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(54) **ELEVATOR DEVICE**

**AUFZUGSVORRICHTUNG**

**DISPOSITIF D'ASCENSEUR**

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**Description****TECHNICAL FIELD**

**[0001]** The present invention relates to an elevator apparatus for raising and lowering a car by driving forces of a plurality of driving machines.

**BACKGROUND ART**

**[0002]** In a conventional elevator apparatus, a car is raised and lowered by a first driving machine and a second driving machine which are provided in an upper portion of a hoistway. The car is provided with a sensor for detecting an inclination of the car. During traveling of the car, the first and second driving machines are controlled so as to cancel the inclination of the car according to signals from the sensor (see, for example, Patent Document 1).

**[0003]** Further, a braking device for an elevator provided with a first brake coil arranged in response to a first brake and a second brake coil arranged in response to a second brake is known from Patent Document 2. Coil exciting circuits for exciting the brake coils, respectively, a contact point for cutting off an electric power at elevator stopping time and a voltage holding circuit are disposed. Further, the first coil exciting circuit discharges a coil current to the voltage holding circuit from the first brake coil when cutting off the power source, and the second coil exciting circuit delays the attenuation of the coil current of the second brake coil by using electric energy accumulated in the voltage holding circuit when cutting off the power source.

**[0004]**

Patent Document 1: WO 2004/026749 A1

Patent Document 2: JP 2001 146366 A

**[0005]** Document EP 1 538 121 discloses an elevator apparatus driven by plurality of driving machines with brakes controlled to balance the load.

**DISCLOSURE OF THE INVENTION****PROBLEM TO BE SOLVED BY THE INVENTION**

**[0006]** In the conventional elevator apparatus as described above, when braking timings of brake devices of a first driving machine and a second driving machine are deviated from each other at the time of emergency braking, an inclination of the car is generated, so there is a fear of the passenger in the car experiencing discomfort.

**[0007]** The present invention has been made with a view toward solving the above-mentioned problem. It is an object of the present invention to provide an elevator apparatus capable of restraining generation of an inclination of the car at the time of emergency braking.

**MEANS FOR SOLVING THE PROBLEM**

**[0008]** An elevator apparatus according to the present invention includes the features of claim 1 and in particular: a plurality of driving machines; a car that is raised and lowered by driving forces of the driving machines; and a plurality of brake devices for braking the ascent and descent of the car, in which the brake devices have a plurality of brake main bodies belonging to a plurality of different groups, and in which, at the time of emergency braking, the brake devices generate braking forces by the brake main bodies with timings deviated from group to group.

**BRIEF DESCRIPTION OF THE DRAWINGS****[0009]**

[Fig. 1] Fig. 1 is a schematic view of an elevator apparatus according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a circuit diagram showing driving circuits for first through sixth electromagnetic coils of Fig. 1.

[Fig. 3] Fig. 3 is an explanatory view illustrating a difference in operation between brake main bodies due to a difference in electric resistance value between resistors of Fig. 2.

[Fig. 4] Fig. 4 is a circuit diagram showing driving circuits for first through sixth electromagnetic coils of an elevator apparatus according to Embodiment 2 of the present invention.

[Fig. 5] Fig. 5 is a block diagram showing a control portion for controlling first through sixth selection switches of Fig. 4.

[Fig. 6] Fig. 6 is a block diagram showing a control portion for controlling first through sixth selection switches of an elevator apparatus according to Embodiment 3 of the present invention.

[Fig. 7] Fig. 7 is a circuit diagram showing driving circuits for first through sixth electromagnetic coils of an elevator apparatus according to Embodiment 4 of the present invention.

[Fig. 8] Fig. 8 is an explanatory view showing a difference in contact opening operation between electromagnetic switch devices due to a difference in electric resistance value between resistors of Fig. 7.

**BEST MODE FOR CARRYING OUT THE INVENTION**

**[0010]** In the following, preferred embodiments of the present invention will be described with reference to the drawings.

**Embodiment 1**

**[0011]** Fig. 1 is a schematic view of an elevator apparatus according to Embodiment 1 of the present inven-

tion. In the drawing, first and second driving machines (i.e., hoists) 1 and 2 are installed in an upper portion of a hoistway. The first driving machine 1 has a first driving sheave 3, a first motor 4 for rotating the first driving sheave 3, a first brake drum 5, which is a brake rotary member to be rotated integrally with the first driving sheave 3, and a first brake device 6 for braking the rotation of the first brake drum 5.

[0012] The second driving machine 2 has a second driving sheave 7, a second motor 8 for rotating the second driving sheave 7, a second brake drum 9, which is a brake rotary member to be rotated integrally with the second driving sheave 7, and a second brake device 10 for braking the rotation of the second brake drum 9.

[0013] A plurality of first main ropes 11 (only one of which is shown in the drawing) are wound around the first driving sheave 3. A plurality of second main ropes 12 (only one of which is shown in the drawing) are wound around the second driving sheave 7.

[0014] A car 13 is connected to first end portions of the first and second main ropes 11 and 12. A first counterweight 14 is connected to second end portions of the first main ropes 11. A second counterweight 15 is connected to second end portions of the second main ropes 12. That is, the car 13 and the first and second counterweights 14 and 15 are suspended in the hoistway by the first and second main ropes 11 and 12 through a 1:1 roping system, and are raised and lowered in the hoistway by the driving forces of the first and second driving devices 1 and 2.

[0015] Provided on the car 13 are a first rope connecting portion 13a and a second rope connecting portion 13b arranged on the opposite side of the first rope connecting portion 13a with respect to the center of gravity of the car 13. In a vertical projection plane, the first and second rope connecting portions 13a and 13b are arranged symmetrically with respect to the center of gravity of the car 13. The first main ropes 11 are connected to the first rope connecting portion 13a, and the second main ropes 12 are connected to the second rope connecting portion 13b.

[0016] The first brake device 6 has first through third brake main bodies 16a through 16c belonging to a plurality of different groups (here, first through third groups). The second brake device 10 has fourth through sixth brake main bodies 16d through 16f belonging to a plurality of different groups (here, first through third groups).

[0017] To be more specific, the first and fourth brake main bodies 16a and 16d belong to the first group, the second and fifth brake main bodies 16b and 16e belong to the second group, and the third and sixth brake main bodies 16c and 16f belong to the third group.

[0018] The first brake main body 16a has a first brake shoe 17a to be brought into and out of contact with the braking surface of the first brake drum 5, a first brake spring (i.e., mechanical spring) 18a for pressing the first brake shoe 17a against the first brake drum 5, a first iron core 19a fixed to the first brake shoe 17a, and a first

electromagnetic coil 20a for attracting the first iron core 19a to thereby separate the first brake shoe 17a from the first brake drum 5.

[0019] Like the first brake main body 16a, the second through sixth brake main bodies 16b through 16f have brake shoes 17b through 17f, brake springs 18b through 18f, iron cores 19b through 19f, and electromagnetic coils 20b through 20f, respectively.

[0020] Fig. 2 is a circuit diagram showing driving circuits for the first through sixth electromagnetic coils 20a through 20f. Electric currents from first through sixth brake attraction amplifiers 21a through 21f are supplied to the electromagnetic coils 20a through 20f through an electromagnetic switch device 22, respectively.

[0021] The electromagnetic switch device 22 has first through sixth contacts 22a through 22f connected between the brake attraction amplifiers 21a through 21f and the electromagnetic coils 20a through 20f, respectively, and an opening/closing drive portion 22g for opening and closing the contacts 22a through 22f. The opening/closing drive portion 22g has an iron core 22h, a switch coil 22i wound around the iron core 22h, and a resistor 22j and a diode 22k connected in parallel to the switch coil 22i.

[0022] The contacts 22a through 22f are normally closed. However, when an emergency stop command signal is input to the opening/closing drive portion 22g, the contacts 22a through 22f are opened. This causes the electric currents supplied to the electromagnetic coils 20a through 20f of the brake main bodies 16a through 16f to be cut off simultaneously.

[0023] First through sixth corresponding resistors 23a through 23f and first through sixth corresponding diodes 24a through 24f are connected in parallel to the first through sixth electromagnetic coils 20a through 20f. The diodes 24a through 24f are connected in series to the corresponding resistors 23a through 23f.

[0024] Here, the electric resistance values of the resistors 23a through 23f connected to the electromagnetic coils 20a through 20f belonging to the same group are set to be the same. To be more specific, the electric resistance value R1 of the first resistor 23a is the same as the electric resistance value R4 of the fourth resistor 23d (i.e.,  $R1 = R4$ ), the electric resistance value R2 of the second resistor 23b is the same as the electric resistance value R5 of the fifth resistor 23e (i.e.,  $R2 = R5$ ), and the electric resistance value R3 of the third resistor 23c is the same as the electric resistance value R6 of the sixth resistor 23f (i.e.,  $R3 = R6$ ).

[0025] The electric resistance values of the resistors 23a through 23f connected to the electromagnetic coils 20a through 20f belonging to different groups are set to be different. To be more specific, the electric resistance value R1 of the first resistor 23a is larger than the electric resistance value R2 of the second resistor 23b (i.e.,  $R1 > R2$ ), and the electric resistance value R2 of the second resistor 23b is larger than the electric resistance value R3 of the third resistor 23c (i.e.,  $R2 > R3$ ).

**[0026]** Next, the operation of this embodiment will be described. During normal operation, the first and second motors 4 and 8 are driven in synchronism with each other, whereby the first and the second sheaves 3 and 7 are rotated simultaneously, and the car 13 and the counterweights 14 and 15 are raised and lowered in the hoistway. During traveling of the car 13, the brake shoes 17a through 17f are kept away from the brake drums 5 and 9 by the electromagnetic actuators composed of the iron cores 19a through 19f and the electromagnetic coils 20a through 20f against the forces of the brake springs 18a through 18f.

**[0027]** When the car 13 is at rest, the electromagnetic coils 20a through 20f are in a non-energized state, and the brake shoes 17a through 17f are pressed against the brake drums 5 and 9 by the spring forces of the brake springs 18a through 18f, thus keeping the car 13 at rest.

**[0028]** When the car 13 is to be brought to an emergency stop during traveling of the car 13, the electricity supply to the motors 4 and 8 is cut off, and an emergency stop signal is input to the opening/closing drive portion 22g, opening the contacts 22a through 22f simultaneously. As a result, the electricity supply to the electromagnetic coils 20a through 20f is also forcibly cut off, and the brake shoes 17a through 17f are pressed against the drums 5 and 9 by the spring forces of the brake springs 18a through 18f. As a result, frictional forces are generated between the brake shoes 17a through 17f and the brake drums 5 and 9, and the rotation of the brake drums 5 and 9 and the driving sheaves 3 and 7 is stopped, whereby the car 13 is stopped abruptly.

**[0029]** At this point, the electric resistance values of the resistors 23a through 23f connected in parallel to the electromagnetic coils 20a through 20f are set as described above, so the timings with which the braking forces are generated by the brake main bodies 16a through 16f are slightly deviated from group to group. That is, the brake main bodies 16a through 16f are grouped in terms of brake operation timing.

**[0030]** Here, Fig. 3 is an explanatory view showing a difference in operation between the brake main bodies 16a through 16f due to a difference in electric resistance value between the resistors 23a through 23f of Fig. 2. The period of time between the moment when the power supply to the electromagnetic coils 20a through 20f is cut off by the emergency stop command and the moment when the electric current flowing through the electromagnetic coils 20a through 20f is reduced to 0 is shortened when the electric resistance values of the resistors 23a through 23f are increased. Thus, the larger the electric resistance values of the resistors 23a through 23f, the quicker the shoe gaps (i.e., the gaps between the brake shoes 17a through 17f and the brake drums 5 and 9) are reduced to 0. That is, the larger the electric resistance values of the resistors 23a through 23f, the earlier the braking forces are generated and exerted.

**[0031]** Thus, in the case where the electric resistance values of the resistors 23a through 23f are set as stated

above, the braking forces are generated in the order: the first and fourth brake main bodies 16a and 16d, the second and fifth brake main bodies 16b and 16e, and the third and sixth brake main bodies 16c and 16f.

**[0032]** In such the elevator apparatus, at the time of emergency braking, the timings with which the braking forces are generated by the brake main bodies 16a through 16f are deviated from group to group, so it is possible to prevent an excessive deceleration from being applied to the car 13. Further, since the braking forces are applied to the first and second brake drums 5 and 9 a plurality of times, so if there should be a slight deviation in braking timing between the right and left sides, the difference in braking force, is small. Thus, it is possible to prevent generation of an inclination of the car 13 at the time of emergency braking.

#### Embodiment 2

**[0033]** Next, Fig. 4 is a circuit diagram showing driving circuits for the first through sixth electromagnetic coils 20a through 20f of an elevator apparatus according to Embodiment 2 of the present invention. The overall construction of the elevator apparatus is the same as that of Embodiment 1 (shown in Fig. 1). In the drawing, two first resistors 23a1 and 23a2 are provided in a circuit in parallel with the first electromagnetic coil 20a. The first resistors 23a1 and 23a2 are connected in parallel to each other, and are connected in series to the first diode 24a.

**[0034]** Between the first diode 24a and the first resistors 23a1 and 23a2, there is connected a first selection switch 25a selectively connecting one of the first resistors 23a1 and 23a2 to the first diode 24a. As in the first electromagnetic coil 20a, in the second through sixth electromagnetic coils 20b through 20f also, there are connected second through sixth resistors 23b1 through 23f2 and second through sixth selection switches 25b through 25f, respectively.

**[0035]** The electric resistance value of the first resistor 23a1 is set to be slightly larger than the electric resistance value of the first resistor 23a2. The electric resistance value of the second resistor 23b1 is set to be slightly larger than the electric resistance value of the second resistor 23b2. The electric resistance value of the third resistor 23c1 is set to be slightly larger than the electric resistance value of the third resistor 23c2. The electric resistance value of the fourth resistor 23d1 is set to be slightly larger than the electric resistance value of the fourth resistor 23d2. The electric resistance value of the fifth resistor 23e1 is set to be slightly larger than the electric resistance value of the fifth resistor 23e2. The electric resistance value of the sixth resistor 23f1 is set to be slightly larger than the electric resistance value of the sixth resistor 23f2.

**[0036]** The electric resistance value of the first resistor 23a1 is equal to the electric resistance value of the fourth resistor 23d1. The electric resistance value of the first resistor 23a2 is equal to the electric resistance value of

the fourth resistor 23d2. The electric resistance value of the second resistor 23b1 is equal to the electric resistance value of the fifth resistor 23e1. The electric resistance value of the second resistor 23b2 is equal to the electric resistance value of the fifth resistor 23e2. The electric resistance value of the third resistor 23c1 is equal to the electric resistance value of the sixth resistor 23f1. The electric resistance value of the third resistor 23c2 is equal to the electric resistance value of the sixth resistor 23f2.

**[0037]** Further, the electric resistance values of the first resistors 23a1 and 23a2 are larger than the electric resistance values of the second resistors 23b1 and 23b2. The electric resistance values of the second resistors 23b1 and 23b2 are larger than the electric resistance values of the third resistors 23c1 and 23c2.

**[0038]** Fig. 5 is a block diagram showing a control portion for controlling the first through sixth selection switches 25a through 25f of Fig. 4. First and second weighing devices 26 and 27 output signals corresponding to the load of the car 13. The first weighing device 26 is provided at the first rope connecting portion 13a. The second weighing device 27 is provided at the second rope connecting portion 13b. To be more specific, the weighing devices 26 and 27 output signals corresponding to the respective tensions of the main ropes 11 and 12, through expansion and contraction of built-in elastic bodies.

**[0039]** The signals from the weighing devices 26 and 27 are input to a comparing portion 28. The comparing portion 28 compares the signals from the weighing devices 26 and 27 with each other, thereby detecting an imbalance between the tension of the first main ropes 11 and the tension of the second main ropes 12. A command generating portion 29 generates a command signal for operating the selection switches 25a through 25f according to the imbalance detection result obtained by the comparing portion 28.

**[0040]** The command generating portion 29 performs switching operation on the selection switches 25a through 25f so as to deviate the braking force generating timings of the brake main bodies 16a through 16f belonging to the same group from each other according to the difference in tension between the first and second main ropes 11 and 12. For example, when the tension of the first main ropes 11 is higher than the tension of the second main ropes 12, the first through third resistors 23a1, 23b1, and 23c1 and the fourth through sixth resistors 23d2, 23e2, and 23f are selected.

**[0041]** As a result, in the first group, the fourth brake main body 16d generates a braking force slightly earlier than the first brake main body 16a. In the second group, the fifth brake main body 16e generates a braking force slightly earlier than the second brake main body 16b. In the third group, the sixth brake main body 16f generates a braking force slightly earlier than the third brake main body 16c.

**[0042]** The comparing portion 28 and the command generating portion 29 may be formed by computers per-

forming operations on the signals from the weighing devices 26 and 27 converted to digital signals, or by analog circuits using analog signals from the weighing devices 26 and 27 as they are.

**[0043]** In such the elevator apparatus, at the time of emergency braking, the braking force generating timings of the brake main bodies 16a through 16f belonging to the same group are deviated from each other to cancel the difference in tension between the first and second main ropes 11 and 12, so it is possible to more effectively restrain generation of an inclination of the car 13 at the time of emergency braking.

#### Embodiment 3

**[0044]** Next, Fig. 6 is a block diagram showing a control portion for controlling the first through sixth selection switches 25a through 25f of an elevator apparatus according to Embodiment 3 of the present invention. In this embodiment, instead of the weighing devices 26 and 27, a command generating portion 31 generates a command for performing switching on the selection switches 25a through 25f according to a signal from a car inclination sensor 30 adapted to output a signal corresponding to an inclination of the car 13. The command generating portion 31 outputs a command signal to the selection switches 25a through 25f so as to deviate the braking force generating timings of the brake main bodies 16a through 16f belonging to the same group to thereby cancel the inclination of the car 13.

**[0045]** For example, when the car 13 is inclined in such a direction that the second rope connecting portion 13b is lower than the first rope connecting portion 13a, the braking force of the fourth brake main body 16d is generated slightly earlier than that of the first brake main body 16a, the braking force of the fifth brake main body 16e is generated slightly earlier than that of the second brake main body 16b, and the braking force of the sixth brake main body 16f is generated slightly earlier than that of the third brake main body 16c. Other than the points described above, this embodiment has the same construction as Embodiment 2.

**[0046]** In such the elevator apparatus, at the time of emergency braking, the braking force generating timings of the brake main bodies 16a through 16f belonging to the same group are deviated from each other so as to cancel the inclination of the car 13, so it is possible to more effectively restrain generation of an inclination of the car 13 at the time of emergency braking.

#### Embodiment 4

**[0047]** Next, Fig. 7 is a circuit diagram showing driving circuits for the first through sixth electromagnetic coils 20a through 20f of an elevator apparatus according to Embodiment 4 of the present invention. The construction of the elevator apparatus as a whole is the same as that of Embodiment 1 (shown in Fig. 1). Electric currents from

the first and fourth brake attraction amplifiers 21a and 21d are supplied to the first and fourth electromagnetic coils 20a and 20d, respectively, which belong to the first group, through a first electromagnetic switch device 32.

**[0048]** The first electromagnetic switch device 32 has the contacts 22a and 22d connected between the brake attraction amplifiers 21a and 21d and the electromagnetic coils 20a and 20d, and a first opening/closing drive portion 32a for opening and closing the contacts 22a and 22d. The first opening/closing drive portion 32a has a first iron core 32b, a first switch coil 32c wound around the first iron core 32b, and a first resistor 32d and a first diode 32e, which are connected in parallel to the first switch coil 32c.

**[0049]** Electric currents from the second and fifth brake attraction amplifiers 21b and 21e are supplied to the second and fifth electromagnetic coils 20b and 20e, respectively, which belong to the second group, through a second electromagnetic switch device 33. The second electromagnetic switch device 33 has the contacts 22b and 22e, and a second opening/closing drive portion 33a. The second opening/closing drive portion 33a has a second iron core 33b, a second switch coil 33c, a second resistor 33d, and a second diode 33e.

**[0050]** Electric currents from the third and sixth brake attraction amplifiers 21c and 21f are supplied to the third and sixth electromagnetic coils 20c and 20f, respectively, which belong to the third group, through a third electromagnetic switch device 34. The third electromagnetic switch device 34 has the contacts 22c and 22f, and a third opening/closing drive portion 34a. The third opening/closing drive portion 34a has a third iron core 34b, a third switch coil 34c, a third resistor 34d, and a third diode 34e.

**[0051]** The contacts 22a through 22f are normally closed. However, when an emergency stop command signal is input to the opening/closing, drive portions 32 through 34, the contacts 22a through 22f are opened, whereby the electric currents supplied to the electromagnetic coils 20a through 20f of the brake main bodies 16a through 16f are cut off.

**[0052]** The respective electric resistance values of the resistors 32d, 33d, and 34d, which belong to different groups, are different from one another. To be more specific, the electric resistance value of the first resistor 32d is larger than the electric resistance value of the second resistor 33d, and the electric resistance value of the second resistor 33d is larger than the electric resistance value of the third resistor 34d.

**[0053]** Here, Fig. 8 is an explanatory view showing a difference in contact opening operation between the electromagnetic switch devices 32 through 34 due to the difference in electric resistance value between the resistors 32d, 33d, and 34d of Fig. 7. The period of time between the moment when an emergency stop command signal is input to the opening/closing drive portions 32a, 33a, and 34a (i.e., when the voltage of the command signal is reduced to 0) and the moment when the contacts 22a

through 22f are actually opened is shortened when the electric resistance values of the resistors 32d, 33d, and 34d are increased.

**[0054]** Thus, when the electric resistance values of the resistors 23a through 23f are set as described above, the braking forces are generated in the order: the first and fourth brake main bodies 16a and 16d, the second and fifth brake main bodies 16b and 16e, and the third and sixth brake main bodies 16c and 16f.

**[0055]** In such the elevator apparatus, at the time of emergency braking, the timings with which the braking forces are generated by the brake main bodies 16a through 16f are deviated from group to group, so it is possible to prevent an excessive deceleration from being applied to the car 13. Further, since the braking forces are applied to the first and second brake drums 5 and 9 a plurality of times, it is possible to restrain generation of an inclination of the car 13 at the time of emergency braking.

**[0056]** While one brake device is provided with three brake main bodies in the examples described above, it is also possible for one brake device to be provided with two or four or more brake main bodies.

**[0057]** Further, while all the brake main bodies provided in one brake device belong to different groups from one another in the examples described above, it is also possible for a plurality of brake main bodies to belong to the same group. For example, when providing four brake main bodies in one brake device, it is possible for the four brake main bodies to be divided into two groups each including two brake main bodies.

**[0058]** Further, while two driving machines are used in the examples described above, the number of driving machines may be three or more.

**[0059]** Furthermore, while two counterweights are used in the examples described above, the number of counterweights may be one or three or more.

**[0060]** Further, while the timings with which the braking operations are started are deviated from group to group of the brake main bodies 16a through 16f in the examples described above, it is also possible to divide the brake main bodies into a plurality of groups, with intermittent or continuous control methods for the braking forces differing from group to group.

**[0061]** Further, while the present invention is applied to a brake device for braking the rotation of a driving sheave in the examples described above, the present invention is also applicable to a brake device for braking the ascent/descent of a car by some other method as defined within appended claims. For example, the present invention may also be applied to a plurality of car brake devices mounted to the car, for braking the ascent and descent of a car by holding braking members in press contact with car guide rails. In this case, each car brake device is provided with a plurality of brake main bodies belonging to a plurality of different groups. The present invention may also be applied to a plurality of rope brake devices provided in a hoistway or on a support member

supporting a driving machine and adapted to brake the ascent and descent of a car through braking of the movement of main ropes. In this case also, each rope brake device is provided with a plurality of brake main bodies belonging to a plurality of different groups.

## Claims

### 1. An elevator apparatus comprising:

a a first driving machine (1) having a first driving sheave (3), a first motor (4) for rotating the first driving sheave (3) and a first brake device (6) for braking the rotation of the first driving sheave (3);

a second driving machine (2) having a second driving sheave (7), a second motor (8) for rotating the second driving sheave (7) and a second brake device (10) for braking the rotation of the second driving sheave (7); and

a car (13) that is raised and lowered by driving forces of the first and second driving machines (1, 2) and comprises a first rope connecting portion (13a) and a second rope connecting portion (13b) arranged on the opposite side of the first rope connecting portion (13a) with respect to the center of gravity of the car; and

the first and second brake devices (6, 10) are provided for braking the ascent and descent of the car (13)

wherein the car (13) is suspended by a plurality of first main ropes (11) wound around the first driving sheave (3) and suspended by a plurality of second main ropes (12) wound around the second driving sheave (7), wherein the first main rope (11) is connected to the first rope connecting portion (13a) and the second main rope (12) is connected to the second rope connecting portion (13b),

### characterized in that

the first brake device (6) has a plurality of brake main bodies (16a through 16c) belonging to a plurality of different groups,

the second brake device (10) has a plurality of brake main bodies (16d through 16f) belonging to a plurality of different groups, and

wherein, at the time of emergency braking, the first and second brake devices (6, 10) generate braking forces by the brake main bodies (16a through 16f) with timings deviated from group to group, to prevent an excessive deceleration from being applied to the car (13) or to cancel the difference in tension between the plurality of first and second main ropes, so as to prevent generation of inclination of the car (13).

2. An elevator apparatus according to Claim 1, wherein the brake devices (6, 10) detect a difference in tension between the first and second main ropes (11, 12), and deviate, at the time of emergency braking, the timings with which the braking forces of the brake main bodies (16a through 16f) of the same group are generated according to the difference in tension.

3. An elevator apparatus according to Claim 1, wherein the brake devices (6, 10) detect an inclination of the car (13), and

deviate the timings with which the braking forces of the brake main bodies (16a through 16f) of the same group are generated according to the inclination of the car (13).

4. An elevator apparatus according to Claim 1, wherein the brake main bodies (16a through 16f) have brake shoes (17a through 17f) to be brought into and out of contact with brake rotary members (5, 9) rotated integrally with the first and second driving sheaves (3, 7), brake springs (18a through 18f) for pressing the brake shoes (17a through 17f) against the brake rotary members (5, 9), electromagnetic coils (20a through 20f) for generating electromagnetic forces for separating the brake shoes (17a through 17f) from the brake rotary members (5, 9) against forces of the brake springs (18a through 18f), and resistors (23a through 23f) connected in parallel to the electromagnetic coils (20a through 20f), and wherein the resistors (23a through 23f) have electric resistance values differing from group to group.

5. An elevator apparatus according to Claim 1, wherein the brake main bodies (16a through 16f) have brake shoes (17a through 17f) to be brought into and out of contact with brake rotary members (5, 9) rotated integrally with the first and second driving sheaves (3, 7), brake springs (18a through 18f) for pressing the brake shoes (17a through 17f) against the brake rotary members (5, 9), and electromagnetic coils (20a through 20f) for generating electromagnetic forces for separating the brake shoes (17a through 17f) from the brake rotary members (5, 9) against forces of the brake springs (18a through 18f), and wherein, at the time of emergency braking, electricity supply to the electromagnetic coils (20a through 20f) is cut off with timings differing from group to group.

6. An elevator apparatus according to Claim 5, further comprising a plurality of electromagnetic switches (32, 33, 34) for switching between supply and cut-off of an electric current to the electromagnetic coils (20a through 20f),

wherein the electromagnetic switch devices (32, 33, 34) have contacts (22a through 22f) connected to the electromagnetic coils (20a through 20f), switch coils (32c, 33c, 34c) for opening and closing the con-

tacts (22a through 22f), and resistors (32d, 33d, 34d) connected in parallel to the switch coils (32c, 33c, 34c), and  
 wherein the resistors (32d, 33d, 34d) have electric resistance values differing from group to group.

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## Patentansprüche

### 1. Fahrstuhlvorrichtung, umfassend:

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eine erste Antriebsmaschine (1) mit einer ersten Antriebsrolle (3), einem ersten Motor (4) zum Drehen der ersten Antriebsrolle (3) und einer ersten Bremseinrichtung (6) zum Bremsen der Drehung der ersten Antriebsrolle (3);

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eine zweite Antriebsmaschine (2) mit einer zweiten Antriebsrolle (7), einem zweiten Motor (8) zum Drehen der zweiten Antriebsrolle (7) und einer zweiten Bremseinrichtung (10) zum Bremsen der Drehung der zweiten Antriebsrolle (7); und

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einen Fahrkorb (13), der durch Antriebskräfte der ersten und zweiten Antriebsmaschine (1, 2) angehoben und abgesenkt wird und einen ersten Seilverbindungsabschnitt (13a) und einen zweiten Seilverbindungsabschnitt (13b) umfasst, wobei der zweite Seilverbindungsabschnitt in Bezug auf den Schwerpunkt des Fahrkorbs auf der gegenüberliegenden Seite des ersten Seilverbindungsabschnitts angeordnet ist, und

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die erste und zweite Bremseinrichtung (6,10) zum Bremsen des Anhebens und Absenkens des Fahrkorbs (13) vorgesehen sind, wobei der Fahrkorb (13) durch eine Vielzahl von ersten Hauptseilen (11), die um die erste Antriebsrolle (3) gewunden sind, und durch eine Vielzahl von zweiten Hauptseilen (12), die um die zweite Antriebsrolle (7) gewunden sind, aufgehängt ist, wobei das erste Hauptseil (11) mit dem ersten Seilverbindungsabschnitt (13a) verbunden ist und das zweite Hauptseil (12) mit dem zweiten Seilverbindungsabschnitt (13b) verbunden ist,

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**dadurch gekennzeichnet, dass**

die erste Bremseinrichtung (6) eine Vielzahl von Bremshauptkörpern (16a bis 16c) aufweist, die zu einer Vielzahl von unterschiedlichen Gruppen gehören,

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die zweite Bremseinrichtung (10) eine Vielzahl von Bremshauptkörpern (16d bis 16f) aufweist, die zu einer Vielzahl von unterschiedlichen Gruppen gehören, und

wobei zum Zeitpunkt einer Notbremsung, die erste und zweite Bremseinrichtung (6,10) anhand der Bremshauptkörper (16a bis 16f) Bremskräfte von Gruppe zu Gruppe zu unter-

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schiedlichen Zeitpunkten erzeugen, um zu verhindern, dass eine übermäßige Verzögerung auf den Fahrkorb (13) ausgeübt wird oder um einen Unterschied in der Spannung zwischen der Vielzahl von ersten und zweiten Hauptseilen aufzuheben, um so zu verhindern, dass eine Neigung des Fahrkorbs (13) erzeugt wird.

2. Fahrstuhlvorrichtung nach Anspruch 1, wobei die Bremseinrichtungen (6,10) einen Unterschied in der Spannung zwischen den ersten und den zweiten Hauptseilen (11,12) erfassen und zum Zeitpunkt der Notbremsung, die Zeitpunkte, zu denen die Bremshauptkörper (16a bis 16f) die Bremskräfte erzeugen, entsprechend des Unterschieds in der Spannung voneinander abweichend machen.

3. Fahrstuhlvorrichtung nach Anspruch 1, wobei die Bremseinrichtungen (6,10) eine Neigung des Fahrkorbs (13) erfassen, und entsprechend der Neigung des Fahrkorbs (13) die Zeitpunkte, zu denen die Bremskräfte der Bremshauptkörper (16a bis 16f) der gleichen Gruppe erzeugt werden, voneinander abweichend machen.

4. Fahrstuhlvorrichtung nach Anspruch 1, wobei die Bremshauptkörper (16a bis 16f) ferner aufweisen: Bremsbacken (17a bis 17f), um mit Bremsdrehelementen (5, 9), die mit den Antriebsrollen (3, 7) integral drehen, in Kontakt oder nicht in Kontakt gebracht zu werden, Bremsfedern (18a bis 18f), um die Bremsbacken (17a bis 17f) gegen die Bremsdrehelemente (5, 9) zu drücken, elektromagnetische Spulen (20a bis 20f) zur Erzeugung elektromagnetischer Kräfte für das Trennen der Bremsbacken (17a bis 17f) von den Bremsdrehelementen (5,9) gegen die Kräfte der Bremsfedern (18a bis 18f), und Widerstände (23a bis 23f), die parallel zu den elektromagnetischen Spulen (20a bis 20f) angeschlossen sind, und wobei die Widerstände (23a bis 23f) elektrische Widerstandswerte aufweisen, die von Gruppe zu Gruppe unterschiedlich sind.

5. Fahrstuhlvorrichtung nach Anspruch 1, wobei die Bremshauptkörper (16a bis 16f) ferner aufweisen: Bremsbacken (17a bis 17f), um mit Bremsdrehelementen (5, 9), die mit den Antriebsrollen (3, 7) integral drehen, in Kontakt oder nicht in Kontakt gebracht zu werden, Bremsfedern (18a bis 18f), um die Bremsbacken (17a bis 17f) gegen die Bremsdrehelemente (5,9) zu drücken, elektromagnetische Spulen (20a bis 20f) zur Erzeugung elektromagnetischer Kräfte für das Trennen der Bremsbacken (17a bis 17f) von den Bremsdrehelementen (5, 9) gegen die Kräfte der Bremsfedern (18a bis 18f), und wobei zum Zeitpunkt der Notbremsung, die Strom-



zufuhr zu den elektromagnetischen Spulen (20a bis 20f) von Gruppe zu Gruppe zu unterschiedlichen Zeitpunkten getrennt wird.

6. Fahrstuhlvorrichtung nach Anspruch 5, ferner umfassend eine Vielzahl von elektromagnetischen Schaltern (32, 33, 34), um zwischen einer Versorgung und einer Trennung eines elektrischen Stroms zu den elektromagnetischen Spulen (20a bis 20f) zu schalten, wobei die elektromagnetischen Schalteinrichtungen (32, 33, 34) Kontakte (22a bis 22f) aufweisen, die mit den elektromagnetischen Spulen (20a bis 20f) verbunden sind, Schaltspulen (32c, 33c, 34c) zum Öffnen und Schließen der Kontakte (22a bis 22f), und Widerstände (32d, 33d, 34d) die parallel zu den Schaltspulen (32c, 33c, 34c) angeschlossen sind, und wobei die Widerstände (32d, 33d, 34d) von Gruppe zu Gruppe unterschiedliche elektrische Widerstandswerte aufweisen.

## Revendications

1. Appareil d'ascenseur comprenant:

une première machine d'entraînement (1) comportant une première poulie d'entraînement (3), un premier moteur (4) pour la rotation de la première poulie d'entraînement (3) et un premier dispositif de frein (6) pour le freinage de la rotation de la première poulie d'entraînement (3) ; une seconde machine d'entraînement (2) comportant une seconde poulie d'entraînement (7), un second moteur (8) pour la rotation de la seconde poulie d'entraînement (7) et un second dispositif de frein (10) pour le freinage de la rotation de la seconde poulie d'entraînement (7) ; et

une cabine (13) qui est levée et abaissée par des forces d'entraînement des première et seconde machines d'entraînement (1, 2) et comprend une première partie de liaison de câble (13a) et une seconde partie de liaison de câble (13b) agencée sur le côté en face de la première partie de liaison de câble (13a) par rapport au centre de gravité de la cabine ; et

les premier et second dispositifs de frein (6, 10) étant fournis pour le freinage de l'ascension et la descente de la cabine (13),

dans lequel la cabine (13) est suspendue par une pluralité de premiers câbles principaux (11) enroulés autour de la première poulie d'entraînement (3) et suspendue par une pluralité de seconds câbles principaux (12) enroulés autour de la seconde poulie d'entraînement (7), dans lequel le premier câble principal (11) est relié à

la première partie de liaison de câble (13a) et le second câble principal (12) est relié à la seconde partie de liaison de câble (13b),

**caractérisé en ce que** le premier dispositif de frein (6) comporte une pluralité de corps principaux de frein (16a à 16c) appartenant à une pluralité de groupes différents,

le second dispositif de frein (10) comporte une pluralité de corps principaux de frein (16d à 16f) appartenant à une pluralité de différents groupes et dans lequel, au moment du freinage d'urgence, les premier et second dispositifs de frein (6, 10) génèrent des forces de freinage par les corps principaux de frein (16a à 16f) avec des minutages déviés de groupe en groupe pour empêcher qu'une décélération excessive ne soit appliquée à la cabine (13) ou pour annuler la différence de tension entre la pluralité de premiers et seconds câbles principaux de sorte à empêcher la génération d'une inclinaison de la cabine (13).

2. Appareil d'ascenseur selon la revendication 1, dans lequel les dispositifs de frein (6, 10) détectent une différence de tension entre les premier et second câbles principaux (11, 12) et dévient, au moment du freinage d'urgence, les minutages avec lesquels les forces de freinage des corps principaux de frein (16a à 16f) du même groupe sont générées selon la différence de tension.

3. Appareil d'ascenseur selon la revendication 1, dans lequel les dispositifs de frein (6, 10) détectent une inclinaison de la cabine (13) et dévient les minutages avec lesquels les forces de freinage des corps principaux de frein (16a à 16f) du même groupe sont générées selon l'inclinaison de la cabine (13).

4. Appareil d'ascenseur selon la revendication 1, dans lequel les corps principaux de frein (16a à 16f) comportent des sabots de frein (17a à 17f) à amener en et hors contact avec des éléments rotatifs de frein (5, 9) mis en rotation intégrale avec les première et seconde poulies d'entraînement (3, 7), des ressorts de frein (18a à 18f) pour le pressage des sabots de frein (17a à 17f) contre les éléments rotatifs de frein (5, 9), des bobines électromagnétiques (20a à 20f) pour la génération de forces électromagnétiques pour la séparation des sabots de frein (17a à 17f) des éléments rotatifs de frein (5, 9) contre des forces des ressorts de frein (18a à 18f) et des résistances (23a à 23f) reliées en parallèle aux bobines électromagnétiques (20a à 20f) et dans lequel les résistances (23a à 23f) ont des valeurs de résistance électrique différant de groupe en groupe.

5. Appareil d'ascenseur selon la revendication 1, dans lequel les corps principaux de frein (16a à 16f) comportent des sabots de frein (17a à 17f) à amener en et hors contact avec des éléments rotatifs de frein (5, 9) mis en rotation intégrale avec les première et seconde poulies d'entraînement (3, 7), des ressorts de frein (18a à 18f) pour le pressage des sabots de frein (17a à 17f) contre les éléments rotatifs de freins (5, 9) et des bobines électromagnétiques (20a à 20f) pour la génération de forces électromagnétiques pour la séparation des sabots de frein (17a à 17f) des éléments rotatifs de frein (5, 9) contre les forces des ressorts de frein (18a à 18f) et dans lequel, au moment du freinage d'urgence, la fourniture d'électricité aux bobines électromagnétiques (20a à 20f) est interrompue avec des minutages différant de groupe en groupe.
6. Appareil d'ascenseur selon la revendication 5, comprenant en outre une pluralité de commutateurs électromagnétiques (32, 33, 34) pour la commutation entre la fourniture et l'interruption d'un courant électrique aux bobines électromagnétiques (20a à 20f), dans lequel les dispositifs de commutation électromagnétique (32, 33, 34) comportent des contacts (22a à 22f) reliés aux bobines électromagnétiques (20a à 20f), des bobines de commutation (32c, 33c, 34c) pour l'ouverture et la fermeture des contacts (22a à 22f), et des résistances (32d, 33d, 34d) reliées en parallèle aux bobines de commutation (32c, 33c, 34c) et dans lequel les résistances (32d, 33d, 34d) ont des valeurs de résistance électrique différant de groupe en groupe.

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FIG. 1

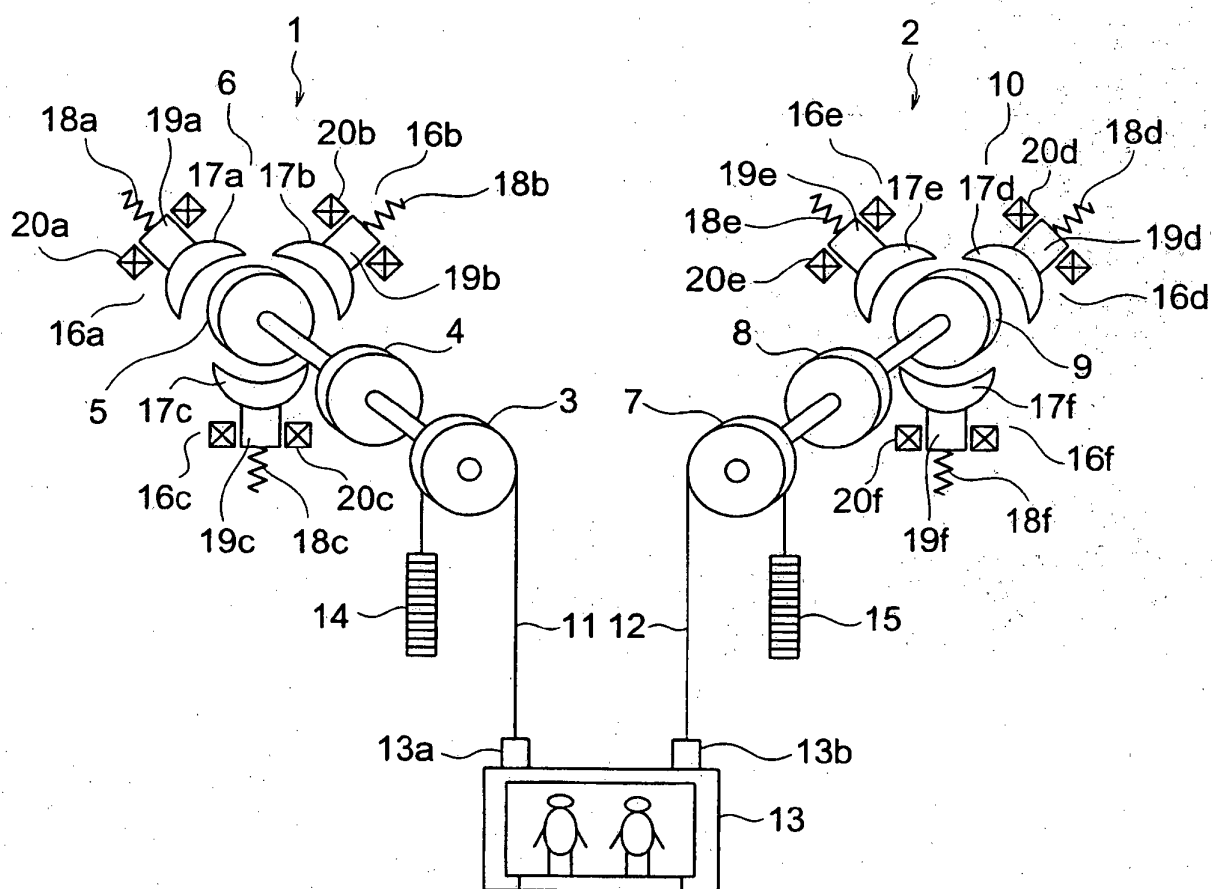


FIG. 2

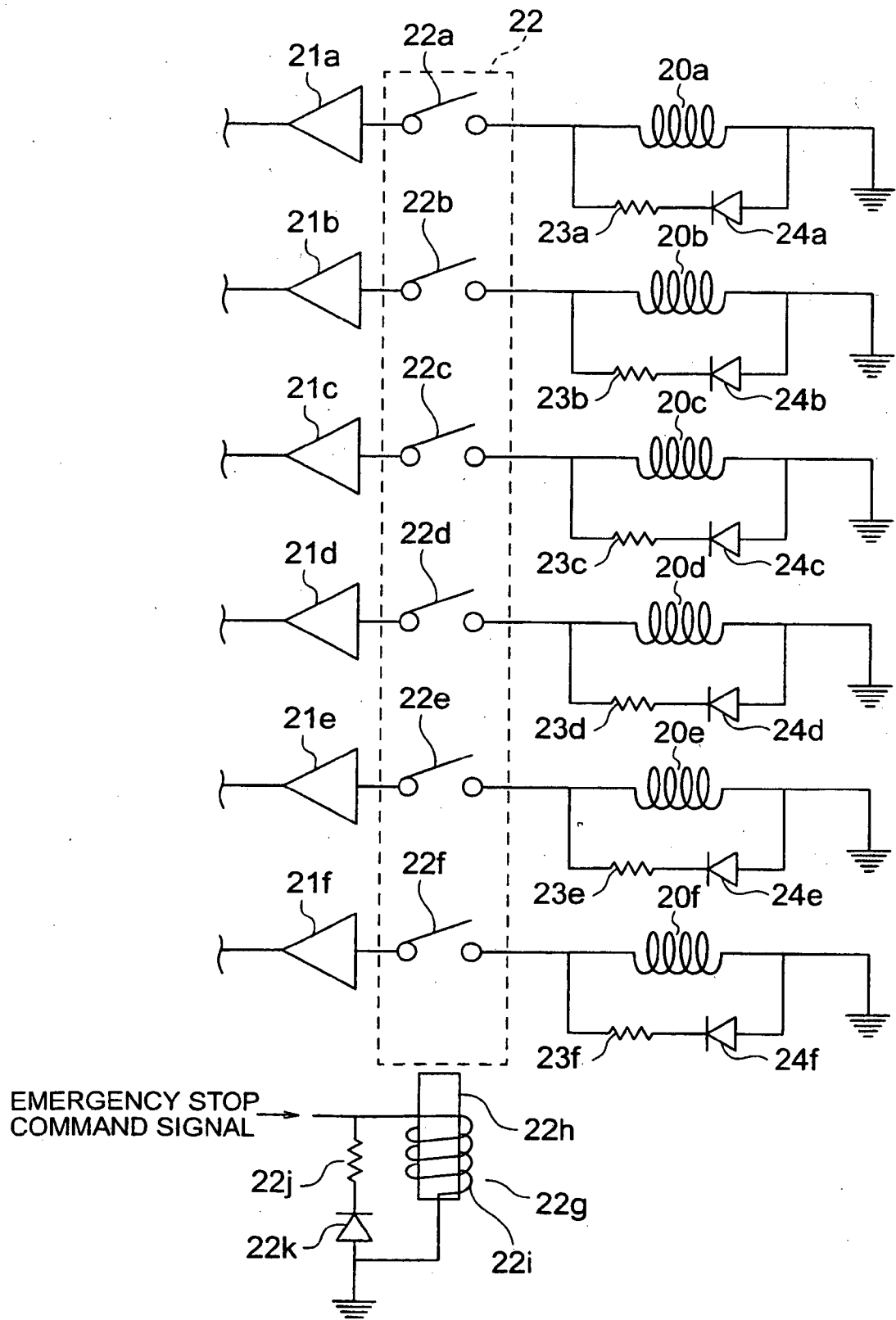


FIG. 3

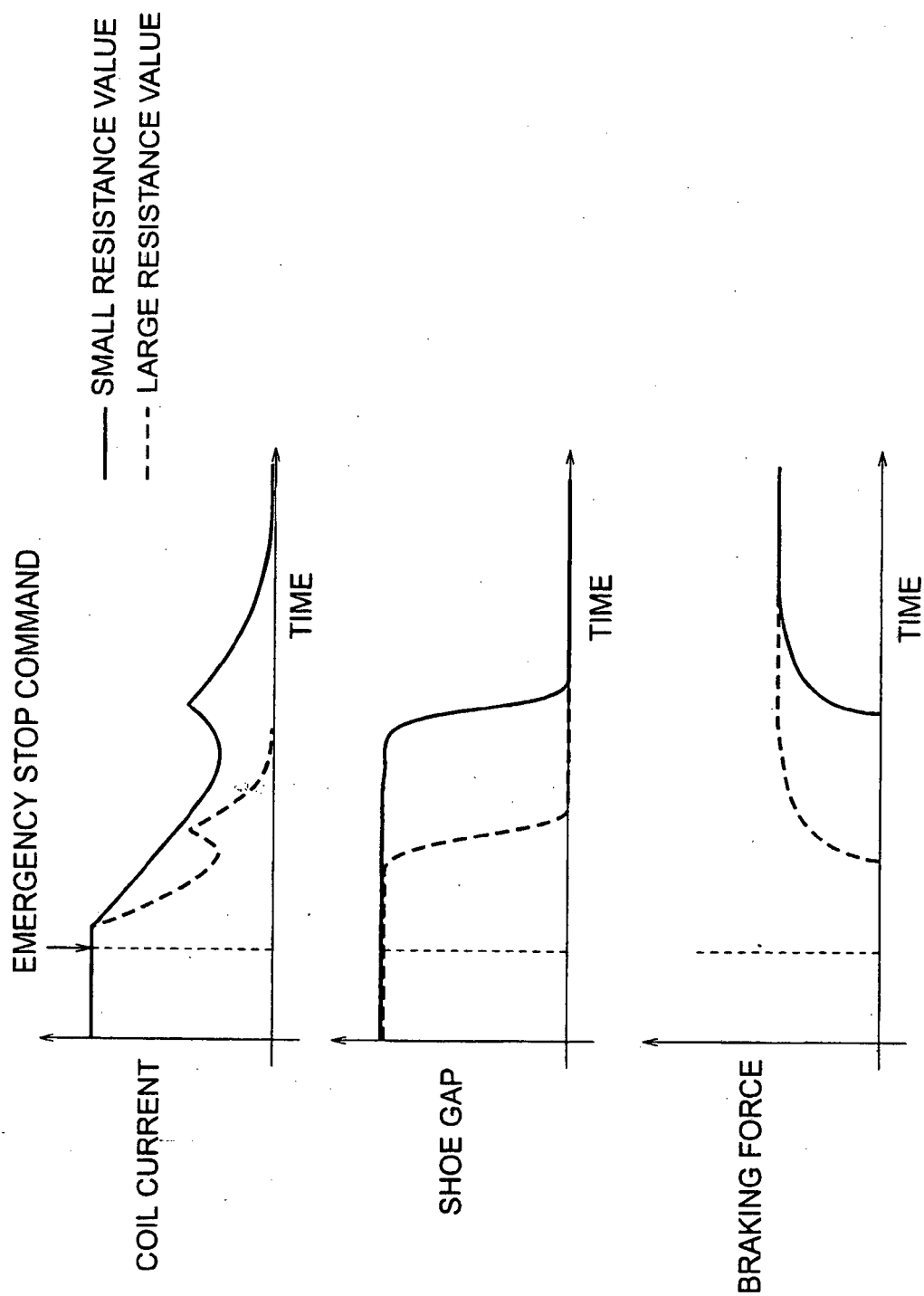


FIG. 4

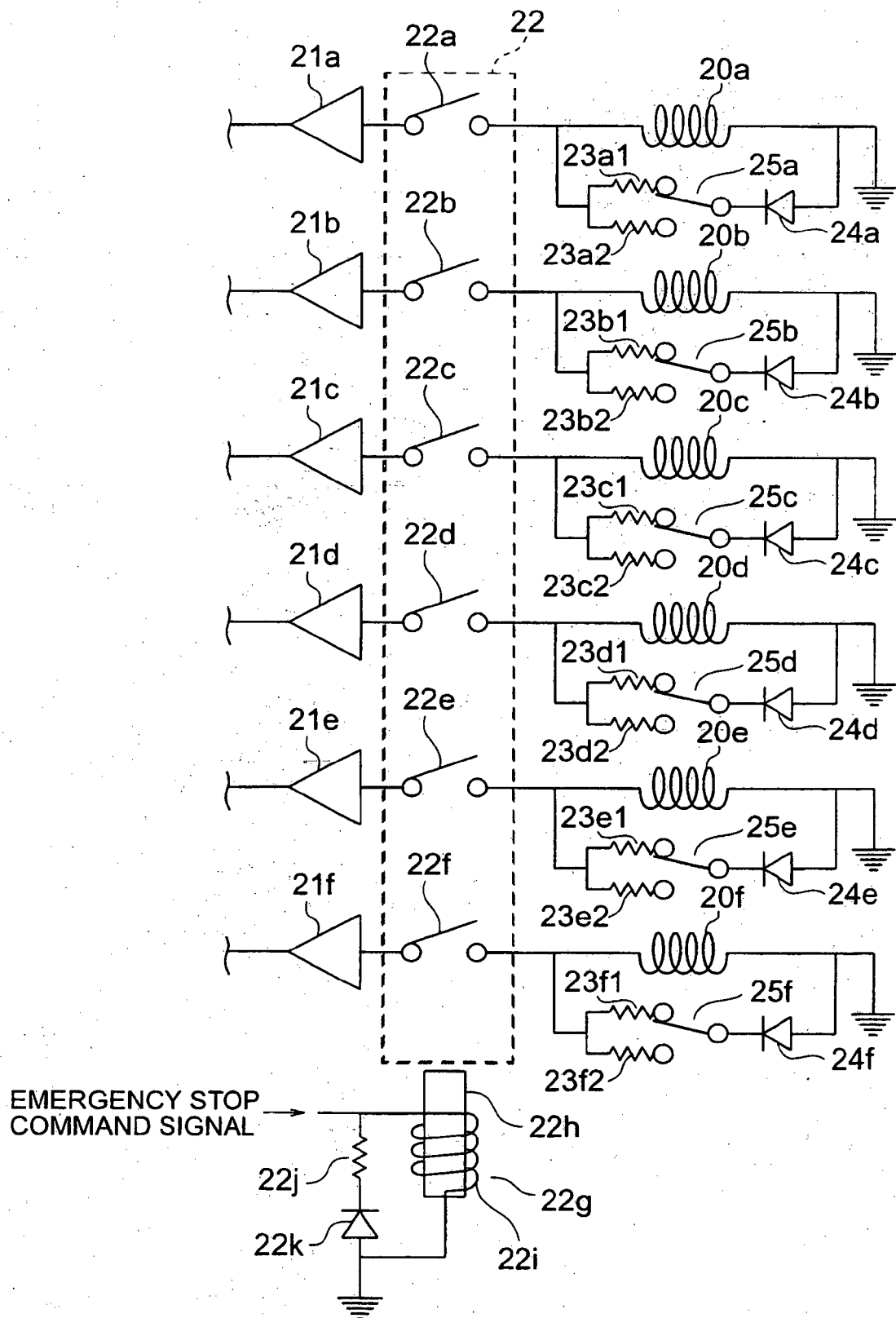


FIG. 5

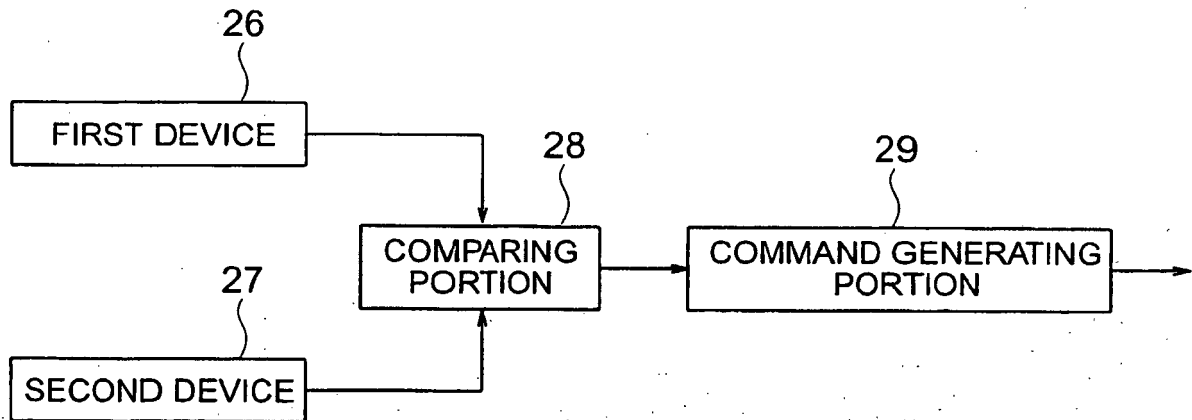


FIG. 6

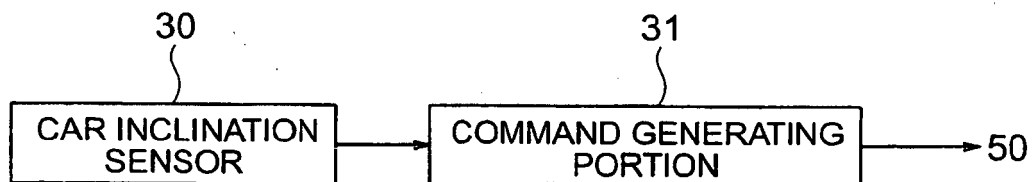


FIG. 7

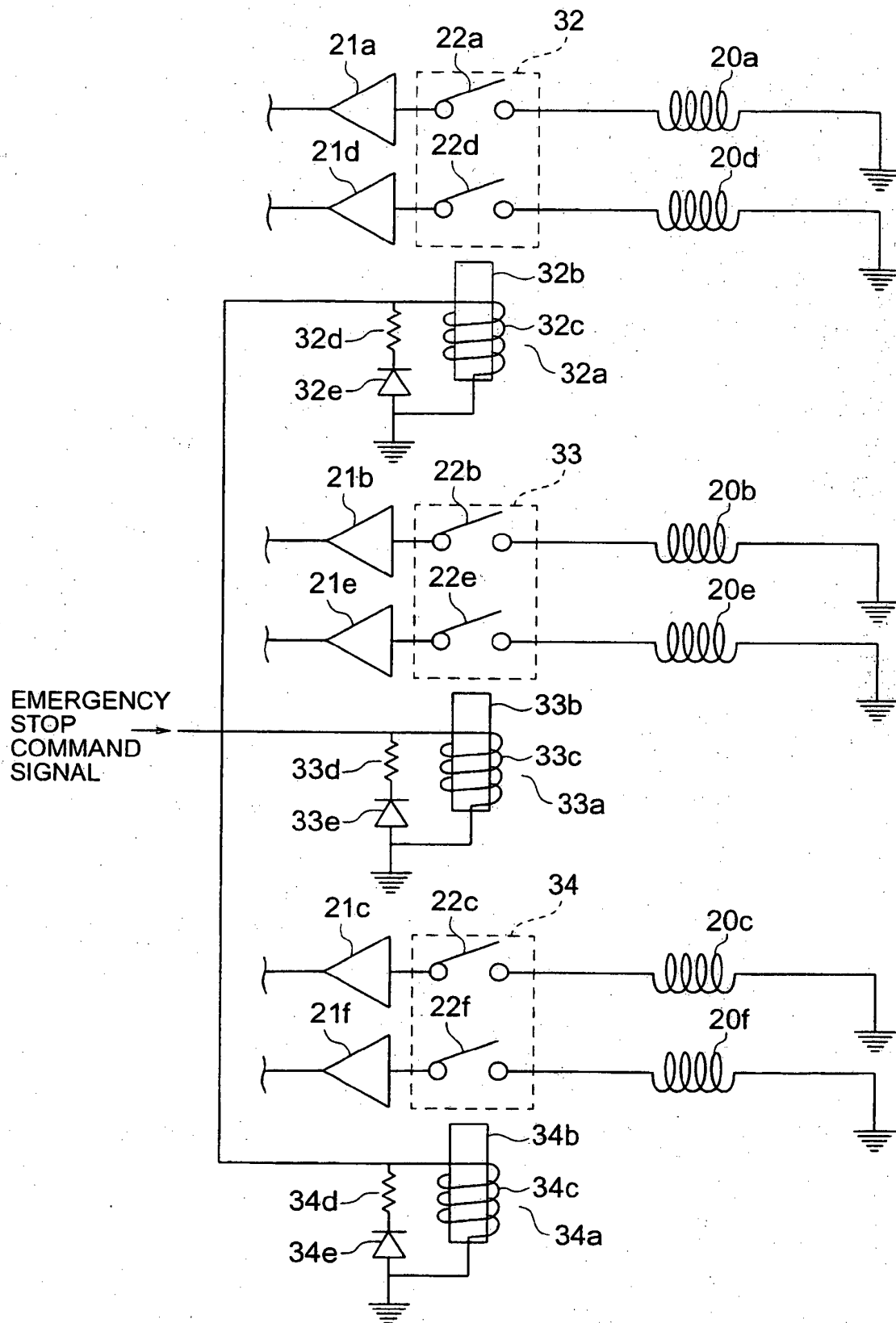
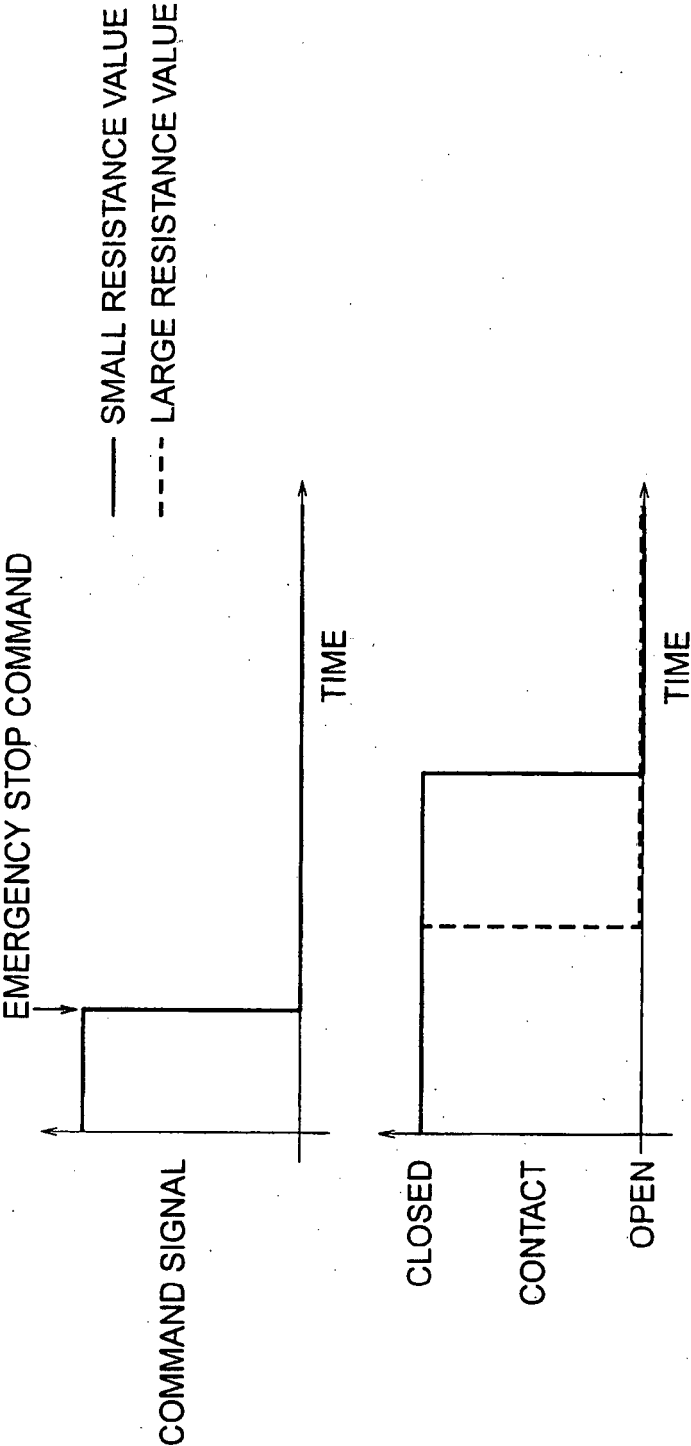




FIG. 8



**REFERENCES CITED IN THE DESCRIPTION**

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