(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 864 936 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

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

(21) Application number: **05727783.2**

(22) Date of filing: **30.03.2005**

(51) Int Cl.:
B66B 5/06 *(2006.01)*

(86) International application number:
PCT/JP2005/006109

(87) International publication number:
WO 2006/103768 (05.10.2006 Gazette 2006/40)

(84) Designated Contracting States:
DE ES FR PT

(71) Applicant: **MITSUBISHI DENKI KABUSHIKI KAISHA**
Chiyoda-ku
Tokyo 100-8310 (JP)

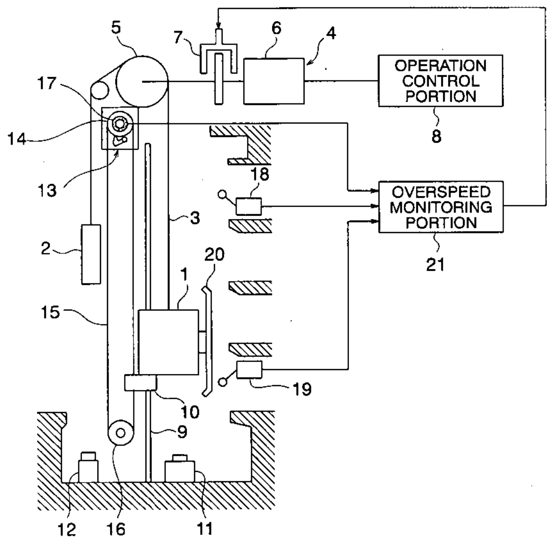
(72) Inventors:
- **Okamoto, Kenichi**
  c/o Mitsubishi Denki K. K.
  Tokyo; 1008310 (JP)
- **Kugiya, Takuo**
  c/o Mitsubishi Denki K. K.
  Tokyo; 1008310 (JP)
- **Ueda, Takaharu**
  c/o Mitsubishi Denki K. K.
  Tokyo; 1008310 (JP)

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

(54) ELEVATOR APPARATUS

(57) In an elevator apparatus, the operation of a car is controlled by an operation control portion. A speed of the car is monitored by an overspeed monitoring portion, which is separated from the operation control portion. The overspeed monitoring portion detects a position of the car and a speed of the car, and compares an overspeed, which has been set in accordance with the position of the car, with the speed of the car. The overspeed monitoring portion also generates a braking command signal for stopping the car when the speed of the car reaches an overspeed. In addition, the overspeed monitoring portion sets the overspeed independently from the operation control portion, and sets the overspeed differently depending on a running direction of the car when the car is located in the vicinity of a terminal floor.

FIG. 1



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Description

Technical Field

[0001] The present invention relates to an elevator apparatus which monitors whether or not a running speed of a car has reached an overspeed.

Background Art

[0002] In a conventional elevator apparatus, a speed governor monitors whether or not a running speed of a car has reached an overspeed. In the speed governor, an overspeed as a criterion of abnormality is set on the basis of information on a running speed pattern of the car and information on registration of car calls, and an actual running speed of the car is compared with the set overspeed (e.g., see Patent Document 1).

[0003] Patent Document 1: JP 2003-10468 A

Disclosure of the Invention

Problem to be solved by the Invention

[0004] In the conventional elevator apparatus, however, the speed governor obtains the information on the running speed pattern of the car and the information on registration of car calls from a control panel. Therefore, when the car runs out of control due to abnormality in the control panel, the information from the control panel may also be irregular. As a result, the speed governor may become unable to detect overspeed, or a braking device may be actuated unnecessarily.

[0005] The present invention has been made to solve the problems as discussed above, and it is therefore an object of the invention to obtain an elevator apparatus capable of more accurately detecting that the running speed of a car has reached an overspeed.

Means for solving the Problem

[0006] An elevator apparatus according to the present invention includes: a car for being raised/lowered within a hoistway; an operation control portion for controlling operation of the car; an overspeed monitoring portion for detecting a position of the car and a speed of the car, comparing an overspeed set in accordance with the position of the car with the speed of the car, and generating a braking command signal for stopping the car when the speed of the car reaches the overspeed; and a brake portion for braking the car in accordance with the braking command signal from the overspeed monitoring portion, and in the elevator apparatus, the overspeed monitoring portion sets the overspeed independently from the operation control portion , and sets the overspeed differently depending on a running direction of the car when the car is located in a vicinity of a terminal floor.

Brief Description of the Drawings

[0007]

[Fig. 1] A structural diagram of an elevator apparatus according to Embodiment 1 of the present invention.
[Fig. 2] A block diagram showing an essential part of Fig. 1.
[Fig. 3] A graph showing a running speed pattern, a first overspeed, and a second overspeed during normal running of a car of Fig. 1 from an upper terminal floor to a lower terminal floor.
[Fig. 4] A structural diagram showing an elevator apparatus according to Embodiment 2 of the present invention.
[Fig. 5] A block diagram showing an essential part of Fig. 4.
[Fig. 6] A graph showing a running speed pattern, a first overspeed, and a second overspeed during normal running of a car of Fig. 4 from an upper terminal floor to a lower terminal floor.
[Fig. 7] A structural diagram showing an elevator apparatus according to Embodiment 3 of the present invention.
[Fig. 8] A graph showing a running speed pattern, a first overspeed, and a second overspeed during normal running of a car of Fig. 7 from an upper terminal floor to a lower terminal floor.

Best Modes for carrying out the Invention

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

Embodiment 1

[0009] Fig. 1 is a schematic diagram showing an elevator apparatus according to Embodiment 1 of the present invention. Referring to Fig. 1, a car 1 and a counterweight 2 are suspended within a hoistway by a main rope 3. The car 1 and the counterweight 2 are raised/lowered within the hoistway by a driving force of a drive device (hoisting machine) 4.

[0010] A driving apparatus 4 includes: a drive sheave 5 around which the main rope 3 wound; a motor portion 6 which rotates the drive sheave 5; a brake portion 9 that brakes the rotation of the drive sheave 5 to brake the running of the car 1. The brake portion 9 is, for example, an electromagnetic brake apparatus. In the electromagnetic brake apparatus, a spring force of a braking spring is used to push a brake shoe against a braking surface to brake the rotation of the drive sheave 5, and an electromagnetic magnet is excited to separate the brake shoe from the braking surface to cancel the braking.

[0011] The drive device 4 is controlled by an operation control portion 8. That is, the operation of the car 1 is controlled by the operation control portion 8. The operation control portion 8 has a computer (not shown) having a calculation processing portion (a CPU), a storage portion (a ROM, a RAM, a hard disk, and the like), and signal input/output portions.

[0012] The hoistway includes a pair of car guide rails 9 that guide raising/lowering of the car 1 and a pair of counterweight guide rails (not shown) that guide raising/lowering of the counterweight 2. In a lower part of the car 1, a safety device 10 that engages with the car guide rails 9 to stop in an emergency is provided. The safety device 10 has a pair of braking pieces (wedge members) that are operated by mechanical operation and pushed toward the car guide rails 9.

[0013] A car buffer 11 for absorbing a shock of a collision of the car 1 with a bottom portion of the hoistway and a counterweight buffer 12 for absorbing a shock of a collision of the counterweight 2 with the bottom portion of the hoistway are installed in a lower portion within the hoistway. Buffers 11 and 12 employ, for example, oil-filled or spring-loaded buffers.

[0014] A speed governor (a mechanical speed governor) 13 for mechanically monitoring a running speed of the car 1 is installed in an upper portion of the hoistway. The speed governor 13 detects that the running speed of the car 1 has reached a second overspeed (a Trip speed). The speed governor 13 is provided with an upper pulley 14. A detection rope 15 is wound around the upper pulley 14. The detection rope 15 is connected at both ends thereof to an operating mechanism of a safety device 10. The lower end of the detection rope 15 is wound around a lower pulley 16 disposed in the lower portion of the hoistway.

[0015] When the car 1 is raised/lowered, a detection rope 15 is moved in circulation, so the upper pulley 14 is rotated at a rotational speed corresponding to a running speed of the car 1. When the speed governor 13 detects that the running speed of the car 1 has reached the second overspeed, the detection rope 15 is gripped by a rope catch of the speed governor 13 to stop the circulation of the detection rope 15. In response to the stoppage of the circulation of the detection rope 15, the safety device 10 performs a braking operation.

[0016] The speed governor 13 is fitted with a rotation detector 17 for generating a detection signal corresponding to the rotation of the upper pulley 14. Employed as the rotation detector 17 is, for example, a dual-sense type encoder for outputting detection signals for two systems simultaneously.

[0017] An upper terminal floor switch 18 for detecting that the car 1 is running in the vicinity of an upper terminal floor is provided in the vicinity of the upper terminal floor in the hoistway. A lower terminal floor switch 19 for detecting that the car 1 is running in the vicinity of a lower terminal floor is provided in the vicinity of the lower terminal floor in the hoistway. The car 1 is mounted with a cam 20 for operating the terminal floor switches 18 and 19 to open/close them.

[0018] Information from the rotation detector 17 and the terminal floor switches 18 and 19 is input to an overspeed monitoring portion 21 for monitoring whether or not the running speed of the car 1 has reached a first overspeed. The overspeed monitoring portion 21 sets the first overspeed and detects that the running speed of the car 1 has reached the first overspeed, independently operating from the operation control portion 8 and without utilizing information obtained therefrom. The overspeed monitoring portion 21 is constituted by a computer different from the computer of the operation control portion 8. In addition, the overspeed monitoring portion 21 and the rotation detector 17 are supplied with electric power from a power source different from a power source of the operation control portion 8.

[0019] The first overspeed is set lower than the second overspeed set in the speed governor 13. The overspeed monitoring portion 21 monitors a running speed of the car 1. When the running speed of the car 1 reaches the first overspeed, the overspeed monitoring portion 21 outputs a braking command signal to the brake portion 7 to brake rotation of the drive sheave 5, thereby stopping the car 1 as an emergency measure.

[0020] Fig. 2 is a block diagram showing an essential part of Fig. 1. Referring to Fig. 2, the overspeed monitoring portion 21 has a car position detecting portion 22, a running direction detecting portion 23, a car speed detecting portion 24, an overspeed setting portion 25, a comparison/determination portion 26, and a braking command portion 27.

[0021] The car position detecting portion 22 detects a position of the car 1 based on information from the rotation detector 17 and the terminal floor switches 18 and 19. The car speed detecting portion 24 corrects a detection error in the rotation detector 17 resulting from a slip or the like between the upper pulley 14 and the detection rope 15, using signals from the terminal floor switches 18 and 19.

[0022] The running direction detecting portion 23 detects a running direction of the car 1 based on the information from the rotation detector 17. In the running direction detecting portion 23, a signal processing is provided with a hysteretic element for minor changes in the running direction of the car 1 resulting from an external force as disturbance, which is applied to the car 1 due to, for example, a violent behavior or the like of a passenger in the car 1, so a detected result of the running direction is prevented from being reversed unnecessarily. In other words, the running direction detecting portion 23 ignores the minor changes in the running direction of the car 1.

[0023] The car speed detecting portion 24 detects a running speed of the car 1 based on the information from the rotation detector 17. More specifically, the car speed detecting portion 24 converts the information from the rotation detector 17 into the information on temporal changes in the rotation amount of the upper pulley 14, thereby detecting a running speed of the car 1.

[0024] The overspeed setting portion 25 sets the first overspeed based on pieces of information on the position of the car and the running direction of the car, which are obtained from the car position detecting portion 22 and the running direction detecting portion 23 respectively. A comparison/determination portion 26 compares the first overspeed set by the overspeed setting portion 25 with a speed of the car detected by the car speed detecting portion 24, and determines whether or not there is abnormality, namely, whether or not the speed of the car has reached the first overspeed. When the comparison/determination portion 26 detects abnormality, the braking command portion 27 generates a braking command signal and outputs the signal to the brake portion 7.

[0025] Blocks illustrated in the overspeed monitoring portion 21 of Fig. 2 indicate functions, which are implemented by the computer constituting the overspeed monitoring portion 21. That is, the computer of the overspeed monitoring portion 21 has a calculation processing portion (a CPU), a storage portion (a ROM, a RAM, a hard disk, and the like), and signal input/output portions. Programs for realizing the functions of the car position detecting portion 22, the running direction detecting portion 23, the car speed detecting portion 24, the overspeed setting portion 25, the comparison/determination portion 2 6, and the braking command portion 27 are stored in the storage portion. The calculation processing portion performs calculation processings regarding the functions of the car position detecting portion 22, the running direction detecting portion 23, the car speed detecting portion 24, the overspeed setting portion 25, the comparison/determination portion 26, and the braking command portion 27 based on the programs.

[0026] Next, a concrete method of setting the first overspeed will be described. Fig. 3 is a graph showing a running speed pattern, the first overspeed, and the second overspeed during normal running of the car 1 of Fig. 1 from the upper terminal floor to the lower terminal floor. In the diagram, a maximum value of the running speed pattern in the case where the car 1 runs from the upper terminal floor to the lower terminal floor is indicated by a maximum speed pattern 31 (a solid line ABCDE). The first overspeed is set according to a first overspeed pattern 32 (chain single-dashed lines IJK). Furthermore, the second overspeed is set according to a second overspeed pattern 33 (chain double-dashed lines LM).

[0027] The maximum speed pattern 31 is calculated such that an acceleration curve after the start of the running of the car 1 represents a maximum value of an acceleration expected in the vicinity of the upper terminal floor, and that a deceleration curve before stoppage of the car 1 represents a maximum value of a deceleration expected in the vicinity of the lower terminal floor.

[0028] However, when the car 1 runs (is lowered) toward the lower terminal floor, the magnitude of the deceleration in the vicinity of the lower terminal floor (a gradient at each point on a curve DE: e.g., 0.6 m/s^2) may be made smaller than the magnitude of the acceleration in the vicinity of the upper terminal floor (a gradient at each point on a curve ABC: 0.9 m/s^2) so that a speed V_1 (V_1 = K) of a collision of the car 1 with the car buffer 11 can be reduced. A speed in a constant-speed running range (straight line CD) is set for calculation to a maximum value V_2 expected in this range (e.g., 1.5m/s). Moreover, according to the maximum speed pattern 31, deceleration of the car 1 starts from a position of the lower terminal floor switch 19. The maximum speed pattern 31 as described above is independently calculated inside the overspeed monitoring portion 21, without recourse to the information from the operation control portion 8.

[0029] Referring to Fig. 3, a short-distance speed pattern 34 (broken lines ABFG) is a speed pattern according to which the car 1 accelerates at a maximum acceleration and decelerates before reaching a maximum speed. This short-distance speed pattern 34 is assumed to ensure a short running time when the car 1 runs to a relatively near floor. Meanwhile, a long-distance speed pattern 35 (broken lines HDE) is a speed pattern according to which the car 1 accelerates at an acceleration lower than that of the short-distance speed pattern 34 and decelerates at a deceleration lower than that of the short-distance speed pattern 34 after having reached the maximum speed. This long-distance speed pattern 35 is assumed to ensure a short running time when the car 1 runs to a relatively far floor.

[0030] The operation control portion 8 controls the running of the car 1 at a variable maximum speed and a variable acceleration/deceleration in accordance with a load applied to the car and a running distance thereof. The maximum speed pattern 31 represents a maximum value of various speed patterns assumed as described above. Accordingly, the running speed of the car 1 does not exceed the maximum speed pattern 31 in a normal case.

[0031] The first overspeed is set to a value having a predetermined margin with respect to the maximum speed (the running speed in the constant-speed running range) of the maximum speed pattern 31 (e. g. , about one and three-tenths of the maximum speed) when the position of the car 1 is located between the upper terminal floor and the position of the lower terminal floor switch. The first overspeed is set to a value having a predetermined margin with respect to the maximum speed pattern 31 (e.g., about one and three-tenths of the running speed) when the position of the car is located between the position of the lower terminal floor switch and the lower terminal floor.

[0032] For example, given that x, V_2 (m/s), and V_1 (m/s) represent a deceleration distance covered by the car 1 from the start of deceleration to the stoppage at the lower terminal floor, a speed of the car upon the start of deceleration, a speed of a collision of the car 1 with the car buffer 11, respectively, the first overspeed pattern 32 can be determined from a deceleration γ_1 (m/s^2) which can be calculated according to an equation (1).

$$\gamma_1 = (V_1{}^2-(1.3V_2)^2)/(2x) \quad \ldots \quad (1)$$

In the equation (1), a distance Ax from a terminal floor to a face of the car buffer 11 with which the car collides may be added to the deceleration distance x. In addition, a margin ($-\Delta V_1$) may be added to the collision speed V_1 in anticipation to an operational delay of the braking device. That is, the first overspeed pattern 32, which offers higher accuracy, can be set according to an equation (2).

$$\gamma_2 = ((V_1-\Delta V_1)^2-(1.3V_2)^2)/(2(x+\Delta x)) \quad \ldots \quad (2)$$

[0033] The maximum speed pattern 31 and the first overspeed pattern 32 as described above are stored in the storage portion (a memory) of the overspeed monitoring portion 21.

[0034] The foregoing description deals with the case where the car 1 is being lowered. Even in a case where the car 1 is being raised, the first overspeed is set in the same manner. That is, the overspeed setting portion 25 sets the first overspeed in accordance with a detected result in the running direction detecting portion 23 when the car 1 is located in a range between a position of the upper terminal floor switch and the upper terminal floor or in a range between the position of the lower terminal floor switch and the lower terminal floor.

[0035] That is, when the car 1 runs from the position of the lower terminal floor switch toward the lower terminal floor, the first overspeed is set according to the first overspeed pattern 32 as described above. On the contrary, when the car 1 runs from the lower terminal floor side toward the position of the lower terminal floor switch, the first overspeed is set to a value having a predetermined margin with respect to the maximum speed of the maximum speed pattern 31.

[0036] When the car 1 runs from the position of the upper terminal floor switch toward the upper terminal floor, the first overspeed is set to a value having a predetermined margin with respect to a maximum speed pattern for an operation of raising the car 1. When the car 1 runs from the upper terminal floor side toward the position of the upper terminal floor switch, the first overspeed is set to a value having a predetermined margin with respect to a maximum speed in the maximum speed pattern for the operation of raising the car.

[0037] The second overspeed pattern 33 set in the speed governor 13 is set to a value having a predetermined margin with respect to the maximum value of the first overspeed (e. g. , about one and one-tenth of the maximum value of the first overspeed). Further, the second overspeed is a constant speed (V_3) regardless of the position of the car.

[0038] In the elevator apparatus constructed as described above, since the overspeed monitoring portion 21 sets the overspeed independently from an operation control portion 8, it is possible to detect more accurately that the running speed of the car 1 has reached the overspeed, regardless of the state of the operation control portion 8.

[0039] When the car 1 is located in the vicinity of a terminal floor, the first overspeed can be changed in accordance with the running direction of the car 1. In starting to run from a terminal floor, therefore, the car 1 can be caused to run at an increased acceleration, thereby achieving enhancement in operational efficiency. When the car 1 runs toward a terminal floor in a range between the position of a corresponding terminal floor switches and the terminal floor, the first overspeed is set based on the first overspeed pattern, which has a predetermined deceleration. Therefore, abnormality in the speed of the car can be detected earlier.

[0040] Moreover, the car position detecting portion 22 corrects a detection error in the position of the car based on the information from the terminal floor switches 18 and 19. Therefore, the accuracy in detecting the position of the car can be enhanced, so the operation of braking the car can be performed more accurately.

[0041] Furthermore, the overspeed monitoring portion 21 is provided with a hysteretic element for signal processing for detecting the running direction of the car 1 so as to ignore minor changes in the running direction of the car 1. Therefore, changes in the running direction of the car 1 resulting from disturbance can be removed, so a determination on the running direction of the car 1 can be made more accurate.

[0042] By selecting the counterweight buffer 12 and a top clearance size (a distance from the top portion of the car 1 (including components on the car 1) at the position of the uppermost floor to the top portion of the hoistway) on the assumption that the first overspeed (V_1 in Fig. 3) represents a permissible speed of a collision of the counterweight 2 with the counterweight buffer 12, the counterweight buffer 12 can be reduced in size. In this case, it is appropriate to select the car buffer 11 and a pit depth dimension on the assumption that the second overspeed (V_3 in Fig. 3) represents a permissible speed of a collision of the car 1 with the car buffer 11.

Embodiment 2

[0043] Next, reference will be made to Fig. 4, which is a schematic diagram showing an elevator apparatus according to Embodiment 2 of the present invention. In the drawing, the car 1 is mounted with a safety device 41 for performing a breaking operation upon receiving an emergency stop operation command signal from the overspeed monitoring portion 21. The safety device 41 has a braking strip (a wedge member), which operates in response to the input of an emergency stop operation command signal to be pressed against the car guide rails 9.

[0044] A first overspeed and a second overspeed are set in the overspeed monitoring portion 21. When the speed of the car reaches the first overspeed, the overspeed monitoring portion 21 outputs a braking command signal to the brake portion 7. When the speed of the car reaches the second overspeed, the overspeed monitoring portion 21 outputs an emergency stop operation command signal to the safety device 41. The detection rope 15 is connected to the car 1 instead of being connected to the safety device 41.

[0045] Fig. 5 is a block diagram showing an essential part of Fig. 4. The overspeed setting portion 25 sets the first overspeed and the second overspeed based on pieces of information on the position of the car and the running direction thereof, which are obtained from the car position detecting portion 22 and the running direction detecting portion 23 respectively. The comparison/determination portion 26 compares the first overspeed and the second overspeed, which have been set by the overspeed setting portion 25, with the speed of the car detected by the car speed detecting portion 24, and determines whether or not there is abnormality, namely, whether or not the speed of the car has reached the first overspeed and the second overspeed.

[0046] When the speed of the car reaches the first overspeed, the braking command portion 27 generates a braking command signal and outputs the signal to the brake portion 7. When the speed of the car reaches the second overspeed, the braking command portion 27 generates an emergency stop operation command signal and outputs the signal to the safety device 41.

[0047] Next, a method of setting the second overspeed will be described. A method of setting the first overspeed is the same as that of Embodiment 1. Fig. 6 is a graph showing the running speed pattern, the first overspeed, and the second overspeed during normal running of the car 1 of Fig. 4 from the upper terminal floor to the lower terminal floor. The second overspeed is set according to a second overspeed pattern 36 (chain double-dashed lines LMN). The second overspeed pattern 36 is set to a value having a predetermined margin with respect to the first overspeed pattern 32 (e.g., about one and one-tenth of the first overspeed).

[0048] In this case, since the first overspeed decreases at a predetermined deceleration as the car 1 moves toward the lower terminal floor, the second overspeed also decreases as the car 1 moves toward the lower terminal floor. Accordingly, the permissible speed of a collision of the car 1 with the car buffer 11, which is set as the second overspeed, is V_4 ($V_4 < V_3$).

[0049] The maximum speed pattern 31, the first overspeed pattern 32, and the second overspeed pattern 36 as described above are stored in the storage portion (the memory) of the overspeed monitoring portion 21.

[0050] In the elevator apparatus constructed as described above, since the second overspeed is set low when the car 1 is located in the vicinity of a terminal floor, abnormality in the speed of the car can be detected earlier.

[0051] By selecting the car buffer 11, the pit depth dimension, the counterweight buffer 12, and the top clearance size on the assumption that the second overspeed (V_4 in Fig. 6) represents a permissible speed of a collision of the car 1 with the car buffer 11 and a permissible speed of a collision of the counterweight 2 with the counterweight buffer 12, the car buffer 11 and the counterweight buffer 12 can be reduced in size. A space for installing the elevator apparatus can also be reduced, and the maximum speed and acceleration/deceleration of the car 1 can be increased using the same space as before.

Embodiment 3

[0052] Next, reference will be made to Fig. 7, which is a schematic diagram showing an elevator apparatus according to Embodiment 3 of the present invention. In the diagram, the speed governor 13 is provided with an overspeed detector (an overspeed detecting switch) 42. The overspeed detector 42 is mechanically operated to output a braking command signal when the speed of the car reaches a preset first overspeed.

[0053] Braking command signals from the overspeed detector 42 and the overspeed monitoring portion 21 are output to the brake portion 7 through an OR circuit 43. In other words, when a braking command signal is output from at least one of the overspeed detector 42 or the overspeed monitoring portion 21, the braking command signal is input to the brake portion 7. Other components are identical to those of Embodiment 1.

[0054] Fig. 8 is a graph showing the running speed pattern, the first overspeed, and the second overspeed during normal running of the car 1 of Fig. 7 from the upper terminal floor to the lower terminal floor. As is the case with general speed governors, the first overspeed is set constant in the overspeed detector 42 over the entire course of raising/lowering the car 1 (chain single-dashed lines IJO).

[0055] In the elevator apparatus constructed as described above, the first overspeed is monitored not only by the overspeed monitoring portion 21 but also by the speed governor 13 (the overspeed detector 42). Therefore, a braking operation can be performed with more accuracy even when the power source of the overspeed monitoring portion 21 is blocked.

[0056] Although the foregoing examples deal with the operation control portion 8 for controlling the running of the car 1 at a variable maximum speed and a variable acceleration/decelerationin accordance with the load applied to the car and the running distance thereof, the present invention is also applicable to an elevator apparatus designed to keep the maximum speed and the acceleration/deceleration of the car unchanged.

Although the foregoing examples deal with the brake portion 7 for braking rotation of the drive sheave 5, the brake portion should not be limited thereto. For example, the brake portion may be a car brake mounted on the car, a rope brake for gripping the main rope 3, or the like.

Claims

1. An elevator apparatus, comprising:

    a car for being raised/lowered within a hoistway;
    an operation control portion for controlling operation of the car;
    an overspeed monitoring portion for detecting a position of the car and a speed of the car, comparing an overspeed set in accordance with the position of the car with the speed of the car, and generating a braking command signal for stopping the car when the speed of the car reaches the overspeed; and
    a brake portion for braking the car in accordance with the braking command signal from the overspeed monitoring portion,

    wherein the overspeed monitoring portion sets the overspeed independently from the operation control portion, and sets the overspeed differently depending on a running direction of the car when the car is located in a vicinity of a terminal floor.

2. The elevator apparatus according to Claim 1, wherein the overspeed monitoring portion sets the overspeed higher when the car runs away from the terminal floor in the vicinity thereof than when the car runs toward the terminal floor in the vicinity thereof.

3. The elevator apparatus according to Claim 1, wherein the overspeed monitoring portion sets the overspeed based on a maximum speed pattern representing a maximum value of a running pattern assumed when the car runs from one terminal floor to the other terminal floor.

4. The elevator apparatus according to Claim 3, wherein the overspeed monitoring portion sets the overspeed to a value having a predetermined margin with respect to the maximum speed pattern when the car runs toward the terminal floor in the vicinity thereof, and sets the overspeed to a value having a predetermined margin with respect to a maximum speed of the maximum speed pattern when the car runs in a range other than the vicinity of the terminal floor or runs away from the terminal floor in the vicinity thereof.

5. The elevator apparatus according to Claim 3, further comprising:

    a counterweight for being raised/lowered within the hoistway;
    a car buffer for absorbing a shock caused upon a collision of the car with a lower portion of the hoistway; and
    a counterweight buffer for absorbing a shock caused upon a collision of the counterweight with the lower portion of the hoistway,

    wherein the overspeed monitoring portion sets the overspeed based on the maximum speed pattern, a permissible speed of the collision of the car with the car buffer, and a permissible speed of the collision of the counterweight with the counterweight buffer.

6. The elevator apparatus according to Claim 4, further comprising:

   a counterweight for being raised/lowered within the hoistway; and
   a counterweight buffer for absorbing a shock caused upon a collision of the counterweight with a lower portion of the hoistway,

   wherein the counterweight buffer and a distance from a top portion of the car at an uppermost floor position to a top portion of the hoistway are selected on the assumption that the overspeed set by the overspeed monitoring portion represents a permissible speed of a collision of the counterweight with the counterweight buffer.

7. The elevator apparatus according to Claim 1, further comprising:

   a speed governor for mechanically detecting that the speed of the car has reached an overspeed; and
   a safety device mounted on the car, for operating upon detection of the overspeed by the speed governor, wherein:

      the overspeed detected by the overspeed monitoring portion is a first overspeed; and
      the overspeed detected by the speed governor is a second overspeed higher than the first overspeed.

8. The elevator apparatus according to Claim 7, wherein:

   the first overspeed is detected by the speed governor as well; and
   the brake portion receives a braking command signal output thereto when at least one of the speed governor and the overspeed monitoring portion detects that the speed of the car has reached the first overspeed.

9. The elevator apparatus according to Claim 1, wherein the overspeed monitoring portion provides signal processing for detecting the running direction of the car with a hysteretic element to ignore minor changes in the running direction of the car.

10. The elevator apparatus according to Claim 3, further comprising:

   a safety device mounted on the car, for operating in accordance with an emergency stop operation command signal from the overspeed monitoring portion, wherein:

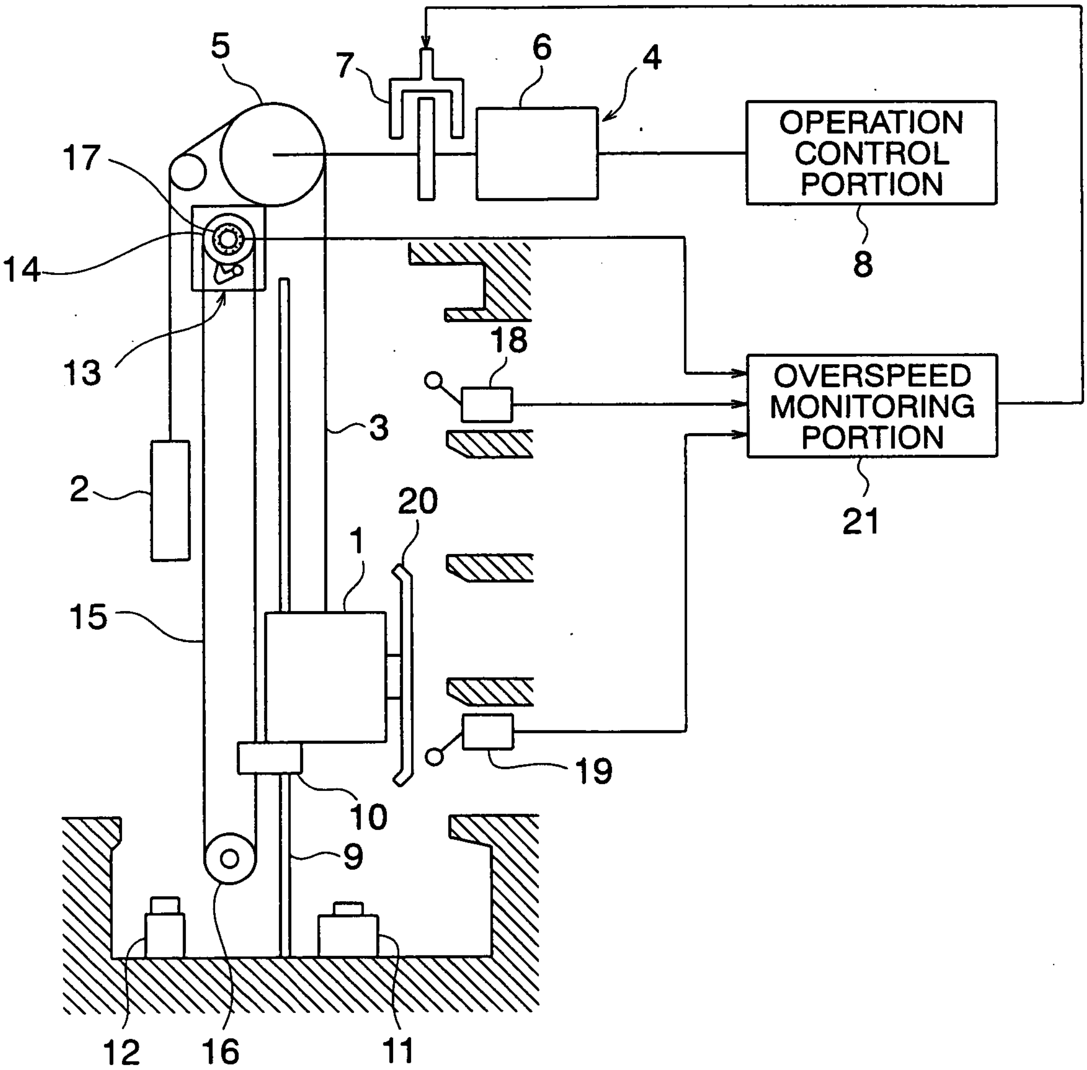
      the overspeed monitoring portion sets a first overspeed serving as a criterion for outputting the braking command signal and a second overspeed serving as a criterion for outputting the emergency stop operation command signal; and
      the first overspeed and the second overspeed are set to a value having a predetermined margin with respect to the maximum speed pattern and a value having a predetermined margin with respect to the first overspeed, respectively, when the car runs toward the terminal floor in the vicinity thereof.

11. The elevator apparatus according to Claim 10, further comprising:

   a counterweight for being raised/lowered within the hoistway;
   a car buffer for absorbing a shock caused upon a collision of the car with a lower portion of the hoistway; and
   a counterweight buffer for absorbing a shock caused upon a collision of the counterweight with the lower portion of the hoistway,

   wherein the car buffer, a pit depth dimension of the hoistway, the counterweight buffer, and a distance from a top portion of the car at an uppermost floor position to a top portion of the hoistway are selected on an assumption that the second overspeed set by the overspeed monitoring portion represents a permissible speed of a collision of the car with the car buffer and a permissible speed of a collision of the counterweight with the counterweight buffer.

FIG. 1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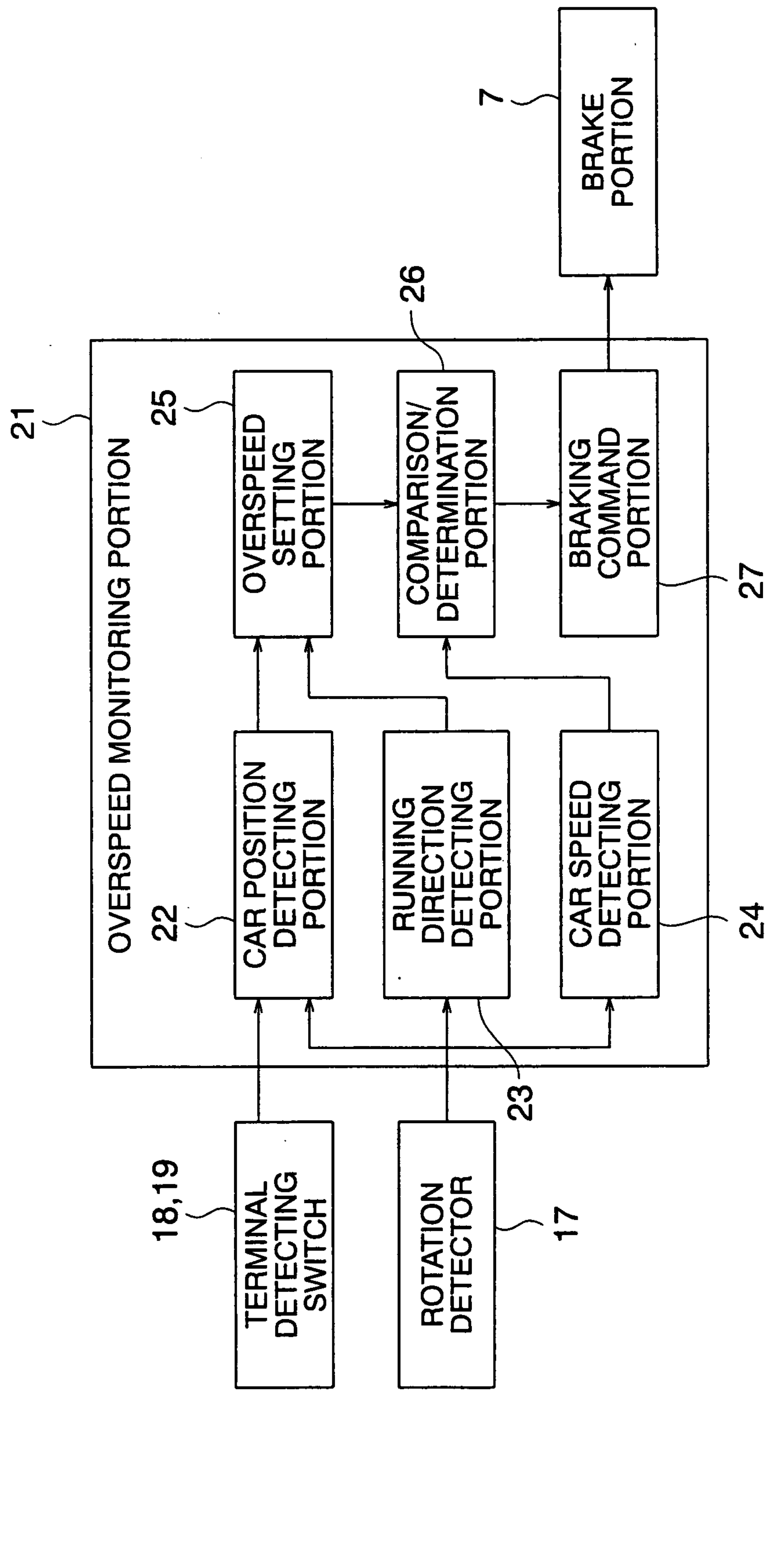
8
17
14
13
18
3
OVERSPEED MONITORING PORTION
21
2
20
1
15
19
10
9
12
16
11

FIG. 2



7
BRAKE PORTION
21
OVERSPEED MONITORING PORTION
25
OVERSPEED SETTING PORTION
26
COMPARISON/ DETERMINATION PORTION
BRAKING COMMAND PORTION
27
22
CAR POSITION DETECTING PORTION
RUNNING DIRECTION DETECTING PORTION
CAR SPEED DETECTING PORTION
24
23
18,19
TERMINAL DETECTING SWITCH
ROTATION DETECTOR
17

FIG. 3

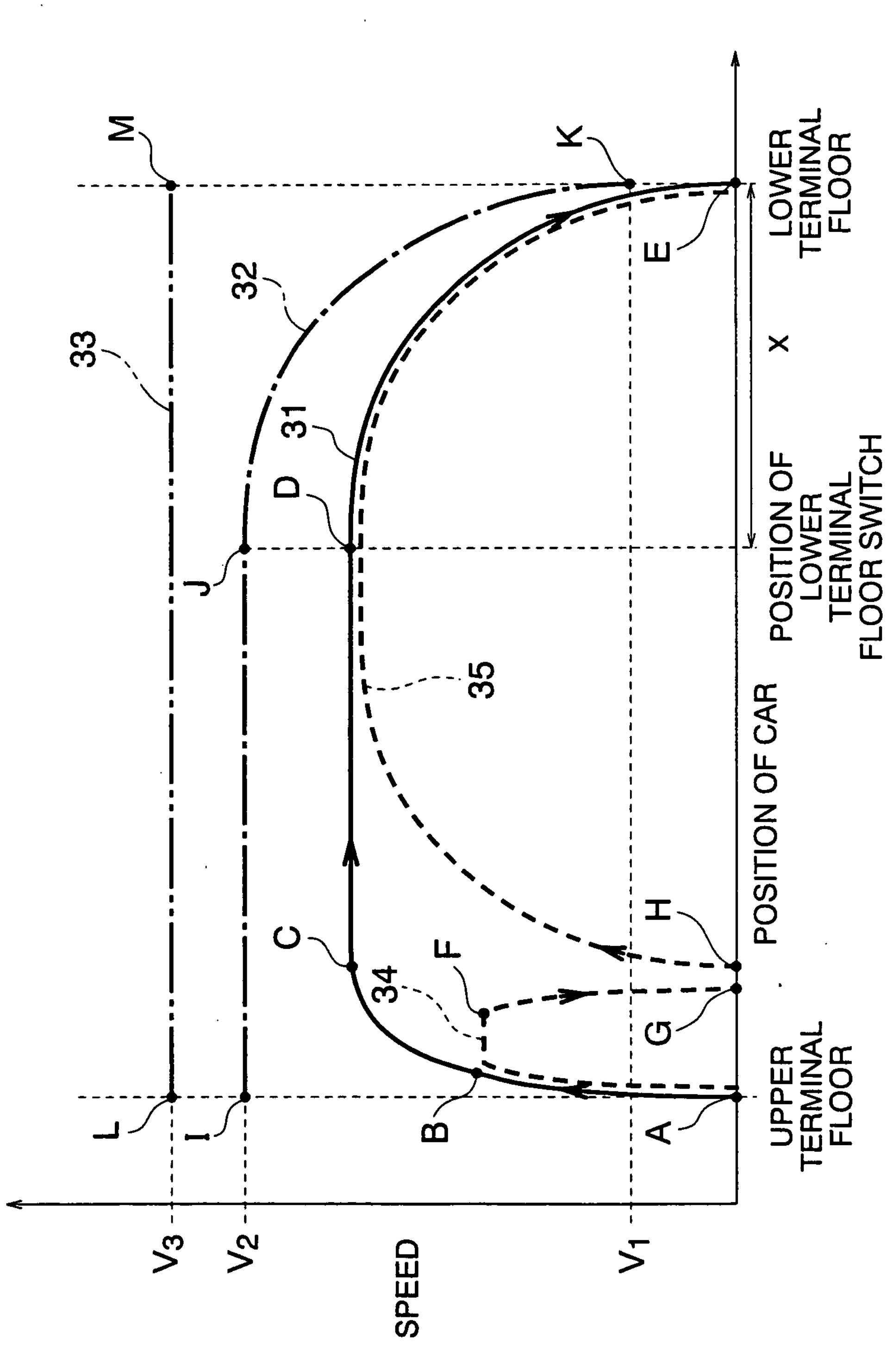

SPEED
V3
V2
V1
L
I
M
J
33
32
31
34
35
A
B
C
D
E
F
G
H
K
X
UPPER TERMINAL FLOOR
POSITION OF CAR
POSITION OF LOWER TERMINAL FLOOR SWITCH
LOWER TERMINAL FLOOR

FIG. 4

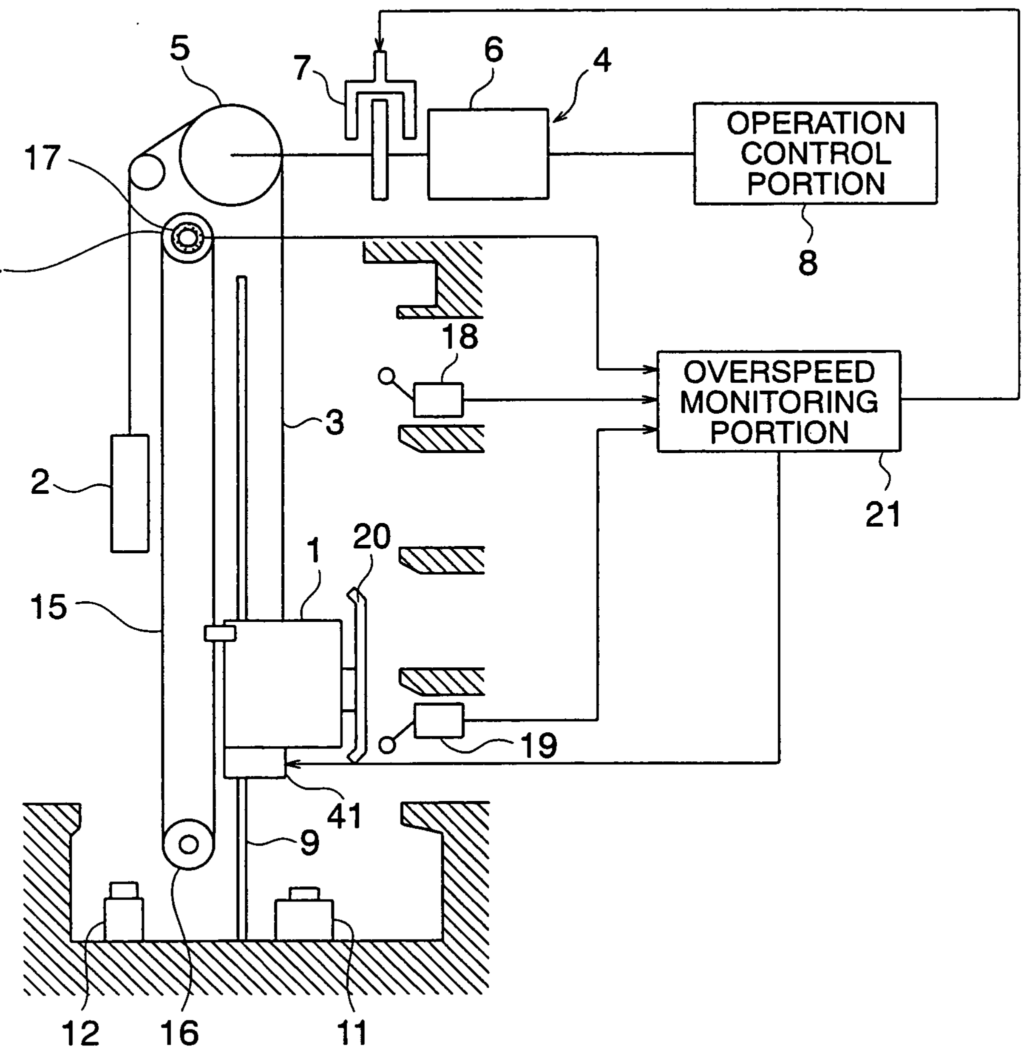

5
7
6
4
17
OPERATION
CONTROL
PORTION
14
8
18
OVERSPEED
MONITORING
PORTION
3
2
21
20
1
15
19
41
9
12
16
11

FIG. 5

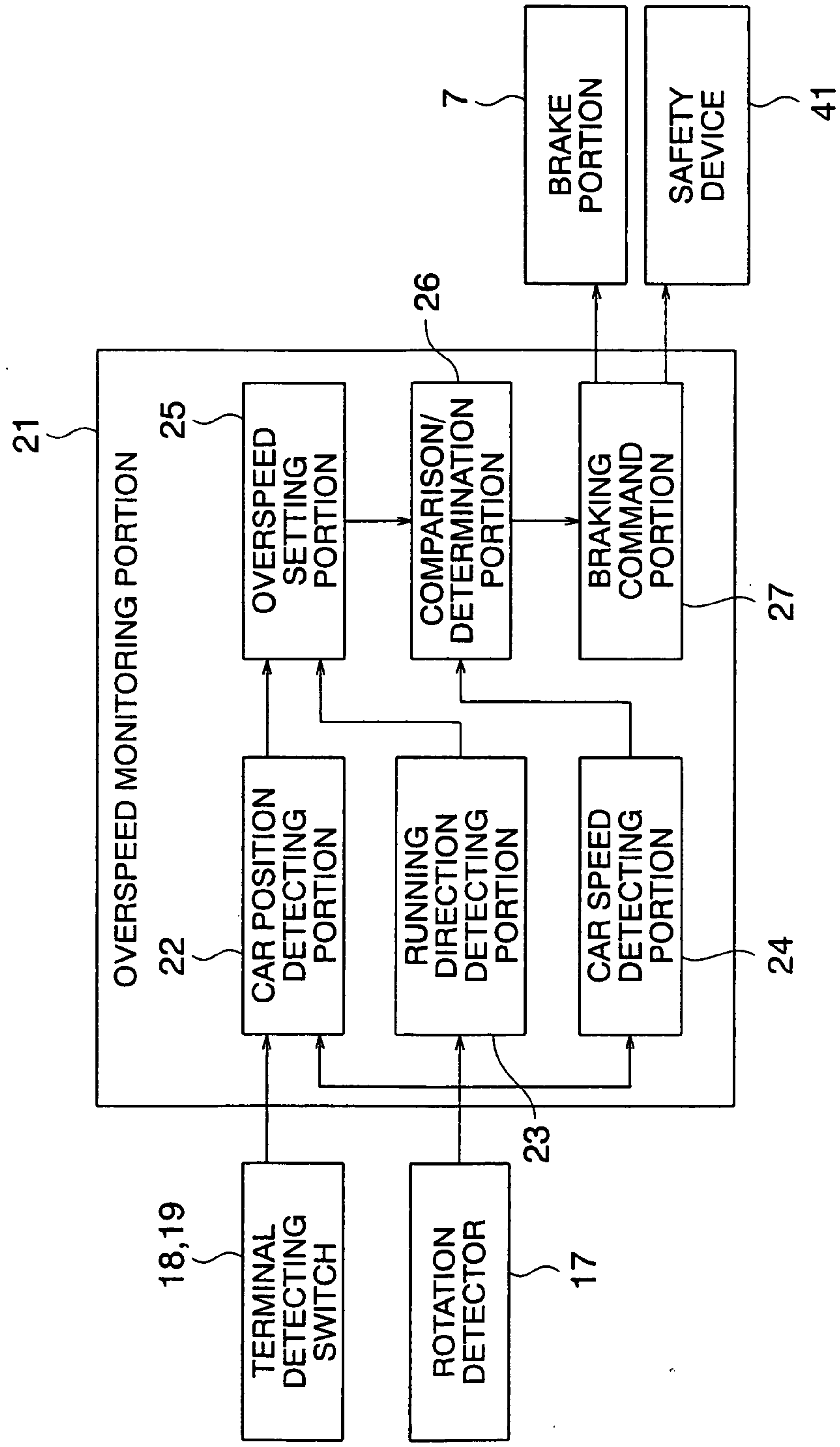

OVERSPEED MONITORING PORTION
21
22
CAR POSITION DETECTING PORTION
RUNNING DIRECTION DETECTING PORTION
23
CAR SPEED DETECTING PORTION
24
25
OVERSPEED SETTING PORTION
26
COMPARISON/ DETERMINATION PORTION
BRAKING COMMAND PORTION
27
7
BRAKE PORTION
SAFETY DEVICE
41
18,19
TERMINAL DETECTING SWITCH
ROTATION DETECTOR
17

FIG. 6

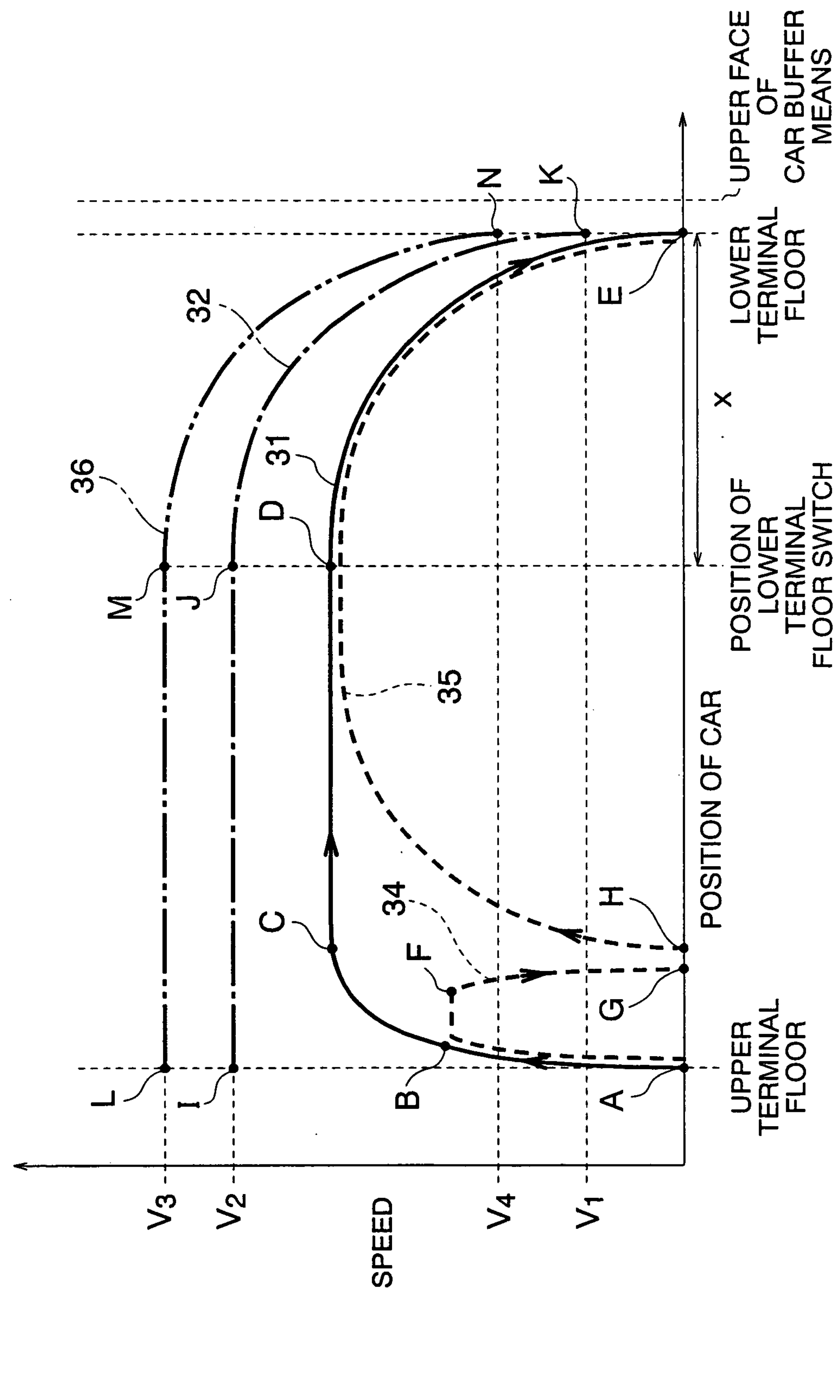

SPEED
V3
V2
V4
V1
L
I
M
J
N
K
A
B
C
D
E
F
G
H
31
32
34
35
36
X
UPPER TERMINAL FLOOR
POSITION OF CAR
POSITION OF LOWER TERMINAL FLOOR SWITCH
LOWER TERMINAL FLOOR
UPPER FACE OF CAR BUFFER MEANS

FIG. 7

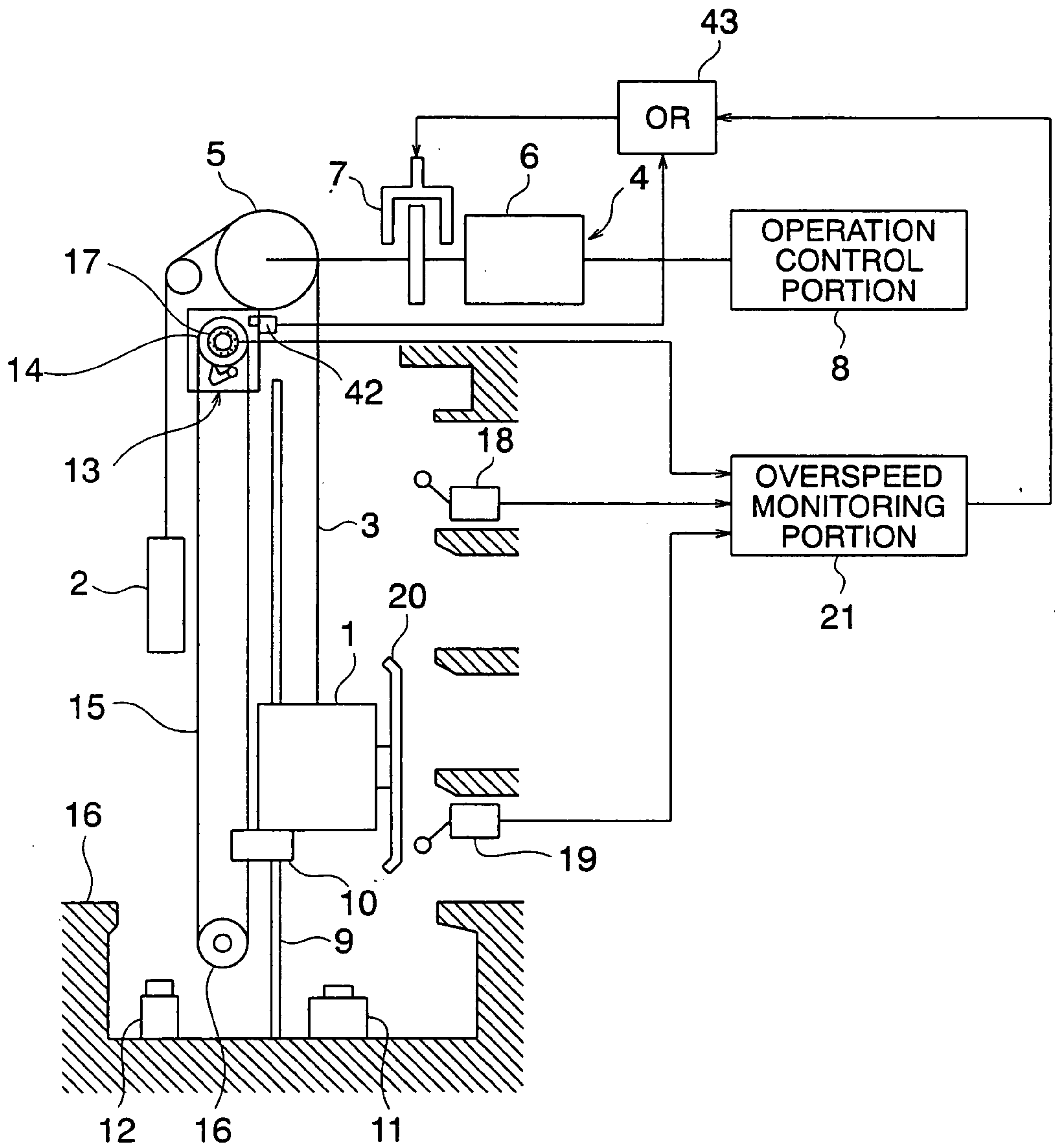
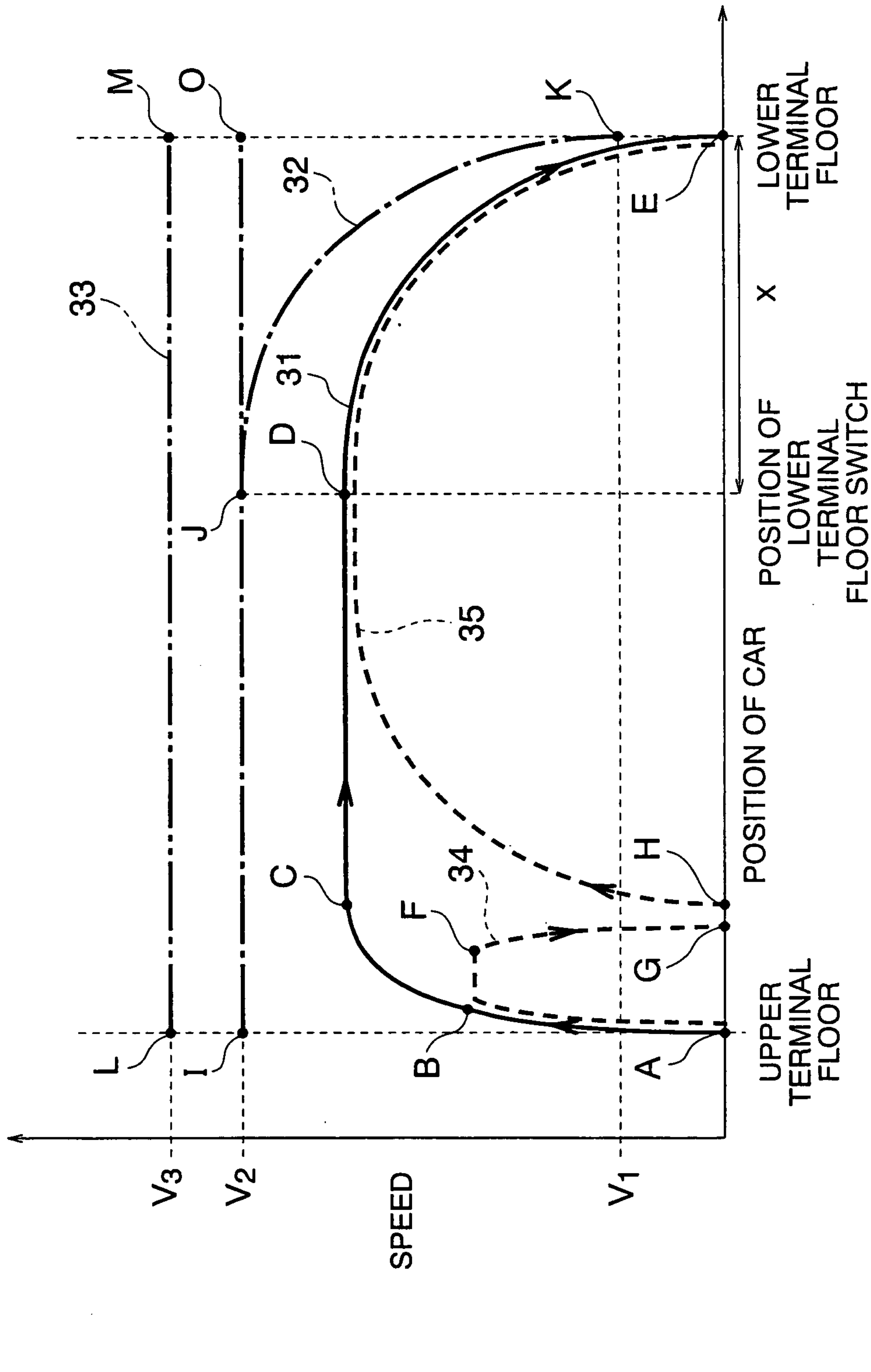

43
OR
5
7
6
4
17
OPERATION CONTROL PORTION
8
14
42
18
13
OVERSPEED MONITORING PORTION
3
2
21
20
1
15
16
19
10
9
12
16
11

FIG. 8



SPEED
V_3
V_2
V_1
POSITION OF CAR
UPPER TERMINAL FLOOR
POSITION OF LOWER TERMINAL FLOOR SWITCH
LOWER TERMINAL FLOOR
X
A
B
C
D
E
F
G
H
I
J
K
L
M
O
31
32
33
34
35

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/006109

A. CLASSIFICATION OF SUBJECT MATTER
B66B5/06(2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B66B5/06(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2005
Kokai Jitsuyo Shinan Koho	1971-2005	Toroku Jitsuyo Shinan Koho	1994-2005

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	JP 2004-137055 A (Toshiba Elevator and Building Systems Corp.), 13 May, 2004 (13.05.04), Par. Nos. [0002] to [0014]; Figs. 15 to 17 (Family: none)	1-3 5,7-8,10-11 4,6,9
Y A	JP 2004-123279 A (Mitsubishi Electric Corp.), 22 April, 2004 (22.04.04), Par. Nos. [0022] to [0024]; Figs. 1, 5, 10 & CN 1486918 A	5 6

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

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"&" document member of the same patent family

Date of the actual completion of the international search 26 December, 2005 (26.12.05)	Date of mailing of the international search report 10 January, 2006 (10.01.06)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/006109

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2002-128414 A (Hitachi, Ltd.), 09 May, 2002 (09.05.02), Par. Nos. [0013] to [0018]; Figs. 1 to 3 (Family: none)	7-8
Y A	JP 2003-327369 A (Mitsubishi Electric Corp.), 19 November, 2003 (19.11.03), Par. Nos. [0015] to [0018]; Figs. 2 to 3 (Family: none)	10-11 7-8
Y A	JP 2001-354372 A (Mitsubishi Electric Corp.), 25 December, 2001 (25.12.01), Par. Nos. [0038] to [0041], [0047] to [0051]; Fig. 2 (Family: none)	11 1-10

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2003010468 A **[0003]**