake power supply contact 12 is constituted by a normally open contact. The brake pow-

er supply contact 12 is provided on a brake coil wire between the brake coil 9 and the around.

**[0014]** Reference numeral 13 denotes a relay power supply. Reference numeral 14 denotes a motor power supply relay coil. The motor power supply relay coil 14 is placed on a motor power supply relay wire of the relay power supply 13. The motor power supply relay coil 14 controls closing and opening of the motor power supply relay contact 11.

**[0015]** Reference numeral 15 denotes a brake power supply relay coil. The brake power supply relay coil 15 is placed on a brake power supply relay wire between the relay power supply 13 and the ground. The brake power supply relay coil 15 controls closing and opening of the brake power supply relay contact 12.

**[0016]** Reference numeral 16 denotes a motor power supply relay driver. The motor power supply relay driver 16 is constituted by a transistor. The motor power supply relay driver 16 is connected in series to the motor power supply relay coil 14 on the motor power supply relay wire.

**[0017]** Reference numeral 17 denotes a brake power supply relay driver. The brake power supply relay driver 17 is constituted by a transistor. The brake power supply relay driver 17 is connected in series to the brake power supply relay coil 15 on the brake power supply relay wire.

**[0018]** Reference numeral 18 denotes a brake coil current control driver. The brake coil current control driver 18 is constituted by a transistor. The brake coil current control driver 18 is connected in series to the brake coil 9 and the brake power supply relay contact 12 on the brake coil wire.

**[0019]** Reference numeral 19 denotes an operation control device. The operation control device 19 controls an operation of the elevator. For example, the operation control device 19 outputs a control signal AA to the drivers 16 to 18.

**[0020]** Reference numeral 20 denotes a brake control device. To the brake control device 20, the control signal AA is input from the operation control device 19. The brake control device 20 outputs a control signal BB to the drivers 16 to 18 according to the control signal AA in normal time.

**[0021]** Further, when an emergency stop signal is input to the brake control device 20 from an seismic sensor or the like (not shown), the brake control device 20 does not follow the control signal AA from the operation control device 19, but independently outputs the control signal BB to the drivers 16 to 18.

**[0022]** In this embodiment, the brake control device 20 outputs a failure detection signal CC when detecting its failure by a self-diagnosis function. The failure detection signal CC is input to a switching device 21. Besides the control signal BB, the control signal AA is directly input to the switching device 21 without via the brake control device 20. A configuration of the switching device 21 will be specifically described below.

**[0023]** The switching device 21 includes a signal switching circuit 22, a signal blocking timer 23, and a signal blocking circuit 24. To the signal switching circuit 22, the control signal AA, the control signal BB, and the failure detection signal CC are input. The signal switching circuit 22 outputs a control signal DD to the motor power supply relay driver 16, a control signal EE to the brake power supply relay driver 17, and a control signal FF to the brake coil current control driver 18.

**[0024]** To the signal blocking timer 23, the failure detection signal CC is input. The signal blocking timer 23 outputs a blocking command GG after a lapse of a preset certain time from the input of the failure detection signal CC. To the signal blocking circuit 24, the control signals DD, EE and FF and the blocking command GG are input.

**[0025]** In the elevator apparatus having such a configuration, the brake control device 20 outputs the control signal BB according to the control signal AA of the operation control device 19 in normal time. The signal switching circuit 22 outputs the control signals DD, EE and FF according to the control signal BB.

**[0026]** The control signals DD, EE and FF are input to the signal blocking circuit 24. The signal blocking circuit 24 transmits the control signals DD, EE and FF to control terminals of the drivers 16 to 18. Then, the drivers 16 to 18 are respectively operated according to the control signals DD, EE and FF. According to these operations, supply of electric power to the motor 3 and the brake coil 9 is controlled.

**[0027]** In contrast to this, in an emergency stop, the brake control device 20 does not follow the control signal AA of the operation control device 19, but independently outputs the control signal BB for controlling reduction of deceleration of the elevator. Then, the signal switching circuit 22 outputs the control signals DD, EE and FF according to the independent control signal BB.

**[0028]** The control signals DD, EE and FF are input to the signal blocking circuit 24. The signal blocking circuit 24 transmits the control signals DD, EE and FF to the control terminals of the drivers 16 to 18, respectively. Then, the drivers 16 to 18 are respectively operated according to the control signals DD, EE and FF. According to these operations, the supply of electric power to the motor 3 and the brake coil 9 is controlled. According to the operations of the motor 3 and the brake shoe 10, the reduction of deceleration of the elevator is controlled.

**[0029]** In this embodiment, when the failure detection signal CC is input to the signal switching circuit 22, the signal switching circuit 22 switches the control signals DD, EE and FF to be output to the signal blocking circuit 24 to those according to the control signal AA. At this time, the operation control device 19 outputs the control signal AA for moving the car 6 to a predetermined evacuation floor within a certain time from the input of the failure detection signal CC. According to the control signal AA, the signal switching circuit 22 outputs the control signals DD, EE and FF.

**[0030]** The control signals DD, EE and FF are input to the signal blocking circuit 24. The signal blocking circuit 24 transmits the control signals DD, EE and FF to the

control terminals of the drivers 16 to 18, respectively. Then, the drivers 16 to 18 are respectively operated according to the control signals DD, EE and FF. According to these operations, the supply of electric power to the motor 3 and the brake coil 9 is controlled. According to the operations of the motor 3 and the brake shoe 10, the car 6 is moved to the predetermined evacuation floor.

**[0031]** After a certain time has elapsed from the failure of the brake control device 20, the signal blocking timer 23 outputs the blocking command GG. The signal blocking circuit 24 blocks the transmission of the control signals DD, EE and FF when the blocking command GG is input. Thus, the supply of electric power to the motor power supply relay coil 14 and the brake power supply relay coil 15 is blocked, and application of a voltage to the brake coil 9 is stopped. Specifically, a stopping state of use of the elevator is maintained.

**[0032]** According to Embodiment 1 described above, when the brake control device 20 fails, the switching device 21 switches the control signal to be output to the drivers 16 to 18 from the control signal BB output from the brake control device 20 to the control signal AA output from the operation control device 19. Thus, even if the brake control device 10 fails, the supply of electric power to the motor power supply relay coil 14 or the like can be controlled to prevent a user from being trapped in the car.

**[0033]** The switching device 21 blocks the transmission of the control signals DD, EE and FF to the drivers 15 to 18 after a lapse of a certain time from the input of the failure detection signal CC. Specifically, the signal blocking circuit 24 blocks the transmission of the control signals DD, EE and FF to the drivers 16 to 18 when the blocking command GG is input.

**[0034]** Thus, after the user in the car 6 is rescued on the evacuation floor or the like, the use of the elevator can be stopped, This can prevent accidental use of the elevator during the failure of the brake control device 20.

Embodiment 2

**[0035]** Figure 2 is a configuration diagram of an elevator apparatus according to Embodiment 2. The same or corresponding parts as or to those in Embodiment 1 are denoted by the same reference numerals, and descriptions thereof will be omitted.

**[0036]** In Embodiment 1, after a lapse of a certain time from the failure of the brake control device 20, the transmission of the control signals DD, EE and FF is blocked. On the other hand, in Embodiment 2, when a brake control device 20 seriously fails, transmission of control signals DD, EE and FF is immediately blocked. In Embodiment 2, soundness of a signal blocking timer 23 is diagnosed. Embodiment 2 will be now described in detail.

**[0037]** As shown in Figure 2, in this embodiment, a brake control device 20 outputs a serious failure detection signal HH when detecting a more serious failure than that in output of a failure detection signal CC by a self-diagnosis function. When the serious failure detection signal HH is input to a signal blocking circuit 24, the signal blocking circuit 24 immediately blocks transmission of the control signals DD, EE and FF.

**[0038]** In this embodiment, a motor power supply relay diagnostic contact 25 and a brake power supply relay diagnostic contact 26 are provided. The contacts 25 and 26 are constituted by normally closed contacts. Contact signals II and JJ thereof are input to the brake control device 20. Thus, the brake control device 20 detects operation states of a motor power supply relay coil 14 and a brake power supply coil 15.

**[0039]** Further, the signal blocking circuit 24 sets a blocking flag KK when blocking the transmission of the control signals DD, EE and FF. The blocking flag KK is input to the brake control device 20. Thus, the brake control device 20 detects an operation state of the signal blocking circuit 24.

**[0040]** In the elevator apparatus having such a configuration, in the case without any call registration, the brake control device 20 outputs a false failure detection signal CC during outputting a control signal BB for driving the relay coils 14 and 15 to the motor power supply relay driver 16 and the brake power supply relay driver 17.

**[0041]** At this time, if the signal blocking timer 23 is sound, the transmission of the control signals DD and EE should not be blocked before a lapse of a certain time. Thus, when the blocking flag KK is first input to the brake control device 20 after a lapse of a certain time from the output of the false failure detection signal CC, the brake control device 20 diagnoses that the signal blocking timer 23 is sound.

**[0042]** The brake control device 20 outputs a false serious failure detection signal HH during outputting the control signal BB for driving the relay coils 14 and 15 to the motor power supply relay driver 16 and the brake power supply relay driver 17.

**[0043]** At this time, if the signal blocking timer 23 is sound, the transmission of the control signals DD and EE should be immediately blocked before a lapse of a certain time from the output of the false serious failure detection signal HH. For a serious failure, it is also important to confirm that the driving of the relay coils 14 and 15 is actually stopped.

**[0044]** Thus, the brake control device 20 diagnoses that the signal blocking timer 23 is sound when confirming that the blocking flag KK is input before a lapse of a certain time from the output of the failure detection signal HH, and also confirming the input of the contact signals II and JJ of the diagnostic contacts 25 and 26.

**[0045]** According to Embodiment 2 described above, when the brake control device 20 seriously fails, the transmission of the control signals DD, EE and FF is immediately blocked. This allows an immediate stop of use of the elevator when the brake control device 20 seriously fails.

**[0046]** The brake control device 20 outputs the false failure detection signal CC and the false serious failure detection signal HH during outputting the control signal

BB to the motor power supply relay driver 16 and the brake power supply relay driver 17 to diagnose soundness of the signal blocking timer 23. Thus, the failure of the signal blocking timer 23 does not block the output of the control signals DD and EE when the brake control device 20 actually fails.

Industrial Applicability

**[0047]** As described above, the elevator apparatus according to the present invention can be used for an elevator for controlling the motor power supply relay or the brake power supply relay using the brake control device without following a command from an elevator control device in an emergency stop.

Description of symbols

**[0048]**

1 motor power supply, 2 power conversion device, 3 motor,
4 sheave, 5 main rope, 6 car, 7 counterweight,
8 brake power supply, 9 brake coil, 10 brake shoe,
11 motor power supply relay contact, 12 brake power supply relay contact,
13 power supply, 14 motor power supply relay coil,
15 brake power supply relay coil, 16 motor power supply relay driver,
17 brake power supply relay driver, 18 brake coil current control driver,
19 operation control device, 20 brake control device,
21 switching device, 22 signal switching circuit,
23 signal blocking timer, 24 signal blocking circuit,
25 motor power supply relay diagnostic contact,
26 brake power supply relay diagnostic contact.

## Claims

**1.** An elevator apparatus comprising:

a relay having a function of blocking supply of electric power to a motor or a brake of an elevator;
a driver that drives the relay;
an operation control device that outputs a control signal to the driver;
a brake control device that outputs a control signal according to the control signal output from the operation control device in normal time, and outputs a control signal independent of the control signal output from the operation control device in an emergency stop of the elevator; and
a switching device that receives as an input the control signal output from the operation control device and the control signal output from the brake control device, and that switches the control signal to be output to the driver from the control signal output from the brake control device to the control signal output from the operation control device when the brake control device fails.

**2.** The elevator apparatus according to claim 1, wherein the brake control device outputs a failure detection signal in failure time,
the switching device switches the control signal to be output to the driver from the control signal output from the brake control device to the control signal output from the operations control device when the failure detection signal is input, and blocks transmission of the control signal to the driver after a lapse of a certain time from the input of the failure detection signal.

**3.** The elevator apparatus according to claim 2, wherein the switching device includes:

a signal switching circuit that receives as an input the control signal output from the operation control device and the control signal output from the brake control device, and that switches the control signal to be output from the control signal output from the brake control device to the control signal output from the operation control device when the failure detection signal is input;
a signal blocking timer that outputs a blocking command after a lapse of a certain time from the input of the failure detection signal; and
a signal blocking circuit that transmits the control signal output from the signal switching circuit to the driver, and blocks the transmission of the control signal to the driver when the blocking command is input.

**4.** The elevator apparatus according to claim 3, wherein the brake control device outputs a serious failure detection signal when a more serious failure occurs than that in the output of the failure detection signal, and
the signal blocking circuit blocks the transmission of the control signal to the driver when the serious failure detection signal is input.

**5.** The elevator apparatus according to claim 4, wherein the brake control device outputs a false failure detection signal during outputting a control signal for driving the relay, and confirms that the signal blocking circuit blocks the transmission of the control signal to the driver after a lapse of a certain time,
outputs a false serious failure detection signal during outputting the control signal for driving the relay and, and confirms that the signal blocking circuit blocks the transmission of the control signal to the driver before a lapse of a certain time and that the driving

of the relay is stopped,
to diagnose soundness of the signal blocking timer.

FIG. 1

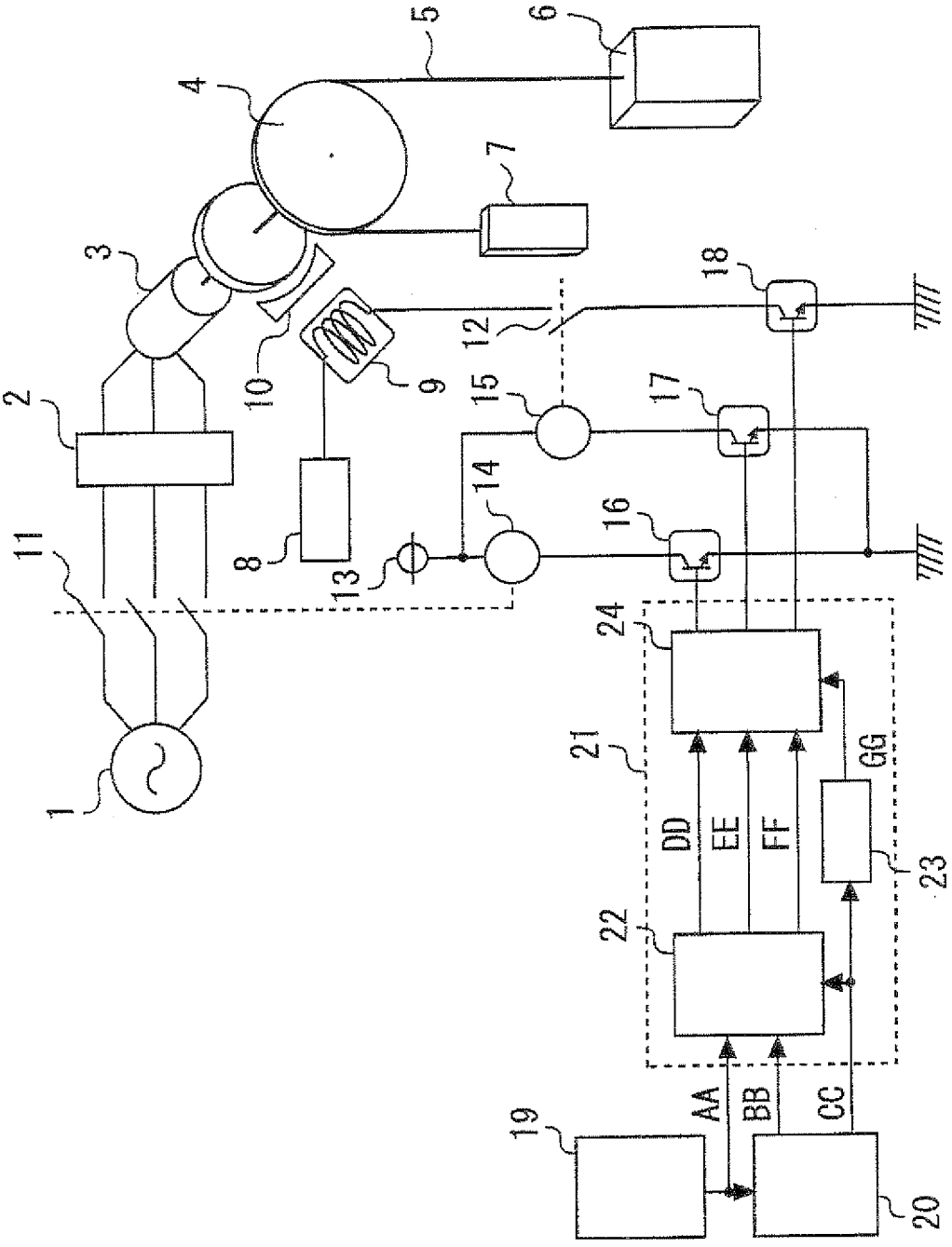
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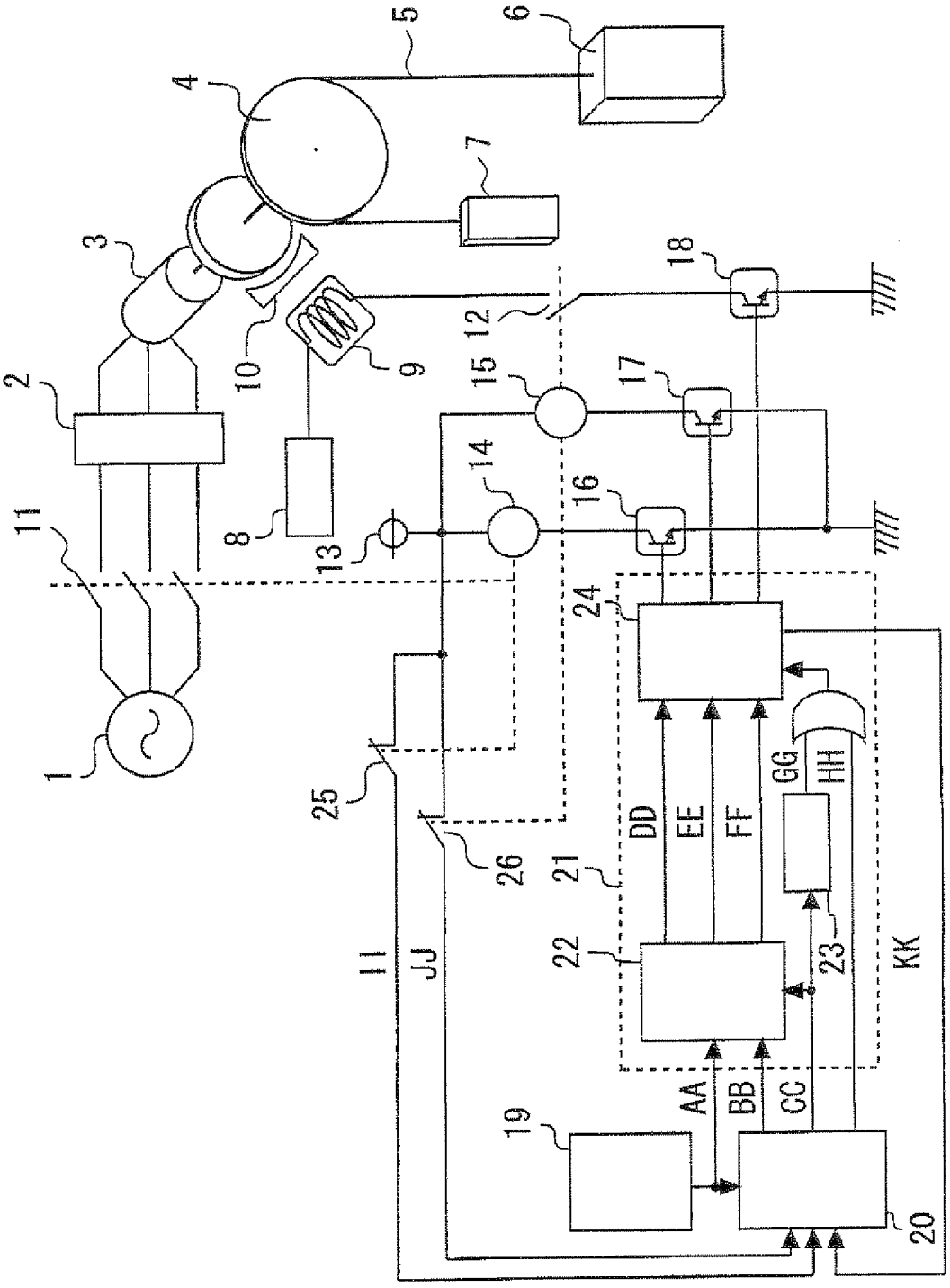
FIG. 2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**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2009/070890

A. CLASSIFICATION OF SUBJECT MATTER
*B66B5/02*(2006.01)i, *B66B1/32*(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, B66B1/32

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. |
|---|---|---|
| A | WO 2008/012896 A1 (Mitsubishi Electric Corp.), 31 January 2008 (31.01.2008), entire text; all drawings & US 2009/0255764 A & EP 2048104 A1 | 1-5 |
| A | WO 2007/108069 A1 (Mitsubishi Electric Corp.), 27 September 2007 (27.09.2007), paragraphs [0008] to [0019]; fig. 1 & EP 1997764 A1 & CN 101128379 A | 1-5 |
| A | JP 6-239542 A (Hitachi, Ltd.), 30 August 1994 (30.08.1994), entire text; all drawings (Family: none) | 1-5 |

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

* Special categories of cited documents:
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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 29 March, 2010 (29.03.10) | 06 April, 2010 (06.04.10) |
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## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- WO 2007060733 A **[0003]**