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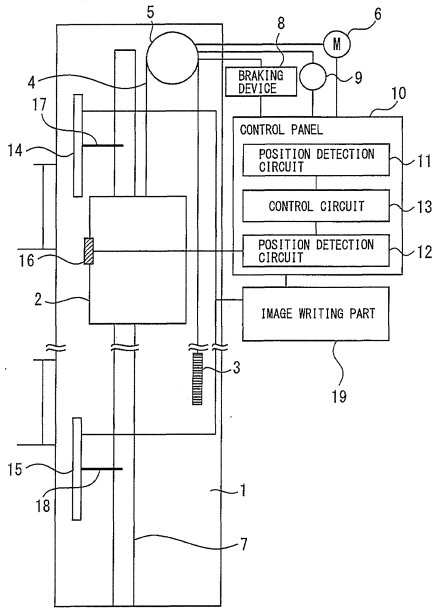
(54) ELEVATOR CONTROL DEVICE

(57) Provided is an elevator controller which can substantially simplify the labor for installation and adjustment and can detect car positions with high accuracy regardless of the skills of workers who perform installation and adjustment.

This controller is provided with an encoder which detects the rotation of a sheave and first position detection means which detects a car position on the basis of detection results of the encoder. Furthermore, this controller is provided with an image indication part which is provided in an end portion of a shaft and an image detection part which is provided on the car. The image detection part detects an image indicated on the image indication part. Second position detection means detects a car position on the basis of detection results of the image detection part. An image writing part adjusts the position of an image indicated on the image indication part on the basis of the car positions detected by the first position detection means and second position detection means.

Fig. 1



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Description

Technical Field

[0001] The present invention relates to an elevator controller in which the traction driving system is adopted.

Background Art

[0002] Patent Literatures 1 and 2 below disclose techniques related to the detection of a car position of an elevator.

[0003] In the technique described in Patent Literature 1, a cam switch is installed on the car of an elevator. This cam switch goes into action when the car reaches a top end portion or a bottom end portion of a shaft, and outputs a signal responding to a car position. For this reason, for example, even in the case where slippage occurs between a main rope and a sheave, it is possible to accurately detect a car position in the end portion of the shaft.

[0004] In the technique described in Patent Literature 2, a position code is indicated along an elevator shaft. This position code is read by a camera installed on a car of the elevator, whereby a car position is detected.

Citation List

Patent Literature

[0005]

Patent Literature 1: Japanese Patent Laid-Open No. 7-223783
Patent Literature 2: Japanese Patent Laid-Open No. 2005-126164

Summary of Invention

Technical Problem

[0006] The technique described in Patent Literature 1 has the problem that the installation and position adjustment of the cam switch require much labor and time and that a difference in installation accuracy occurs depending on the skills of workers. Furthermore, there arises the problem that noises are generated when the cam switch goes into action.

[0007] On the other hand, in the technique described in Patent Literature 2, a problem similar to the problem of Patent Literature 1 occurs although no noises are generated. In particular, it is necessary to install members for indicating a position code along the shaft, resulting in a substantial increase in cost in an elevator having a long travel.

[0008] The present invention was made to solve the problems described above and an object of the invention is to provide an elevator controller which can substantially simplify the labor for installation and adjustment and can detect a car position with high accuracy regardless of the skills of workers who perform installation and adjustment.

Solution to Problem

[0009] An elevator controller of the invention is a controller which comprises an encoder which detects the rotation of a sheave of an elevator, first position detection means which detects a present position of a car of the elevator on the basis of detection results of the encoder, an image indication part which is provided in an end portion of a shaft and indicates an image showing prescribed position information, an image detection part which is provided on the car and detects an image indicated on the image indication part, second position detection means which detects a present position of the car on the basis of detection results of the image detection part, and an image writing part which adjusts the position of an image indicated on the image indication part on the basis of the car positions detected by the first position detection means and the second position detection means.

[0010] Also, an elevator controller of the invention is a controller which comprises an encoder which detects the rotation of a sheave of an elevator, first position detection means which detects a present position of a car of the elevator on the basis of detection results of the encoder, an image indication part which is provided in an end portion of a shaft and indicates an image showing prescribed position information, an image detection part which is provided on the car and detects an image indicated on the image indication part, second position detection means which detects a present position of the car on the basis of detection results of the image detection part, and control means which controls actions of the car on the basis of the car positions detected by the first position detection means and the second position detection means. The image indication part can change an indication position of an image from a prescribed device when the device is connected thereto and can hold indication contents even when power is not supplied.

Advantageous Effects of Invention

[0011] According to the present invention, it is possible to substantially simplify the labor for installation and adjustment, and to detect a car position with high accuracy regardless of the skills of workers who perform installation and adjustment.

Brief Description of Drawings

[0012]

Figure 1 is a block diagram showing an elevator controller in a first embodiment according to the present invention.
Figure 2 is a diagram to explain the function of the controller shown in Figure 1.

Figure 3 is a flowchart showing the actions of the elevator controller in the first embodiment according to the present invention.

Description of Embodiment

[0013] The present invention will be described in more details with reference to the accompanying drawings. Incidentally, in each of the drawings, like numerals refer to like or corresponding parts and redundant descriptions of these parts are appropriately simplified or omitted.

First embodiment

[0014] Figure 1 is a block diagram showing an elevator controller in a first embodiment according to the present invention.

[0015] In Figure 1, reference numeral 1 denotes a shaft of an elevator, reference numeral 2 denotes a car of the elevator, and reference numeral 3 denotes a counterweight. The car 2 and the counterweight 3 are suspended by a main rope 4 in a well bucket manner in the shaft 1.

[0016] Reference numeral 5 denotes a sheave of a traction machine which is a driving device of the elevator, and reference numeral 6 denotes a motor of the traction machine. The main rope 4 is such that part thereof is wound on the sheave 5. When the main rope 4 moves in the longitudinal direction thereof in response to the rotation of the sheave 5, the car 2 ascends and descends in the shaft 1 in a direction responding to the moving direction of the main rope 4. That is, Figure 1 shows an elevator in which the traction driving system is adopted. The counterweight 3 ascends and descends in the shaft 1 in a direction reverse to the car 2.

[0017] Reference numeral 7 denotes a guide rail which guides the ascent and descent of the car 2. The guide rail 7 is installed vertically in the shaft 1. Reference numeral 8 denotes a braking device, and reference numeral 9 denotes an encoder. The braking device 8 and the encoder 9 may be configured as part of the traction machine.

[0018] The braking device 8 is intended for holding the car 2 at a standstill. The braking device 8 goes into action at a stop of the car 2 and prevents the sheave 5 from rotating.

[0019] The encoder 9 is intended for detecting the rotation of the sheave 5. The encoder 9 is installed, for example, on the shaft of the sheave 5, and outputs a signal responding to the rotational direction and rotation angle of the sheave 5.

[0020] A signal outputted from the encoder 9 is inputted to a control panel 10 of the elevator. The control panel 10 is provided with position detection circuits 11 and 12 and a control circuit 13. The position detection circuit 11 detects a present position of the car 2 (a car position) on the basis of a signal (detection results) from the encoder 9. The function of the position detection circuit 11 may be provided in the encoder 9 itself. In this case, position information indicating a car position is inputted to the control panel 10 from the encoder 9.

[0021] As described above, the encoder 9 outputs a signal responding to the rotation of the sheave 5. For this reason, when slippage occurs between the main rope 4 and the sheave 5, a car position detected by the position detection circuit 11 shifts from an actual car position. On the other hand, in the case where the car 2 of the elevator has approached an end portion (a top end portion or a bottom end portion) of the shaft 1, it is necessary to perform control, such as deceleration and stop, at an appropriate timing in order to avoid the collision of the car 2. For this reason, car position detection means is provided in the elevator, apart from the means comprising the encoder 9 and the position detection circuit 11.

[0022] The above-described car position detection means is intended for detecting the presence of the car 2 accurately in the end portions (the top end portion and the bottom end portion) of the shaft 1. The car position detection means is such that the principal part thereof is composed of image indication parts 14 and 15, an image detection part 16, a position detection circuit 12, and a control circuit 13.

[0023] The image indication parts 14 and 15 are intended for indicating an image showing prescribed position information. For example, electronic paper is used as the image indication parts 14 and 15. The portion indicating the image is made of electronic paper, whereby it is possible to change the indication contents (image) and indication position arbitrarily. Furthermore, with electronic paper, it is possible to hold indication contents for a long period even when power is not supplied.

[0024] The image indication part 14 is provided in the top end portion of the shaft 1. The image indication part 14 is fixed to a top end portion of the guide rail 7 via a support arm 17, for example. The image indication part 15 is provided in the bottom end portion of the shaft 1. The image indication part 15 is fixed to a bottom end portion of the guide rail 7 via a support arm 18, for example. The image indication parts 14 and 15 are disposed in such a manner that the indication surfaces for indicating the image face the car 2 side along the ascent and descent direction of the car 2.

[0025] The image detection part 16 is intended for detecting images indicated on the image indication parts 14 and 15. The image detection part 16 is provided on the car 2. The image detection part 16 is disposed in such a manner as to be opposed to the image indication part 14 when the car 2 has reached a prescribed upper position. That is, when the car 2 has reached the upper position, the image indicated on the image indication part 14 is detected by the image detection part 16. On detecting the image of the image indication part 14, the image detection part 16 outputs the detection results (image information) to the control panel 10. Similarly, the image detection part 16 is disposed in such a manner as to be opposed to the image indication part 15 when the car 2 has reached a prescribed lower position. When the car

2 has reached the lower position, the image indicated on the image indication part 15 is detected by the image detection part 16. On detecting the image of the image indication part 15, the image detection part 16 outputs the detection results (image information) to the control panel 10.

[0026] The position detection circuit 12 of the control panel 10 detects a present position of the car 2 on the basis of the information (detection results) from the image detection part 16. For example, the position detection circuit 12 analyzes the image information sent from the image detection part 16, and compares the image information with pre-registered information. Then the position detection circuit 12 makes a determination as to whether the car 2 is in the upper position or lower position. The function of the position detection circuit 12 may be provided in the image detection part 16 itself. In this case, the position information indicating a car position is inputted to the control panel 10 from the image detection part 16.

[0027] In normal operations, the control circuit 13 controls the actions of the car 2 on the basis of a car position detected by the position detection circuit 11 and a signal from a landing switch (not shown). Furthermore, the control circuit 13 changes the actions of the car 2 on the basis of a car position detected by the position detection circuit 12. For example, when it is detected by the position detection circuit 12 that the car 2 is in a prescribed upper position or lower position, the control circuit 13 performs control, such as deceleration and stop, at appropriate timing.

[0028] Next, referring also to Figures 2 and 3, a description will be given of a method of causing the image indication parts 14 and 15 to appropriately indicate an image showing position information. Figure 2 is a diagram to explain the function of the controller shown in Figure 1, and Figure 3 is a flowchart showing the actions of the elevator controller in the first embodiment according to the present invention.

[0029] Reference numeral 19 shown in Figure 1 denotes an image writing part intended for causing the image indication parts 14 and 15 to indicate an image and for adjusting the indication position of an image. When it is necessary to perform the writing of an image in the image indication parts 14 and 15, for example, during the installation and maintenance of an elevator, the image writing part 19 is connected to the control panel 10 and the image indication parts 14 and 15.

[0030] An image showing prescribed position information must be indicated in a position (at a height) necessary for making action changes of the car 2 in order to ensure safe operations of the elevator. For example, for the duration from the detection of an image indicated on the image indication part 14 (or 15) by the image detection part 16 to the start of an action change of the car 2 (for example, deceleration and stop) by the control circuit 13, the time required by the position detection circuit 12 and the control circuit 13 to perform computation elapses. For this reason, in order to accurately detect a car position in an end portion of the shaft 1, it is necessary to cause the image indication parts 14 and 15 to indicate the image also in consideration of a delay in computation by the position detection circuit 12 and the control circuit 13. Furthermore, in order to ensure that the image is detected accurately by the image detection part 16, also the length of the image (the width in the ascent and descent direction of the car 2) is necessary to some extent.

[0031] Specifically, if the distance from the height of the terminal floor to the end of the intermediate floor side of the image is denoted by B, then the distance B can be expressed by the following expression (see Figure 2).

[Expression 1]

$$B = A + (\Delta t_1 + \Delta t_2) \times v$$

where,

A: distance from the height of the terminal floor to the height at which the car 2 is to be detected

Δt_1: delay in computation by the position detection circuit 12

Δt_2: delay in computation by the control circuit 13

v: run speed of the car 2

[0032] Also in consideration of the delays in computation Δt_1 and Δt_2, the image writing part 19 causes an image showing position information to be indicated, for example, between the height B which is calculated by Expression 1 above and the height A. The image which is indicated on the image indication parts 14 and 15 may be a simple one, such as a bar code shown in Figure 2, for example.

[0033] A specific method of indication setting for the image is as shown in Figure 3.

[0034] When during the installation of an elevator, after necessary devices, such as a traction machine and the image indication parts 14 and 15, are attached, the image writing part 19 is connected to the control panel 10 and the image indication parts 14 and 15. The image writing part 19 causes the image indication parts 14 and 15 to indicate an image showing prescribed position information.

[0035] Next, the car 2 is caused to run between the top floor and the bottom floor in a reciprocating manner. Specifically, first, the car 2 is caused to run downward and to stop at the bottom floor (S101). Next, the car 2 is caused to run upward and to stop at the top floor (S102). Furthermore, the car 2 is caused to run downward and to stop at the bottom floor (S103).

[0036] While in S101 to S103 the car 2 is being caused to run in a reciprocating manner, in the control panel 10 the position detection circuits 11 and 12 perform the detection of a car position on the basis of input information.

The control circuit 13 compares the car position detected by the position detection circuit 11 with the car position detected by the position detection circuit 12 and calculates an error in the indication position of an image indicated on the image indication parts 14 and 15. On calculating the error in the indication position, the control circuit 13 sends the calculation results (error) to the image writing part 19 (S104). On the basis of the error calculated by the control circuit 13, the image writing part 19 adjusts (changes) the positions of the images indicated in the image indication parts 14 and 15 so that the indication position of the image satisfies Expression 1 above (S105).

[0037] For example, during the installation of an elevator, it is possible to ascertain that slippage has not occurred between the main rope 4 and the sheave 5 while the car 2 is running in a reciprocating manner. For this reason, the image writing part 19 performs the position adjustment of the images indicated on the image indication parts 14 and 15 on the basis of the car position detected by the position detection circuit 11.

[0038] The processing in S104 may be carried out in the image writing part 19. In this case, the car position detected by the position detection circuit 11 and the car position detected by the position detection circuit 12 are inputted to the image writing part 19.

[0039] Then when the indication position of the image has been appropriately set, the image writing part 19 is detached from the control panel 10 and the image indication parts 14 and 15.

[0040] With the controller having the above-described configuration, it becomes possible to detect a car position with high accuracy in end portions of the shaft 1. The detection accuracy is not influenced by the skills of workers who perform installation and adjustment. Furthermore, because the position adjustment of an image is possible after the installation of the image indication parts 14 and 15, it is possible to substantially simplify the labor for installation and adjustment.

[0041] If electronic paper is used as the image indication parts 14 and 15, it is possible to hold indication contents without power supply and, therefore, it is possible to reduce maintenance costs after image setting. Furthermore, because it is impossible to change the indication contents and indication positions of the image indication parts 14 and 15 unless the image writing part 19 is connected, it is possible to prevent mischieves and malfunctions. In addition, if the image writing part 19 is configured in a detachable manner, it is unnecessary to install the image writing part 19 in individual elevators. For this reason, the above-described function can be realized at low cost.

[0042] In the case where the image indication part 14 is caused to indicate a plurality of images, if the indication position of one image can be appropriately set, the indication positions of other images can be easily set in a relative relation to the one image. The same applies also to the image indication part 15.

Industrial Applicability

[0043] The controller of the present invention can be applied to an elevator provided with the function of detecting a car position in an end portion of the shaft.

Reference Signs List

[0044]

1	shaft
2	car
3	counterweight
4	main rope
5	sheave
6	motor
7	guide rail
8	braking device
9	encoder
10	control panel
11, 12	position detection circuit
13	control circuit
14, 15	image indication part
16	image detection part
17, 18	support arm
19	image writing part

Claims

1. An elevator controller, comprising:

an encoder which detects the rotation of a sheave of an elevator;
first position detection means which detects a present position of a car of the elevator on the basis of detection results of the encoder;
an image indication part which is provided in an end portion of a shaft and indicates an image showing prescribed position information;
an image detection part which is provided on the car and detects an image indicated on the image indication part;

second position detection means which detects a present position of the car on the basis of detection results of the image detection part; and
an image writing part which adjusts the position of an image indicated on the image indication part on the basis of the car positions detected by the first position detection means and the second position detection means.

2. The elevator controller according to claim 1, wherein the image indication part is such that the portion thereof which indicates an image is made of electronic paper and can hold indication contents even when power is not supplied.

3. The elevator controller according to claim 1 or 2, further comprising:

control means which changes actions of the car on the basis of a car position detected by the second position detection means,
wherein the image writing part performs the position adjustment of an image also in consideration of the duration from the detection of an image indicated on the image indication part by the image detection part to the start of an action change of the car by the control means.

4. An elevator controller, comprising:

an encoder which detects the rotation of a sheave of an elevator;
first position detection means which detects a present position of a car of the elevator on the basis of detection results of the encoder;
an image indication part which is provided in an end portion of a shaft and indicates an image showing prescribed position information;
an image detection part which is provided on the car and detects an image indicated on the image indication part;
second position detection means which detects a present position of the car on the basis of detection results of the image detection part; and
control means which controls actions of the car on the basis of the car positions detected by the first position detection means and the second position detection means,
wherein the image indication part can change an indication position of an image from a prescribed device when the device is connected thereto and can hold indication contents even when power is not supplied.

5. The elevator controller according to claim 4, wherein the image indication part is such that the portion thereof which indicates an image is made of electronic paper.

Fig. 1

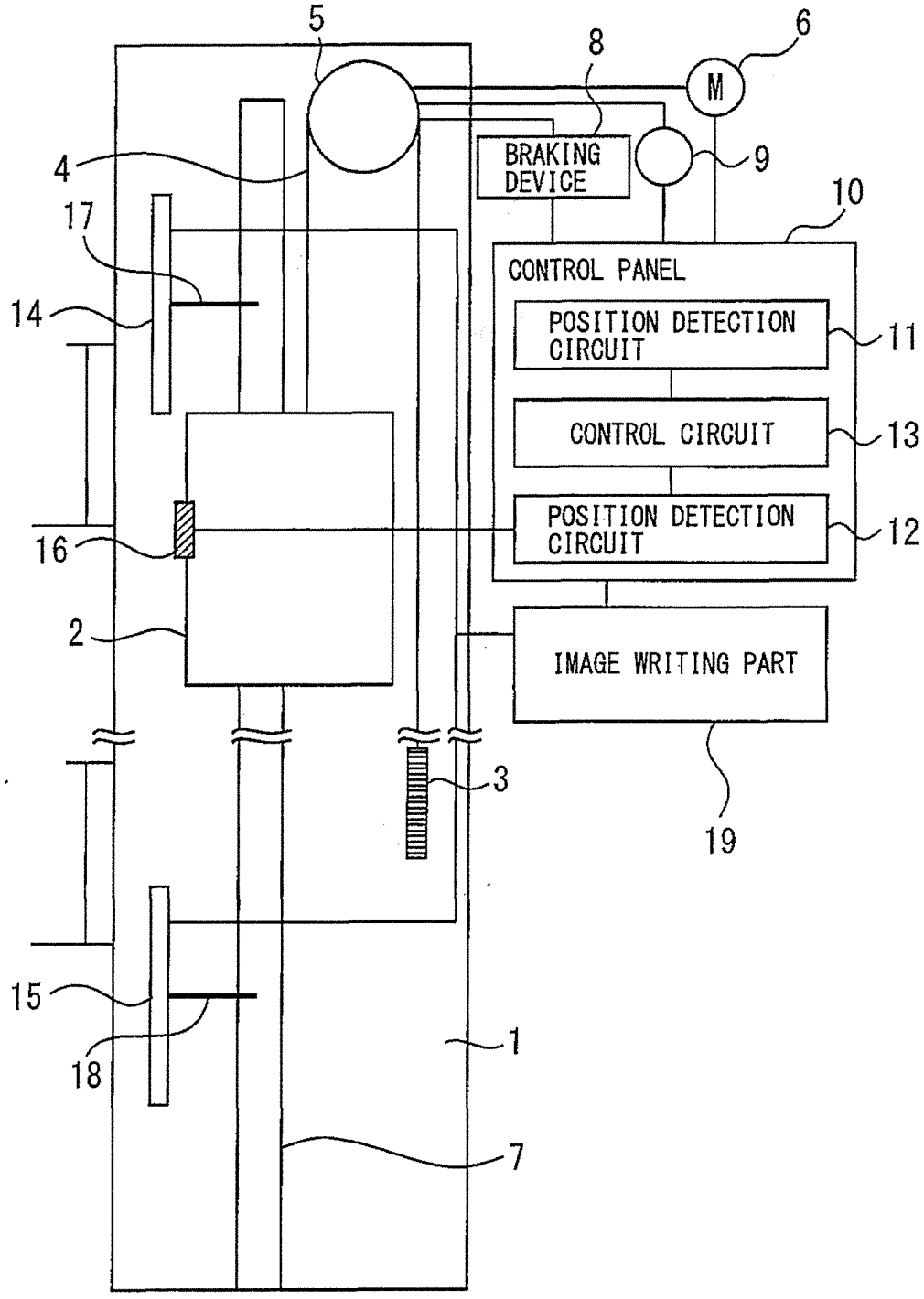

5
8
6
M
4
BRAKING DEVICE
9
10
17
CONTROL PANEL
14
POSITION DETECTION CIRCUIT
11
CONTROL CIRCUIT
13
16
POSITION DETECTION CIRCUIT
12
2
IMAGE WRITING PART
3
19
15
1
18
7

Fig. 2

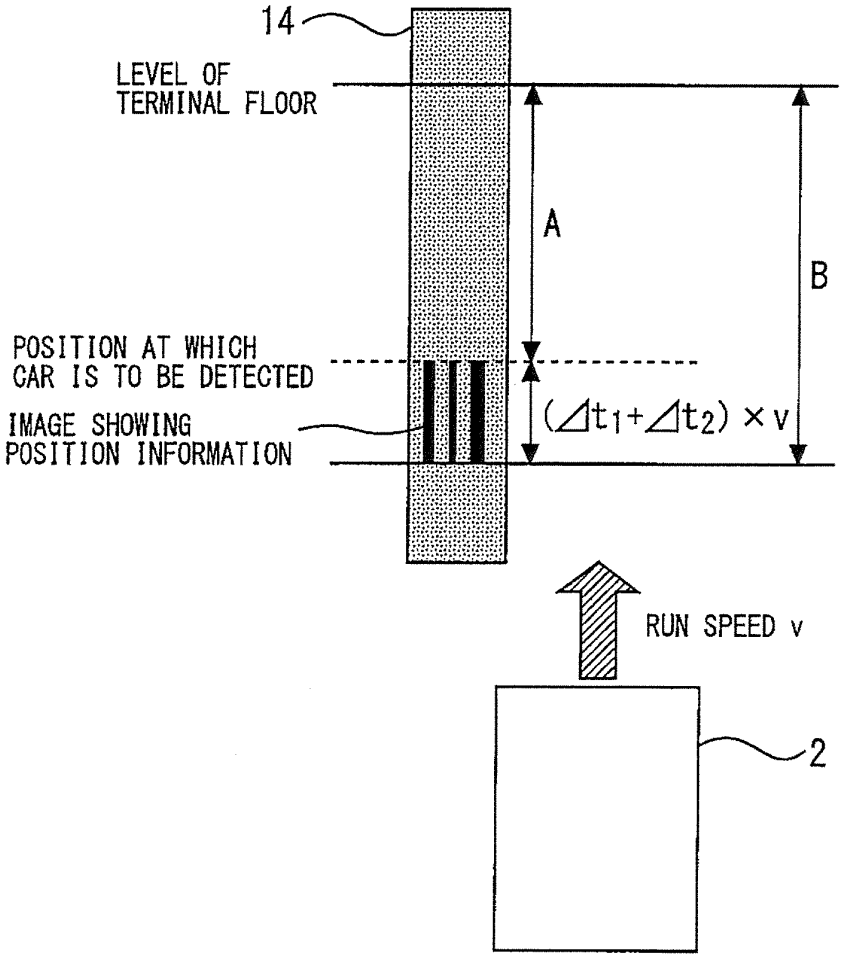
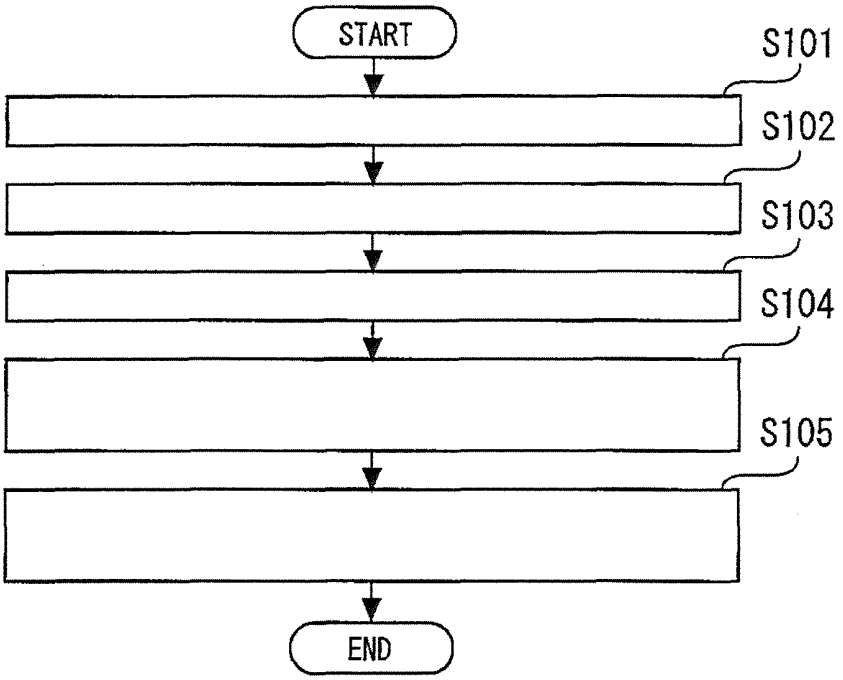

14
LEVEL OF TERMINAL FLOOR
A
B
POSITION AT WHICH CAR IS TO BE DETECTED
IMAGE SHOWING POSITION INFORMATION
(⊿t1+⊿t2) × v
RUN SPEED v
2

Fig. 3



S101:MOVE TO BOTTOM FLOOR
S102:RUN UPWARD TO TOP FLOOR
S103:RUN DOWNWARD TO BOTTOM FLOOR
S104:CALCULATE ERROR IN IMAGE INDICATION POSITION IN CONTROL CIRCUIT AND SEND IT TO IMAGE WRITING PART
S105:CHANGE IMAGE INDICATION POSITIONS ON THE BASIS OF ERROR IN IMAGE INDICATION POSITION FROM CONTROL CIRCUIT

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/056174

A. CLASSIFICATION OF SUBJECT MATTER
B66B3/02(2006.01)i, *B66B5/06*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B66B3/02, B66B5/06

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 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-214965 A (Toshiba Elevator and Building Systems Corp.), 24 September 2009 (24.09.2009), claims 1 to 6; fig. 1 (Family: none)	1-5
A	JP 2007-521211 A (Otis Elevator Co.), 02 August 2007 (02.08.2007), paragraphs [0009] to [0012]; fig. 2 & US 2007/0095617 A1 & WO 2005/062734 A2 & CN 001950285 A	1-5
A	JP 2007-171629 A (Asahi Glass Co., Ltd.), 05 July 2007 (05.07.2007), paragraphs [0011] to [0013] (Family: none)	1-5

☒ 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	Date of mailing of the international search report
15 June, 2011 (15.06.11)	28 June, 2011 (28.06.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/056174

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2010-100395 A (Toshiba Elevator and Building Systems Corp.), 06 May 2010 (06.05.2010), paragraphs [0027] to [0031] (Family: none)	1-5

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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- JP 7223783 A **[0005]**
- JP 2005126164 A **[0005]**