



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**06.11.2013 Bulletin 2013/45**

(51) Int Cl.:  
**B66B 5/06 (2006.01) B66B 5/00 (2006.01)**

(21) Application number: **13179074.3**

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

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

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(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:  
**05727801.2 / 1 880 967**

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Remarks:

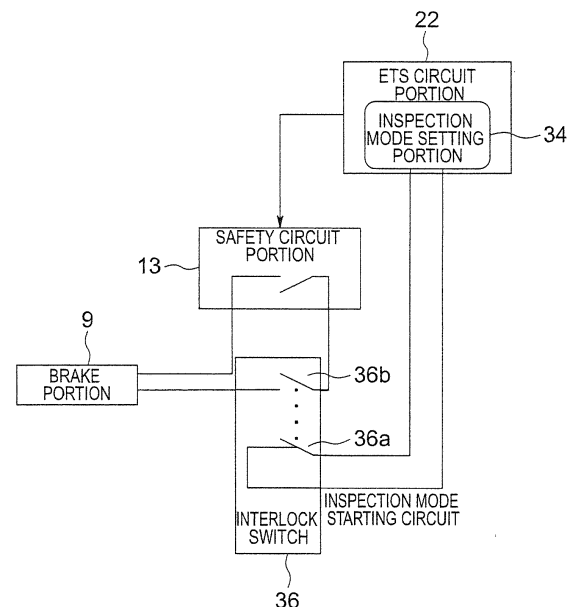
This application was filed on 02-08-2013 as a divisional application to the application mentioned under INID code 62.

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(54) **Overspeed detecting device for elevator apparatus with a safety interlock**

(57) An elevator apparatus comprises:  
a car (3) for being raised/lowered within a hoistway (1);  
a brake portion (9) for braking raising/lowering of the car (3);  
a safety circuit portion (13) for being opened to cause the brake portion (9) to perform a braking operation; and  
an electronic overspeed detecting device (22), which has an overspeed monitoring pattern set to change continuously at least with respect to a position within a car slow-down section of a terminal portion of the hoistway, for monitoring whether or not a speed of the car reaches the overspeed monitoring pattern, characterized in that:  
the electronic overspeed detecting device (22) has operation modes including an inspection mode for inspecting the electronic overspeed detecting device (22) itself; and  
the safety circuit portion (13) is opened in response to a switch in operation mode to the inspection mode.

**FIG. 11**



## Description

### Technical Field

**[0001]** The present invention relates to an elevator apparatus having an electronic overspeed detecting device for monitoring whether or not a speed of a car reaches an overspeed monitoring pattern.

### Background Art

**[0002]** A speed detecting device of a conventional elevator apparatus employs a pulse disc composed of a first circular plate and a second circular plate that are superposed one on another. By changing the angle of superposition of the second circular plate with respect to the first circular plate, the number of effective through-holes of the pulse disc is changed. More specifically, during an inspective operation of checking whether or not the speed detecting device operates normally, the number of the effective through-holes is doubled, so a speed of a hoisting machine that is twice as high as a normal speed thereof is detected in a simulative manner (e. g. , see Patent Document 1).

### **[0003]**

Patent Document 1: JP 05-338948 A

### Disclosure of the Invention

### Problem to be solved by the Invention

**[0004]** In the conventional elevator apparatus constructed as described above, when performing an operation of inspecting the speed detecting device, an operator needs to carry out a troublesome procedure of manually changing the angle of superposition of the second circular plate with respect to the first circular plate at a place where the speed detecting device is installed, namely, in a hoistway or a machinery room.

**[0005]** The present invention has been made to solve the problem as described above, and it is therefore an object of the present invention to obtain an elevator apparatus allowing an operation of inspecting an electronic safety system including an electronic overspeed detecting device to be performed with ease.

### Means for solving the Problem

**[0006]** The elevator apparatus according to the present invention includes: a car for being raised/lowered within a hoistway; a brake portion for braking raising/lowering of the car; a safety circuit portion for being opened to cause the brake portion to perform a braking operation; and an electronic overspeed detecting device, which has an overspeed monitoring pattern set to change continuously at least with respect to a position within a car slow-down section of a terminal portion of the hoistway, for

monitoring whether or not a speed of the car reaches the overspeed monitoring pattern, and in the elevator apparatus, the electronic overspeed detecting device has operation modes including an inspection mode for inspecting the electronic overspeed detecting device itself, and the safety circuit portion is opened in response to a switch in operation mode to the inspection mode.

### Brief Description of the Drawings

### **[0007]**

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

[Fig. 2] A graph of a pattern of overspeed set in speed governor and an ETS circuit portion of Fig. 1.

[Fig. 3] A block diagram showing functions of the ETS circuit portion of Fig. 1.

[Fig. 4] A graph showing a first example of an overspeed monitoring pattern in an inspection mode of the ETS circuit portion of Fig. 1.

[Fig. 5] A graph showing a second example of the overspeed monitoring pattern in the inspection mode of the ETS circuit portion of Fig. 1.

[Fig. 6] A graph showing a third example of the overspeed monitoring pattern in the inspection mode of the ETS circuit portion of Fig. 1.

[Fig. 7] A graph showing a fourth example of the overspeed monitoring pattern in the inspection mode of the ETS circuit portion of Fig. 1.

[Fig. 8] A block diagram showing functions of an ETS circuit portion of an elevator apparatus according to Embodiment 2 of the present invention.

[Fig. 9] A graph showing an example of an overspeed monitoring pattern in an inspection mode of the ETS circuit portion of Fig. 8.

[Fig. 10] A block diagram showing an essential part of an elevator apparatus according to Embodiment 3 of the present invention.

[Fig. 11] A block diagram showing an essential part of an elevator apparatus according to Embodiment 4 of the present invention.

[Fig. 12] A block diagram showing a state of an essential part of an elevator apparatus according to Embodiment 5 of the present invention during normal operation.

[Fig. 13] A block diagram showing a state of the elevator apparatus of Fig. 12 in an inspection mode.

[Fig. 14] A block diagram showing functions of an ETS circuit portion of an elevator apparatus according to Embodiment 6 of the present invention.

[Fig. 15] A front view showing an example of a display screen according to a relative position displaying portion and a reference position displaying portion of Fig. 14.

## Best Mode for carrying out the Invention

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

### Embodiment 1

**[0009]** Fig. 1 is a structural diagram of an elevator apparatus according to Embodiment 1 of the present invention. In the drawing, a hoistway 1 includes a pair of car guide rails 2 and a pair of counterweight guide rails (not shown) provided therein. A car 3 is raised and lowered in the hoistway 1 while being guided by the car guide rails 2. A counterweight 4 is raised and lowered in the hoistway 1 while being guided by the counterweight guide rail.

**[0010]** Provided in a lower part of the car 3 is a safety device 5 that engages with the car guide rails 2 to stop the car 3 in case of an emergency. The safety device 5 has a pair of braking pieces (wedge members) 6 that are moved by mechanical operation to be pushed against the car guide rails 2.

**[0011]** In the upper part of the hoistway 1, a driving apparatus (hoisting machine) 7 that raises and lowers the car 3 and the counterweight 4 via a main rope is provided. The driving apparatus 7 has: a drive sheave 8; a motor portion (not shown) that rotates the drive sheave 8; a brake portion 9 that brakes the rotation of the drive sheave 8; and a motor encoder 10 that generates a detection signal according to the rotation of the drive sheave 8.

**[0012]** 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 8 and an electromagnetic magnet is excited to separate the brake shoe from the braking surface to cancel the braking.

**[0013]** An elevator control panel 11 is provided, for example, in a lower part of the hoistway 1. The elevator control panel 11 includes: an operation control portion 12 that controls operation of the driving apparatus 7; and a safety circuit portion (relay circuit portion) 13 that suddenly stops the car 3 when the elevator has abnormality. The operation control portion 12 is input with a detection signal from the motor encoder 10. Based on the detection signal from the motor encoder 10, the operation control portion 12 calculates the position and speed of the car 3 to control the driving apparatus 7.

**[0014]** When the relay circuit of the safety circuit portion 13 is opened, an electric current to the motor portion of the driving apparatus 7 is blocked and an electric current to the electromagnetic magnet of the brake portion 9 is also blocked, whereby the drive sheave 8 is braked.

**[0015]** In the upper part of the hoistway 1, a speed governor (mechanical speed governor) 14 is provided.

The speed governor 14 includes: a speed governor sheave 15, an overspeed detection switch 16, a rope catch 17, and a speed governor encoder 18 serving as a sensor. The speed governor sheave 15 is wound at a speed governor rope 19. Both ends of the speed governor rope 19 are connected to an operational mechanism of the safety device 5. The lower end of the speed governor rope 19 is wound around a tension sheave 20 provided in the lower part of the hoistway 1.

**[0016]** When the car 3 is raised or lowered, the speed governor rope 19 is moved in circulation and the speed governor sheave 15 is rotated at a rotation speed corresponding to a traveling speed of the car 3. The speed governor 14 mechanically detects that the traveling speed of the car 3 reaches an overspeed. Set as overspeeds to be detected are a first overspeed (OS speed) that is higher than a rated speed and a second overspeed (Trip speed) that is higher than the first overspeed.

**[0017]** When the traveling speed of the car 3 reaches the first overspeed, the overspeed detection switch 16 is operated. When the overspeed detection switch 16 is operated, the relay circuit of the safety circuit portion 13 is opened. When the traveling speed of the car 3 reaches the second overspeed, the rope catch 17 grips the speed governor rope 19 to stop the circulation of the speed governor rope 19. When the circulation of the speed governor rope 19 is stopped, the safety device 5 provides a braking operation.

**[0018]** The speed governor encoder 18 generates a detection signal according to the rotation of the speed governor sheave 15. The speed governor encoder 18 employs a dual sense type encoder that simultaneously outputs two types of detection signals, i.e., a first detection signal and a second detection signal.

**[0019]** The first detection signal and the second detection signal from the speed governor encoder 18 are input to an ETS circuit portion 22 (electronic overspeed detection device) of an Emergency Terminal Slowdown apparatus (ETS apparatus) provided at an electronic safety controller 21. The ETS circuit portion 22 detects, based on a detection signal from the speed governor encoder 18, abnormality of an elevator and outputs a command signal for shifting the elevator to a safe state. More specifically, the ETS circuit portion 22 calculates, independently from the operation control portion 12, the traveling speed and a position of the car 3 based on the signal from the speed governor encoder 18, and monitors whether the traveling speed of the car 3 reaches an overspeed monitoring pattern (overspeed detection level). The overspeed monitoring pattern is set to change continuously with respect to a position within a car slowdown section of a terminal portion of the hoistway.

**[0020]** The ETS circuit portion 22 also converts the signal from the speed governor encoder 18 to a digital signal to perform a digital calculation processing and determine whether the traveling speed of the car 3 reaches an ETS monitoring overspeed. When the ETS circuit portion 22 determines that the traveling speed of the car 3 has

reached the ETS monitoring overspeed, the relay circuit of safety circuit portion 13 is opened.

**[0021]** The ETS circuit portion 22 can also detect abnormality of the ETS circuit portion 22 itself and abnormality of the speed governor encoder 18. When the ETS circuit portion 22 detects abnormality of the ETS circuit portion 22 itself or abnormality of the speed governor encoder 18, a nearest floor stop command signal is output from the ETS circuit portion 22 to the operation control portion 12 as a command signal for shifting the elevator to a safe state. Interactive communication is also possible between the ETS circuit portion 22 and the operation control portion 12.

**[0022]** In predetermined positions in the hoistway 1, there are provided first to fourth reference sensors 23 to 26 for detecting that the car 3 is located at a reference position in the hoistway. Top and bottom terminal landing switches can be used for the reference sensors 23 to 26. Detection signals from the reference sensors 23 to 26 are input to the ETS circuit portion 22. Based on the detection signals from the reference sensors 23 to 26, the ETS circuit portion 22 corrects the information for the position of the car 3 calculated in the ETS circuit portion 22.

**[0023]** On a bottom face of the hoistway 1, a car buffer 27 and a counterweight buffer 28 are provided. These buffers 27 and 28 may be, for example, an oil-filled-type or spring-type buffer.

**[0024]** Fig. 2 is a graph of overspeed patterns set in the speed governor 14 and the ETS circuit portion 22 of Fig. 1. In the drawing, when the car 3 travels at a normal speed (rated speed) from a bottom terminal landing to a top terminal landing, the car 3 draws a normal speed pattern  $V_0$ . The speed governor 14 is associated with a first overspeed pattern  $V_1$  and a second overspeed pattern  $V_2$  by a mechanical position adjustment. The ETS circuit portion 22 is associated with an ETS overspeed monitoring pattern  $V_E$ .

**[0025]** The ETS overspeed monitoring pattern  $V_E$  is set to be higher than the normal speed pattern  $V_0$ . The ETS overspeed monitoring pattern  $V_E$  is also set to have an equal interval from the normal speed pattern  $V_0$  in the entire ascending/descending process. In other words, the ETS overspeed monitoring pattern  $V_E$  changes according to a car position. More specifically, the ETS overspeed monitoring pattern  $V_E$  is set to be fixed in the vicinity of an intermediate floor and is set to continuously and smoothly decline, in the vicinity of a terminal landing, while being closer to an end of the hoistway 1 (upper end and lower end). In this manner, the ETS circuit portion 22 monitors the traveling speed of the car 3 not only in a position in the vicinity of terminal landings but also in a position in the vicinity of an intermediate floor (a fixed speed traveling zone in the normal speed pattern  $V_0$ ). However, the ETS circuit portion 22 does not always have to monitor the traveling speed of the car 3 in a position in the vicinity of the intermediate floor.

**[0026]** The first overspeed pattern  $V_1$  is set to be higher

than the ETS overspeed monitoring pattern  $V_E$ . The second overspeed pattern  $V_2$  is set to be higher than the first overspeed pattern  $V_1$ . The first overspeed pattern  $V_1$  and the second overspeed pattern  $V_2$  are fixed at all heights in the hoistway 1.

**[0027]** Fig. 3 is a block diagram showing functions of the ETS circuit portion 22 of Fig. 1. The ETS circuit portion 22 has a speed detecting portion 31, a position calculating portion 32, an overspeed monitoring portion 33, and an inspection mode setting portion 34. The speed detecting portion 31 detects a running speed of the car 3 based on a signal from the speed governor encoder 18. The position calculating portion 32 calculates a position of the car 3 based on signals from the reference position sensors 23 to 26 and information on the speed of the car 3 which is obtained from the speed detecting portion 31.

**[0028]** The overspeed monitoring portion 33 monitors whether or not the speed of the car 3 reaches a preset overspeed monitoring pattern, based on the information on the speed of the car 3 which is obtained from the speed detecting portion 31, information on the position of the car 3 which is obtained from the position calculating portion 32, and the overspeed monitoring pattern. When the speed of the car 3 reaches an overspeed level of the overspeed monitoring pattern, a forcible slowdown command is output to the safety circuit portion 13 to open the relay circuit thereof.

**[0029]** Included in operation modes of the ETS circuit portion 22 are a normal mode and an inspection mode for inspecting the ETS circuit portion 22 itself. In the inspection mode, the overspeed monitoring pattern can be changed. The inspection mode setting portion 34 sets a change in the overspeed monitoring pattern in the inspection mode.

**[0030]** The ETS circuit portion 22 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. The functions of the speed detecting portion 31, the position calculating portion 32, the overspeed monitoring portion 33, and the inspection mode setting portion 34, which are illustrated in Fig. 3, are realized by the computer of the ETS circuit portion 22. In other words, programs for realizing the functions of the speed detecting portion 31, the position calculating portion 32, the overspeed monitoring portion 33, and the inspection mode setting portion 34 are stored in the storage portion of the computer. Based on the programs, the calculation processing portion performs calculation processings regarding the functions of the speed detecting portion 31, the position calculating portion 32, the overspeed monitoring portion 33, and the inspection mode setting portion 34.

**[0031]** The operation control portion 12 is constituted by a computer that is different from the computer of the ETS circuit portion 22.

**[0032]** Fig. 4 is a graph showing a first example of the overspeed monitoring pattern in the inspection mode of the ETS circuit portion 22 of Fig. 1. In the first example,

the overspeed monitoring pattern  $V_E$  within a car slowdown section in a terminal portion of the hoistway 1 is directly shifted to an intermediate portion of a raising/lowering stroke of the car 3, so an inspective monitoring pattern  $V_{EC}$  is set. In inspecting the ETS circuit portion 22, the car 3 is caused to run within the hoistway 1 according to the normal speed pattern  $V_0$ . However, since the overspeed monitoring pattern has been changed, the running pattern of the car 3 during the inspection coincides with an inspection-time running pattern  $V_{0C}$ .

**[0033]** As described above, the change in the overspeed monitoring pattern is set in the inspection mode, so an overspeed can be detected in the intermediate portion of the hoistway 1 even when the car 3 is caused to run at a rated speed. Consequently, the operation of inspecting the ETS circuit portion 22 can be performed with ease. There is no need to cause the car 3 to run at a speed higher than the rated speed in order to inspect the ETS circuit portion 22. Therefore, there is no need to increase the capacity of the motor portion of the drive device 7 only for the purpose of inspection.

**[0034]** Fig. 5 is a graph showing a second example of the overspeed monitoring pattern in the inspection mode of the ETS circuit portion 22 of Fig. 1. In the second example, the overspeed monitoring pattern  $V_E$  within the car slowdown section in the terminal portion of the hoistway 1 is shifted to a lower value than the normal mode, so an inspective monitoring pattern  $V_{EC}$  is set.

**[0035]** As described above, the operation of inspecting the ETS circuit portion 22 can also be performed with ease by setting the inspective monitoring pattern  $V_{EC}$ , which is lower in speed than the overspeed monitoring pattern in the normal mode, in the inspection mode.

**[0036]** Fig. 6 is a graph showing a third example of the overspeed monitoring pattern in the inspection mode of the ETS circuit portion 22 of Fig. 1. In the third example, the overspeed monitoring pattern  $V_E$  within the car slowdown section in the terminal portion of the hoistway 1 is shifted by an arbitrary distance in a raising/lowering direction of the car 3, so an inspective monitoring pattern  $V_{EC}$  is set.

**[0037]** The inspective monitoring pattern  $V_{EC}$  as described above also enables detection of an overspeed when the car 3 runs at a speed equal to or lower than the rated speed. As a result, the operation of inspecting the ETS circuit portion 22 can be performed with ease.

**[0038]** Fig. 7 is a graph showing a fourth example of the overspeed monitoring pattern in the inspection mode of the ETS circuit portion 22 of Fig. 1. In the fourth example, the inspective monitoring pattern  $V_{EC}$  is so set as to make an overspeed detecting level constant and equal to or lower than the rated speed regardless of the position within the hoistway 1.

**[0039]** The inspective monitoring pattern  $V_{EC}$  as described above also enables detection of an overspeed when the car 3 runs at a speed equal to or lower than the rated speed. As a result, the operation of inspecting the ETS circuit portion 22 can be performed with ease.

## Embodiment 2

**[0040]** Reference will be made next to Fig. 8, which is a block diagram showing functions of the ETS circuit portion 22 of an elevator apparatus according to Embodiment 2 of the present invention. The elevator apparatus according to Embodiment 2 is different from the elevator apparatus according to Embodiment 1 only in the functional structure of the ETS circuit portion 22. The entire construction of the elevator apparatus according to Embodiment 2 is identical to that of the elevator apparatus according to Embodiment 1.

**[0041]** In this example, during the inspection mode, the inspection mode setting portion 34 changes information on the position of the car 3, which is transmitted from the position calculating portion 32 to the overspeed monitoring portion 33. More specifically, in the inspection mode, the ETS circuit portion 22 fixes the information on the position of the car 3, which is transmitted from the position calculating portion 32 to the overspeed monitoring portion 33, to information indicating a predetermined fixed position within the car slowdown section without changing the overspeed monitoring pattern  $V_E$  itself, as shown in, for example, Fig. 9. That is, in the inspection mode, the speed of the car 3 is monitored on the assumption that the position of the car 3 is fixed to the fixed position, although the car 3 is actually running.

**[0042]** Thus, the same state as in the case where the inspective monitoring pattern  $V_{EC}$  is so set as to make the overspeed detecting level constant and equal to or lower than the rated speed regardless of the position within the hoistway 1 is substantially established, so an overspeed can be detected when the car 3 runs at a speed equal to or lower than the rated speed. As a result, the operation of inspecting the ETS circuit portion 22 can be performed with ease.

**[0043]** The fixed position may be variable within the car slowdown section as circumstances demand. The inspection of the ETS circuit portion 22 can thereby be conducted a plurality of times as well while changing the fixed position.

## Embodiment 3

**[0044]** Reference will be made next to Fig. 10, which is a block diagram showing an essential part of an elevator apparatus according to Embodiment 3. Referring to Fig. 10, an automatic inspection command input portion 35 for inputting thereto a command to conduct the inspection of the ETS circuit portion 22 automatically is connected to the ETS circuit portion 22 and the operation control portion 12. When the automatic inspection command is input to the automatic inspection command input portion 35, an inspection mode setting command is input to the inspection mode setting portion 34 of the ETS circuit portion 22, and an inspective running pattern is input to the operation control portion 12.

**[0045]** When the inspection mode setting command is

input to the inspection mode setting portion 34, the operation mode of the ETS circuit portion 22 is switched to the inspection mode, so the change in setting as described in Embodiment 1 or 2 is made. Meanwhile, when the inspective running pattern is input to the operation control portion 12, the operation control portion 12 causes the car 3 to run according to the inspective running pattern. Embodiment 3 is identical to Embodiment 1 or 2 in other constructional details.

**[0046]** In the elevator apparatus constructed as described above, the inspection of the ETS circuit portion 22, including the inspective running of the car 3 and the change in the setting of the ETS circuit portion 22, can be automatically conducted simply by inputting an inspection command to the automatic inspection command input portion 35. In consequence, the burden cast on a maintenance worker or an installation operator during inspection can be lightened.

**[0047]** The inspection mode setting command and the inspective running pattern may be input to the ETS circuit portion 22 and the operation control portion 12 respectively either at the same time or with a time difference. For instance, the inspective running pattern may be input to the operation control portion 12 as soon as a predetermined time elapses after the inspection mode setting command has been input to the ETS circuit portion 22. The car 3 may be caused to start running as soon as a predetermined time elapses after the inspective running pattern has been input to the operation control portion 12.

**[0048]** Furthermore, two or more inspective running patterns may be input to the operation control portion 12. For example, in the case where an initial position of the car 3 for inspection has been determined, a running command according to a corresponding one of the inspective running patterns may be input to the operation control portion 12 after a command to move the car 3 to the initial position has been input to the operation control portion 12 and then an inspection mode setting command has been input to the ETS circuit portion 22.

**[0049]** Still further, the automatic inspection command input portion 35 may be provided independently from the ETS circuit portion 22 and the operation control portion 12, but may also be provided as part of the ETS circuit portion 22 or the operation control portion 12.

#### Embodiment 4

**[0050]** Reference will be made next to Fig. 11, which is a block diagram showing an essential part of an elevator apparatus according to Embodiment 4 of the present invention. Referring to Fig. 11, an interlock switch 36 is connected to the ETS circuit portion 22. When a first switch 36a of the interlock switch 36 is closed, an inspection mode starting circuit is short-circuited, so the inspection mode setting portion 34 sets an inspection mode.

**[0051]** The interlock switch 36 is provided with a second switch 36b, which is connected in series to the safety

circuit portion 13. The second switch 36b is opened/closed in such a manner as to be interlocked with the opening/closing of the first switch 36a mechanically. More specifically, the second switch 36b is opened when the first switch 36a is closed. Accordingly, the safety circuit portion 13 is opened when the first switch 36a is closed.

**[0052]** In the elevator apparatus constructed as described above, since the setting of an inspection mode and the opening of the safety circuit portion 13 are carried out in an interlocking manner, the inspection mode can be set with the car 3 stopped more reliably. An operator is allowed to perform an operation of inspecting the ETS circuit portion 22, which requires the operator to move onto the car 3 or into the hoistway 1, with the car 3 stopped more reliably.

#### Embodiment 5

**[0053]** Reference will be made next to Figs. 12 and 13, which are a block diagram showing a state of an essential part of an elevator apparatus according to Embodiment 5 during normal operation and a block diagram showing a state of the elevator apparatus of Fig. 12 in an inspection mode, respectively. Referring to Figs. 12 and 13, the safety circuit portion 13 and the inspection mode starting circuit are selectively short-circuited using a jumper plug 37. That is, during a normal operation, while the safety circuit portion 13 is short-circuited by the jumper plug 37, the inspection mode starting circuit is open. On the other hand, in the inspection mode, while the inspection mode starting circuit is short-circuited by the jumper plug 37, the safety circuit portion 13 is open.

**[0054]** Included in methods of inspecting the ETS circuit portion 22 with the car 3 stopped is the following method. First of all, information on the position of the car 3, which is transmitted from the position calculating portion 32 to the speed calculating portion 33, is fixed according to the method described in Embodiment 2. Then, the speed governor rope 19 is temporarily removed from the speed governor sheave 15. After that, the speed governor sheave 15 is rotated using an electric drill or the like, so a signal corresponding to a rotational speed of the speed governor sheave 15 is output from the speed governor encoder 18. By conducting the inspection in this manner, a speed of the car 3 can be detected by the speed detecting portion 31 without actually causing the car 3 to run. By looking at the manner in which the switch of the safety circuit portion 13 operates when the speed of the car 3 has exceeded the overspeed monitoring pattern  $V_E$ , it becomes possible to confirm whether or not the ETS circuit portion 22 operates correctly.

**[0055]** In the elevator apparatus constructed as described above, since the setting of the inspection mode and the opening of the safety circuit portion 13 are carried out in an interlocking manner, the inspection mode can be set with the car 3 stopped more reliably. The operator is allowed to perform an operation of inspecting the ETS

circuit portion 22, which requires the operator to move onto the car 3 or into the hoistway 1, with the car 3 stopped more reliably.

#### Embodiment 6

**[0056]** Reference will be made next to Fig. 14, which is a block diagram showing functions of the ETS circuit portion 22 of an elevator apparatus according to Embodiment 6. The ETS circuit portion 22 has the speed detecting portion 31, the position calculating portion 32, the overspeed monitoring portion 33, a floor stop position storing portion 38, a reference position storing portion 39, a relative position displaying portion 40, and a reference position displaying portion 41.

**[0057]** When the car 3 stops at a predetermined floor, a floor stop signal is transmitted from the operation control portion 12 to the floor stop position storing portion 38. Information on the position of the car 3, which has been calculated by the position calculating portion 32, is transmitted to the floor stop position storing portion 38. The floor stop position storing portion 38 thereby stores the position of the car 3 upon stoppage of the car 3 at the predetermined floor, which has been calculated by the position calculating portion 32.

**[0058]** Reference position detection signals from the reference position sensors 23 to 26 and the information on the position of the car 3, which has been calculated by the position calculating portion 32, are transmitted to the reference position storing portion 39. The reference position storing portion 39 thereby stores the position of the car 3 upon passage of the car 3 past a reference position, which has been calculated by the position calculating portion 32.

**[0059]** The relative position displaying portion 40 calculates a distance between two predetermined floors based on the information from the floor stop position storing portion 38, and causes a monitor (not shown) to display the distance as shown in, for example, Fig. 15.

**[0060]** The reference position displaying portion 41 calculates distances from a predetermined floor to the reference position sensors 23 to 26 based on the information from the floor stop position storing portion 38 and the reference position storing portion 39, and causes the monitor to display the distances as shown in, for example, Fig. 15.

**[0061]** The functions of the floor stop position storing portion 38, the reference position storing portion 39, the relative position displaying portion 40, and the reference position displaying portion 41 are realized by the computer of the ETS circuit portion 22. In other words, programs for realizing the functions of the floor stop position storing portion 38, the reference position storing portion 39, the relative position displaying portion 40, and the reference position displaying portion 41 are stored in the storage portion of the computer. Based on the programs, the calculation processing portion performs calculation processings regarding the functions of the floor stop po-

sition storing portion 38, the reference position storing portion 39, the relative position displaying portion 40, and the reference position displaying portion 41.

**[0062]** Accordingly, an inter-floor distance calculating portion and a reference position calculating portion according to Embodiment 6 are constituted by the computer of the ETS circuit portion 22.

**[0063]** In the elevator apparatus as described above, a distance between predetermined floors, which has been output from the relative position displaying portion 40, can be compared with an actual distance between floors of a building. Thus, it is possible to easily check whether or not the ETS circuit portion 22 correctly performs the function of calculating a relative distance.

**[0064]** A distance from a predetermined floor to a reference position, which has been output from the reference position displaying portion 41, can be compared with a predetermined distance from the predetermined floor to the reference position, so it is possible to easily check whether or not the reference position sensors 23 to 26 are positioned correctly. In addition, since the position of the car 3 upon passage thereof past the reference position has been obtained, it is also possible to easily check whether or not the reference position sensors 23 to 26 operate correctly.

**[0065]** Although the functions of the floor stop position storing portion 38, the reference position storing portion 39, the relative position displaying portion 40, and the reference position displaying portion 41 are realized by the computer of the ETS circuit portion 22 in Embodiment 6, they may also be realized by a computer separated from the ETS circuit portion 22. The outputs from the relative position displaying portion 40 and the reference position displaying portion 41 may also be displayed on a monitoring panel installed in an administrative room of the building. Thus, the function of calculating a relative distance and the functions of the reference position sensors 23 to 26 can be confirmed with ease from a remote place.

#### Further Items of Disclosure

##### **[0066]**

1. An elevator apparatus, comprising an electronic overspeed detecting device (22), which has an overspeed monitoring pattern set to change continuously at least with respect to a position within a car slowdown section of a terminal portion of a hoistway, for monitoring whether or not a speed of a car reaches the overspeed monitoring pattern,

##### **characterized in that:**

the electronic overspeed detecting device (22) has operation modes including an inspection mode for inspecting the electronic overspeed detecting device (22) itself; and the overspeed monitoring pattern can be

changed in the inspection mode.

2. The elevator apparatus according to item 1, **characterized in that** the electronic overspeed detecting device (22) shifts the overspeed monitoring pattern for the car slowdown section toward an intermediate portion of a raising/lowering stroke of the car in the inspection mode. 5
3. The elevator apparatus according to item 1, **characterized in that** the electronic overspeed detecting device (22) shifts the overspeed monitoring pattern for the car slowdown section to a speed slower than that in a normal operation in the inspection mode. 10
4. The elevator apparatus according to item 1, **characterized in that** the electronic overspeed detecting device (22) can shift the overspeed monitoring pattern for the car slowdown section in a raising/lowering direction of the car (3) by an arbitrary distance in the inspection mode. 15
5. The elevator apparatus according to item 1, **characterized in that** the electronic overspeed detecting device (22) sets an overspeed detecting level to a value that is constant and equal to or lower than a rated speed regardless of a position within the hoistway (1) in the inspection mode. 20
6. The elevator apparatus, comprising: 25  
an electronic overspeed detecting device (22), which has an overspeed monitoring pattern set to change continuously at least with respect to a position within a car slowdown section of a terminal portion of a hoistway, for monitoring whether or not a speed of a car reaches the overspeed monitoring pattern, 30  
**characterized in that:** 35  
the electronic overspeed detecting device (22) has operation modes including an inspection mode for inspecting the electronic overspeed detecting device (22) itself; and the electronic overspeed detecting device (22) monitors the speed of the car on an assumption that a position of the car is fixed to a predetermined fixed position within the car slowdown section despite a running state of the car (3), in the inspection mode. 40
7. The elevator apparatus according to item 6, **characterized in that** the fixed position can be changed. 45
8. The elevator apparatus according to any one of items 1 to 7, further comprising an operation control portion (12) for controlling operation of the car (3), characterized by further comprising 50  
an automatic inspection command input portion (35) for inputting thereto a command to automatically conduct an inspection of the electronic overspeed detecting device (22), 55

an operation mode of the electronic overspeed detecting device (22) being switched to the inspection mode and the car (3) being automatically caused to start running according to an inspective running pattern by inputting an inspection command to the automatic inspection command input portion (35) .

9. The elevator apparatus according to item 8, **characterized in that** the car (3) is automatically moved to an inspection starting position in a normal running state, an operation mode of the electronic overspeed detecting device (22) is then switched to the inspection mode, and the car (3) is caused to start running according to the inspective running pattern when the inspection command is input to the automatic inspection command input portion (35).

10. An elevator apparatus, comprising:

a car (3) for being raised/lowered within a hoistway (1);  
a brake portion (9) for braking raising/lowering of the car (3);  
a safety circuit portion (13) for being opened to cause the brake portion (9) to perform a braking operation; and  
an electronic overspeed detecting device (22), which has an overspeed monitoring pattern set to change continuously at least with respect to a position within a car slowdown section of a terminal portion of the hoistway, for monitoring whether or not a speed of the car reaches the overspeed monitoring pattern,

**characterized in that:**

the electronic overspeed detecting device (22) has operation modes including an inspection mode for inspecting the electronic overspeed detecting device (22) itself; and  
the safety circuit portion (13) is opened in response to a switch in operation mode to the inspection mode.

11. An elevator apparatus, comprising:

a car (3) for being raised/lowered within a hoistway (1);  
an operation control portion (12) for controlling operation of the car (3); and  
an electronic overspeed detecting device (22), which has an overspeed monitoring pattern set to change continuously at least with respect to a position within a car slowdown section of a terminal portion of the hoistway, for monitoring whether or not a speed of the car reaches the overspeed monitoring pattern,

characterized by further comprising:

a floor-to-floor calculating portion for storing a floor position upon stoppage of the car (3) at a floor, which has been calculated by the electronic overspeed detecting device (22), based on a floor stop signal transmitted from the operation control portion (12) upon stoppage of the car (3) at the floor and information on a position of the car which has been obtained by the electronic overspeed detecting device (22), and calculating a distance between predetermined floors.

12. An elevator apparatus, comprising:

a car (3) for being raised/lowered within a hoistway (1);  
 an operation control portion (12) for controlling operation of the car (3);  
 an electronic overspeed detecting device (22), which has an overspeed monitoring pattern set to change continuously at least with respect to a position within a car slowdown section of a terminal portion of the hoistway, for monitoring whether or not a speed of the car reaches the overspeed monitoring pattern; and  
 reference position sensors (23 to 26) each provided at a reference position within the hoistway (1), for inputting information indicating that the car (3) is located at the reference position into the electronic overspeed detecting device (22),

characterized by further comprising:

a reference position calculating portion for storing a floor position upon stoppage of the car (3) at a floor, which has been calculated by the electronic overspeed detecting device (22), based on a floor stop signal transmitted from the operation control portion (12) upon stoppage of the car (3) at the floor and information on a position of the car which has been obtained by the electronic overspeed detecting device (22), storing a reference position at a time when the car (3) is located at the reference position, which has been calculated by the electronic overspeed detecting device (22), based on the information on the position of the car which has been obtained by the electronic overspeed detecting device (22) and information from the reference position sensors (23 to 26), and calculating a distance between a predetermined floor and the reference position.

a car (3) for being raised/lowered within a hoistway (1);  
 a brake portion (9) for braking raising/lowering of the car (3) ;  
 a safety circuit portion (13) for being opened to cause the brake portion (9) to perform a braking operation; and  
 an electronic overspeed detecting device (22), which has an overspeed monitoring pattern set to change continuously at least with respect to a position within a car slowdown section of a terminal portion of the hoistway, for monitoring whether or not a speed of the car reaches the overspeed monitoring pattern,

**characterized in that:**

the electronic overspeed detecting device (22) has operation modes including an inspection mode for inspecting the electronic overspeed detecting device (22) itself; and  
 the safety circuit portion (13) is opened in response to a switch in operation mode to the inspection mode.

## Claims

1. An elevator apparatus, comprising:

FIG. 1

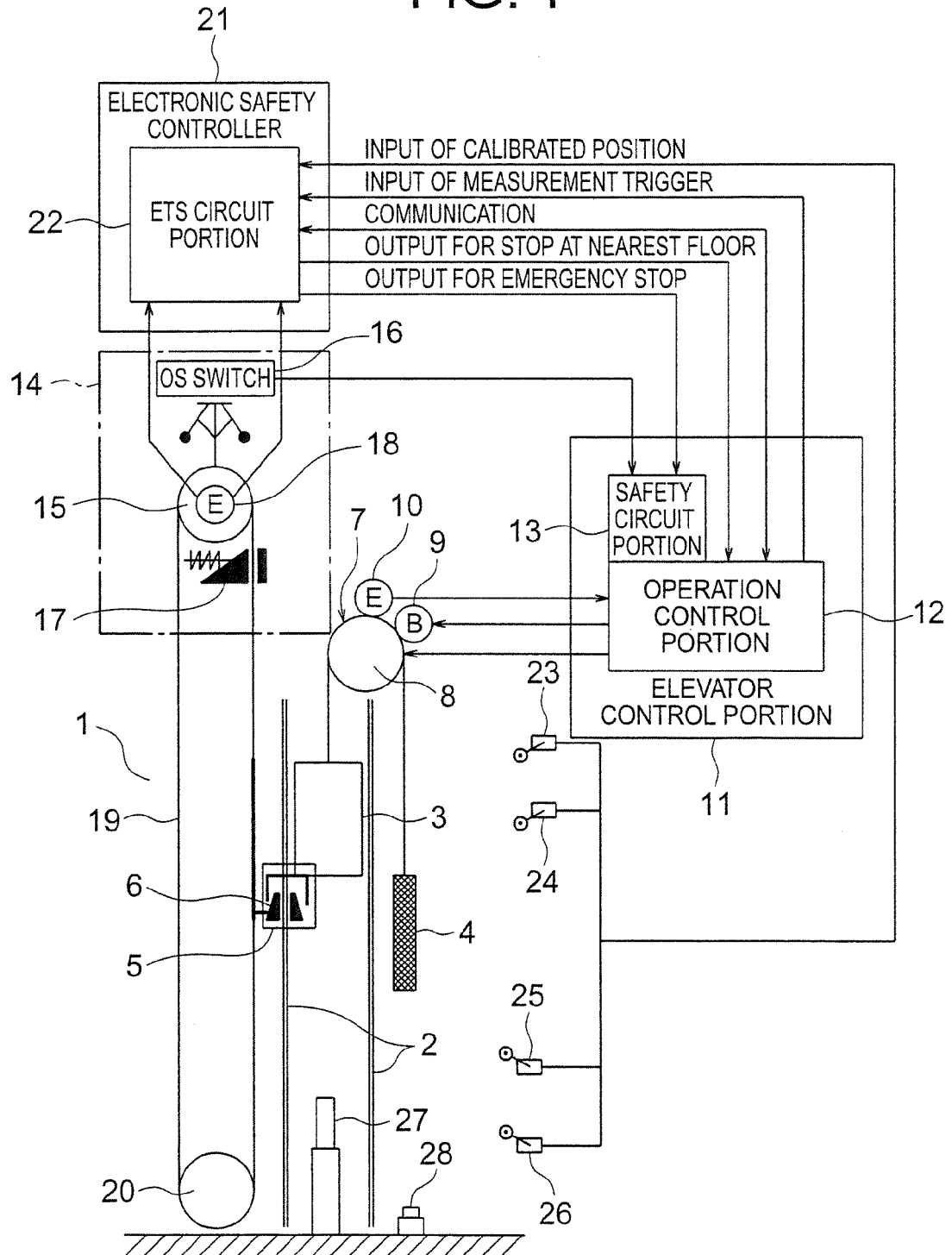


FIG. 2

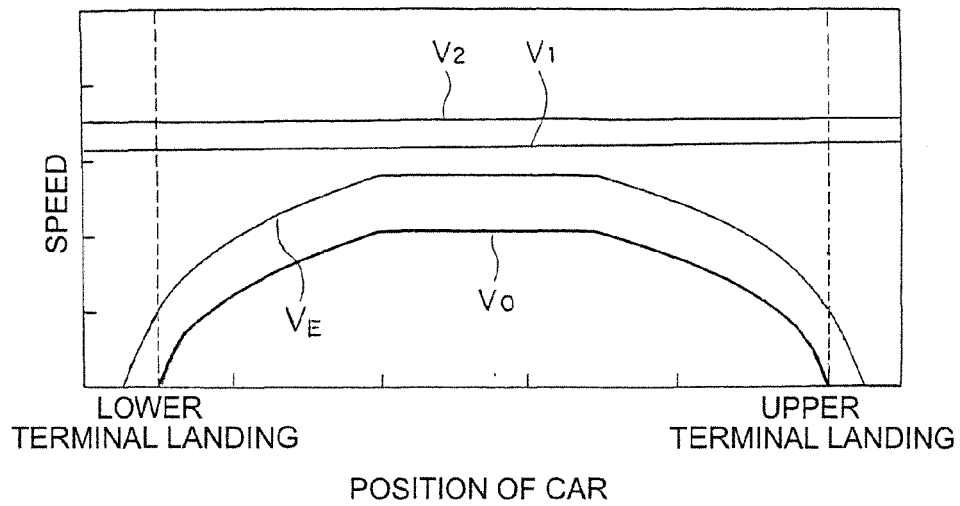


FIG. 3

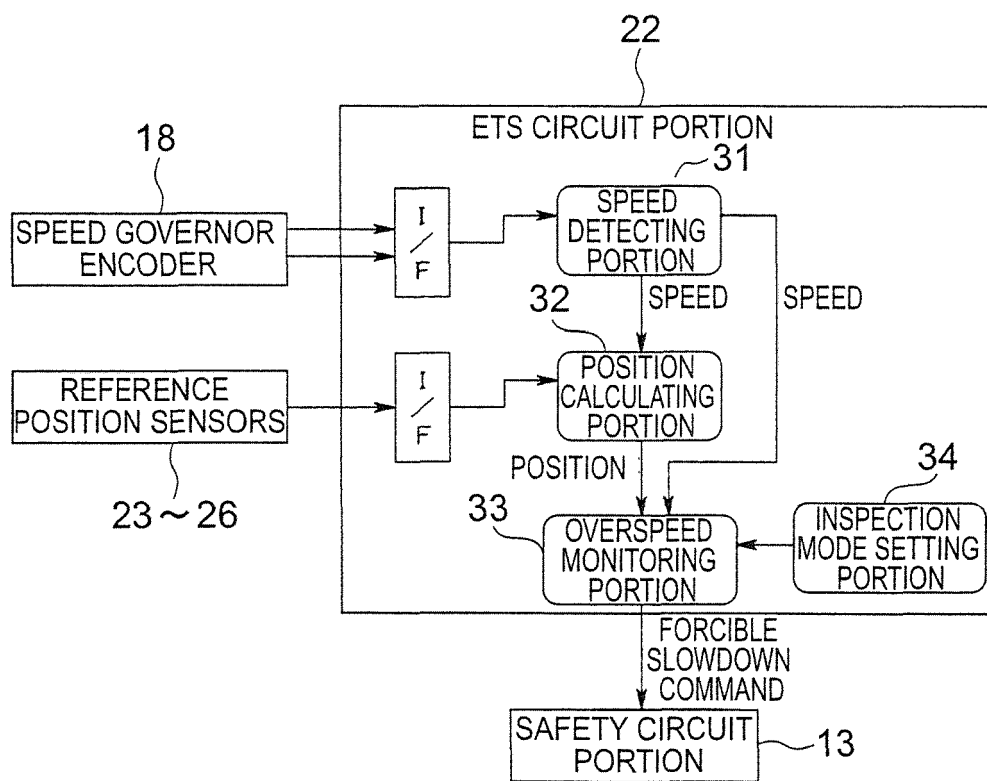


FIG. 4

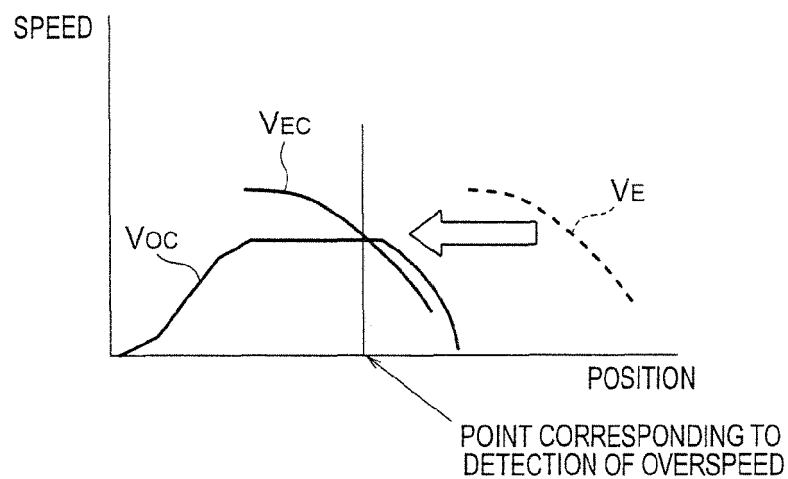


FIG. 5

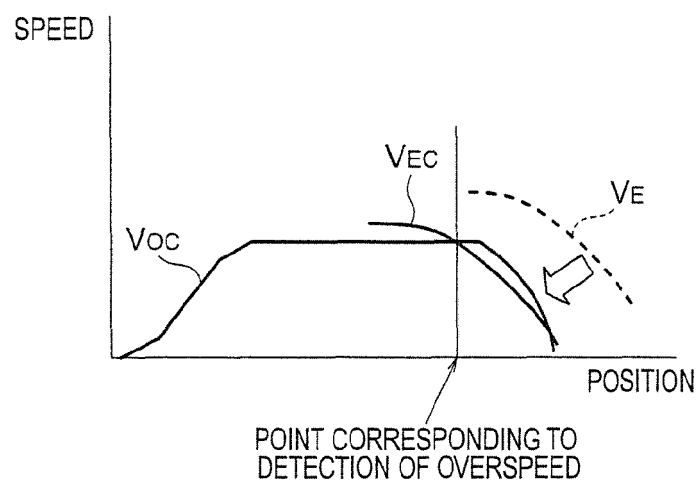


FIG. 6

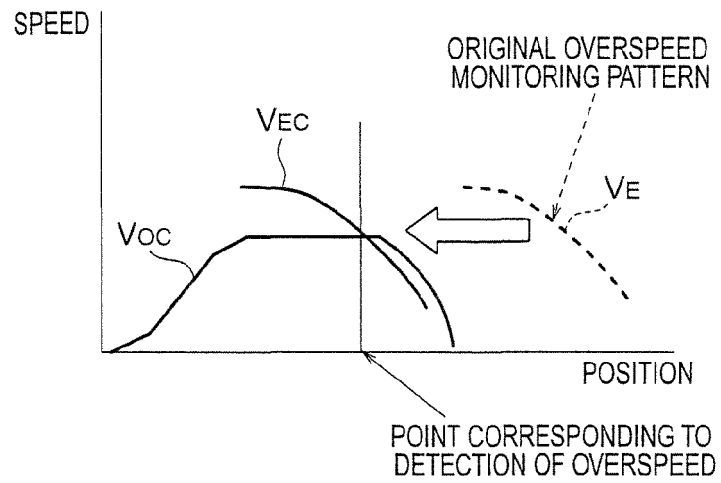


FIG. 7

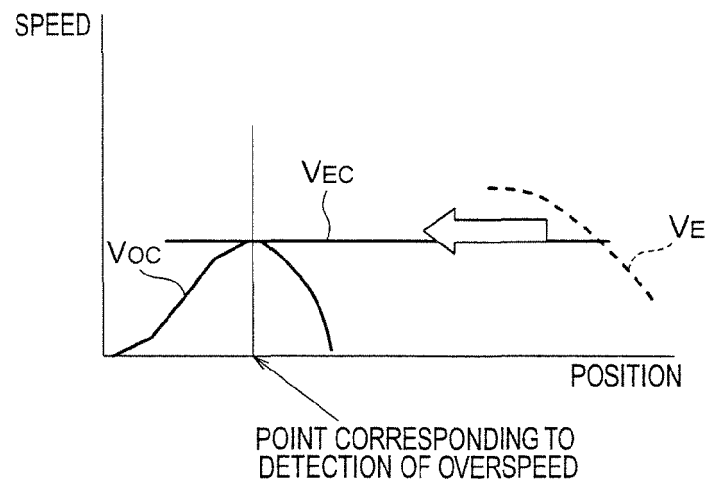


FIG. 8

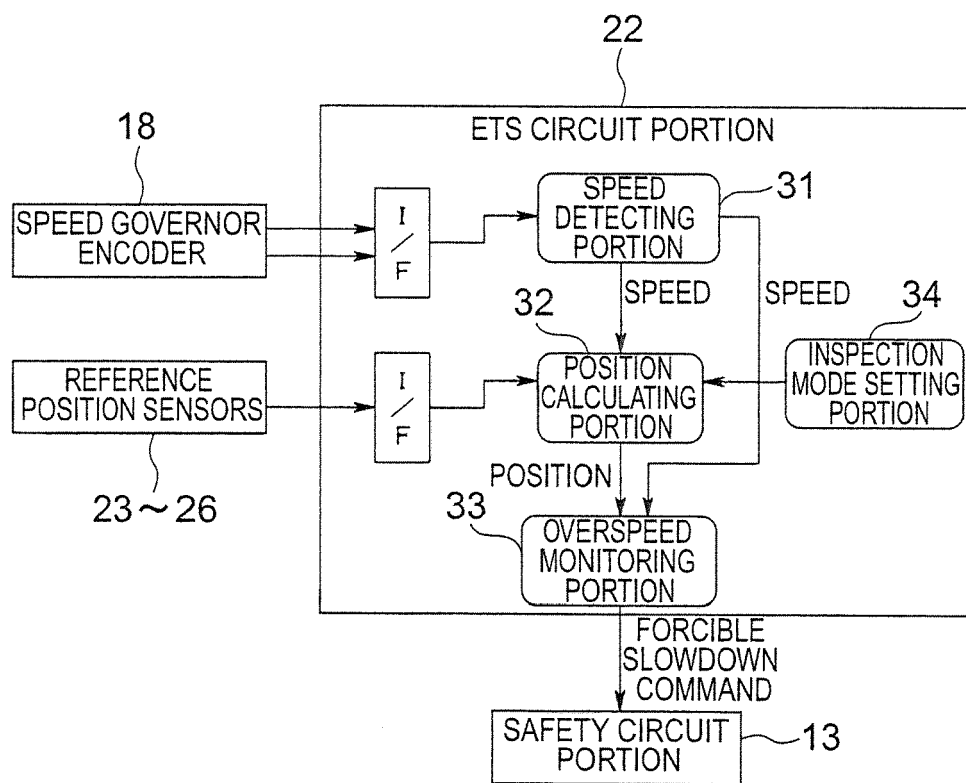


FIG. 9

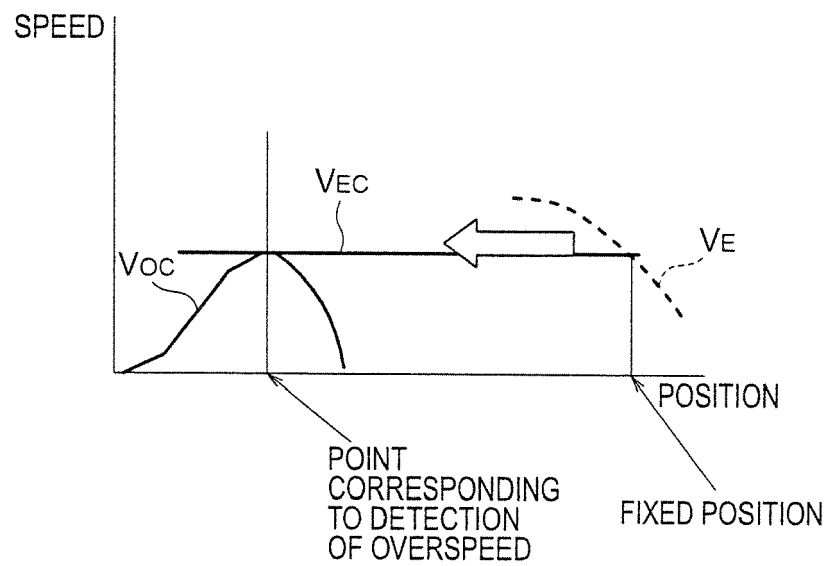


FIG. 10

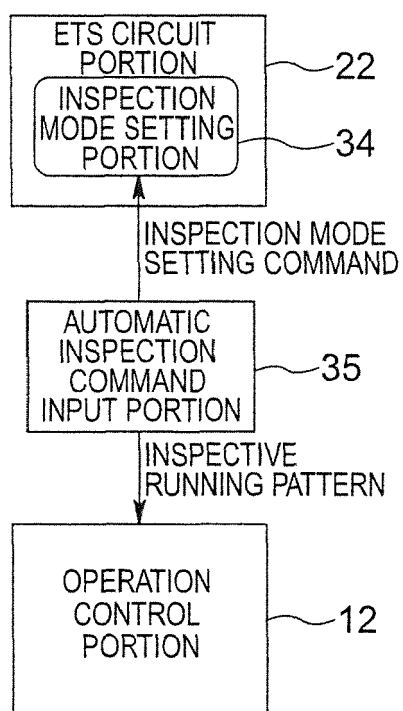


FIG. 11

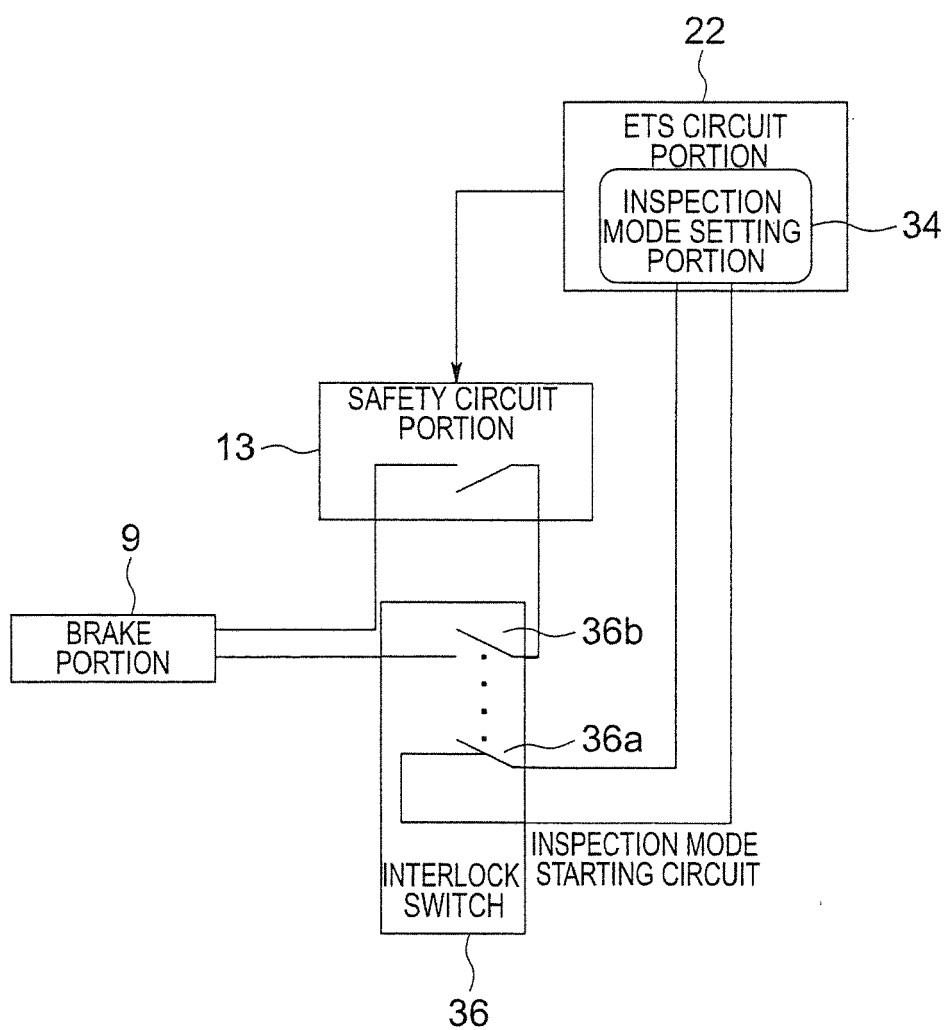


FIG. 12

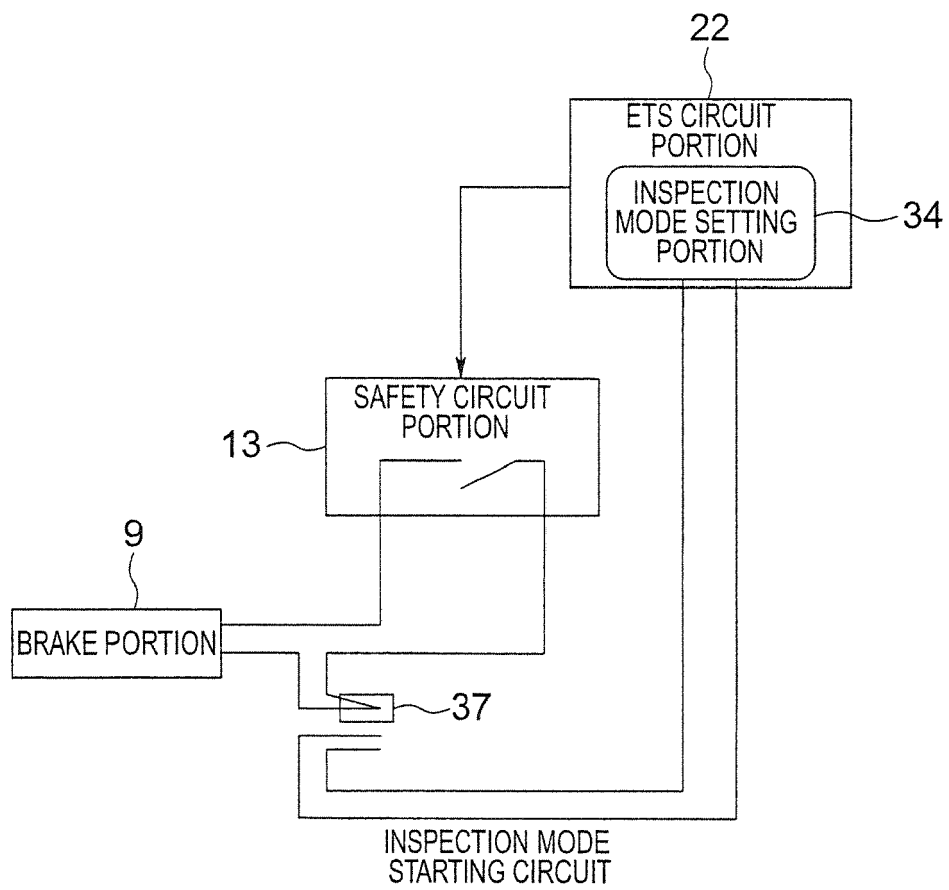


FIG. 13

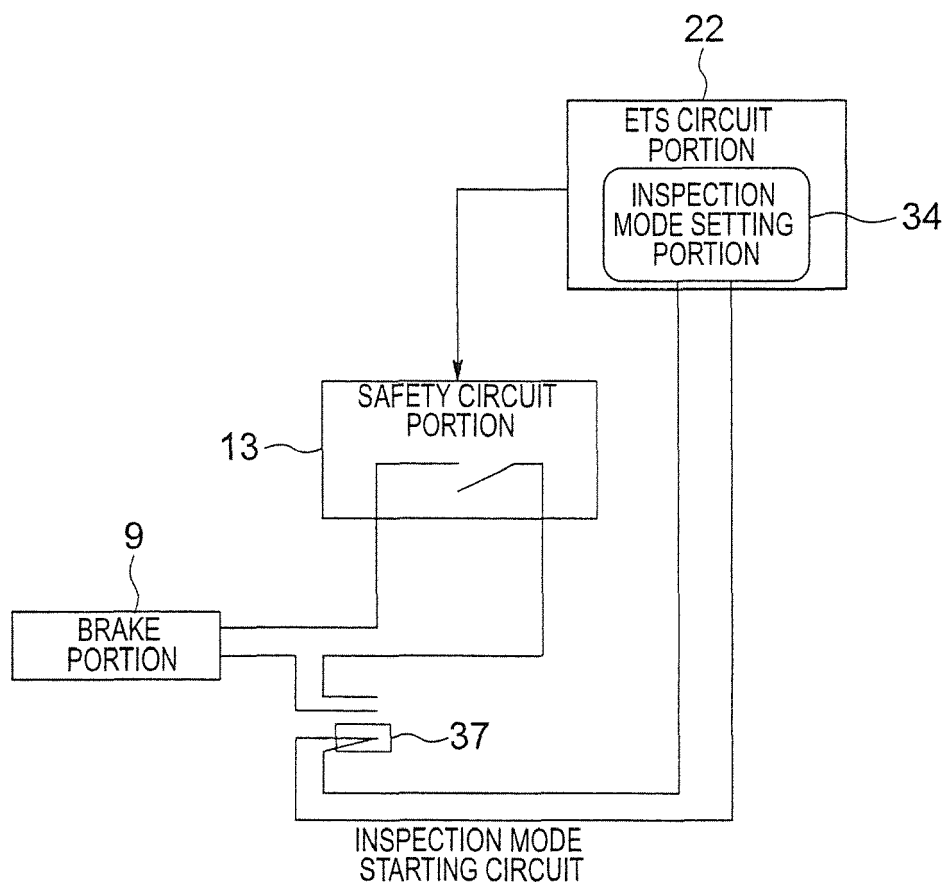


FIG. 14

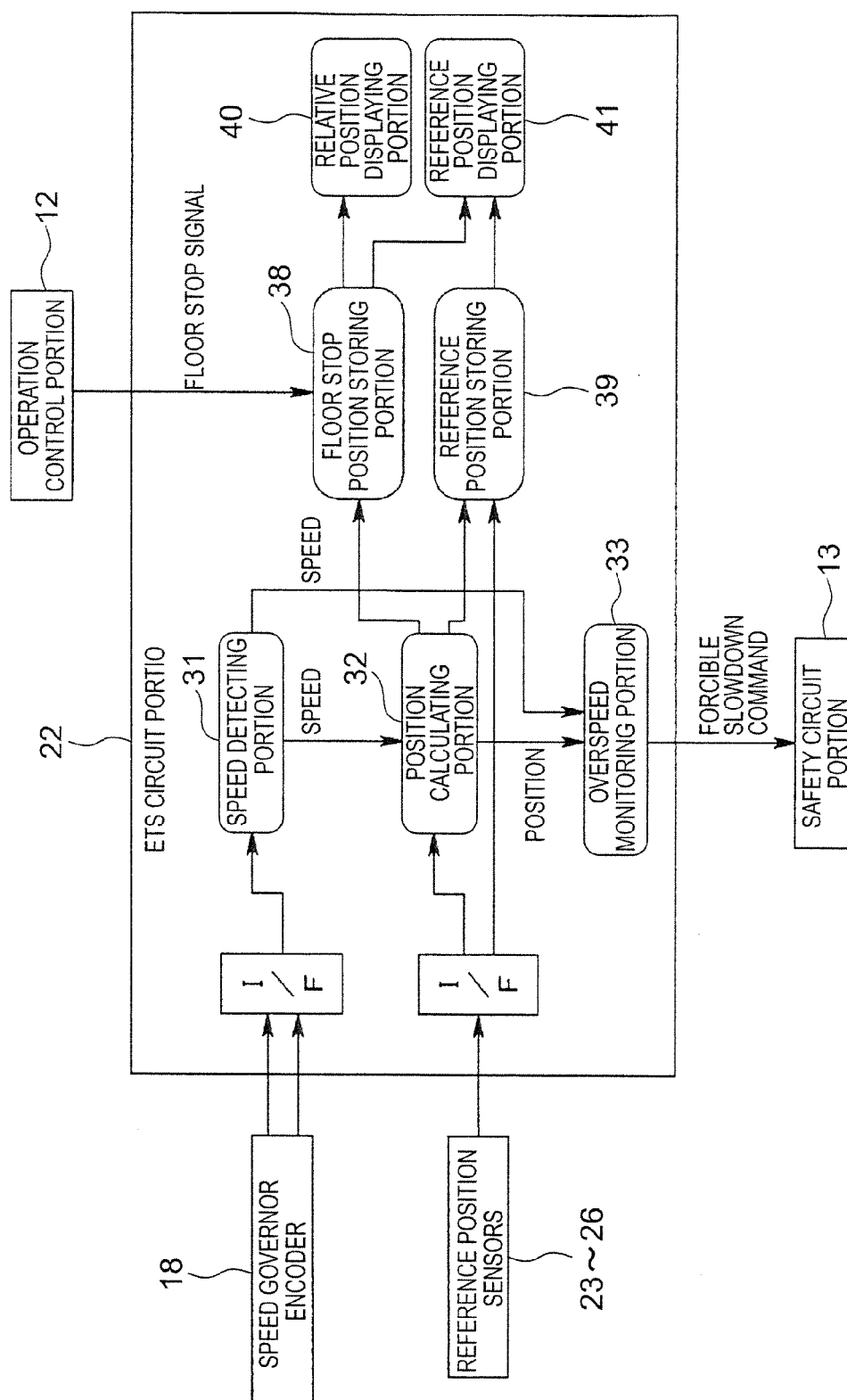
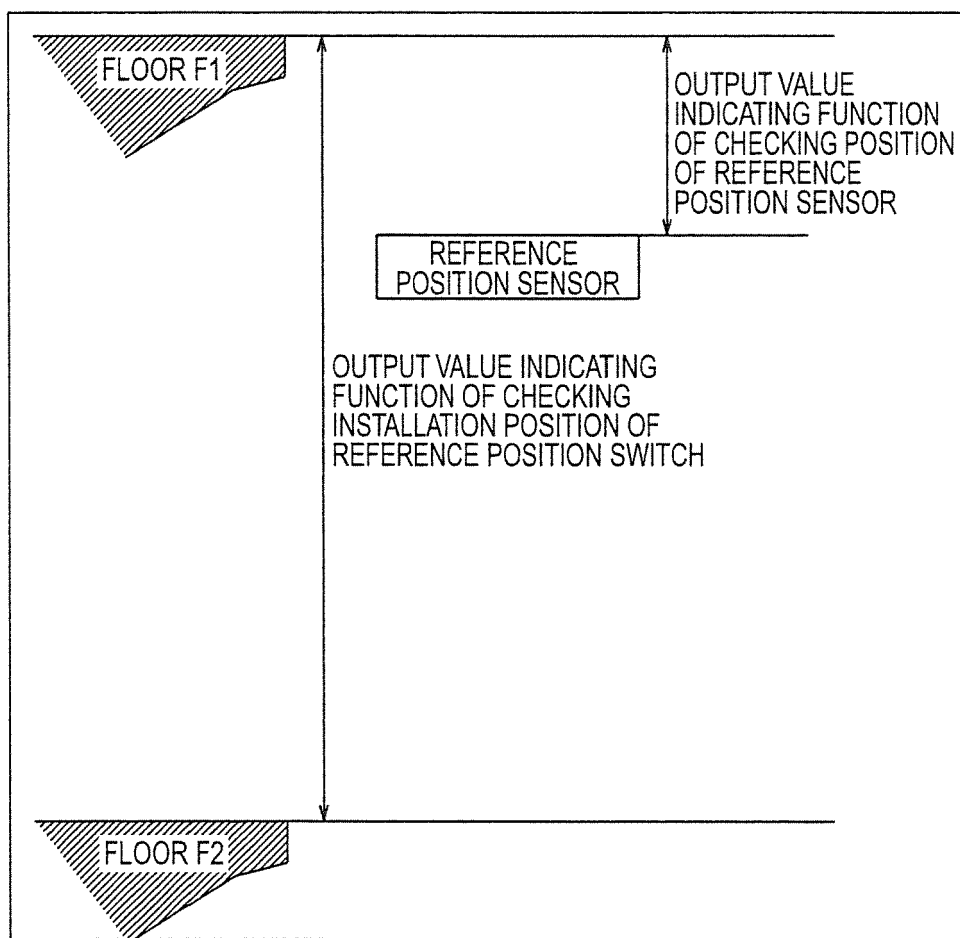


FIG. 15





## EUROPEAN SEARCH REPORT

Application Number  
EP 13 17 9074

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                            |                                                    |                                         |
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| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                                                                              | Relevant to claim                                  | CLASSIFICATION OF THE APPLICATION (IPC) |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                            |                                                    |                                         |
| Place of search<br>The Hague                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                            | Date of completion of the search<br>29 August 2013 | Examiner<br>Piekarski, Adam             |
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EP 13 17 9074

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The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-08-2013

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