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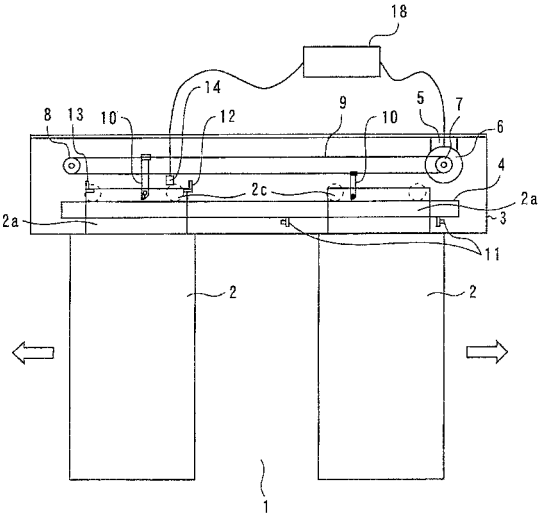
(54) ELEVATOR DOOR CONTROL DEVICE

(57) There is provided an elevator door control device that makes detection so as to be capable of judging which of the full open position and the full close position is the position of a door panel by using a position switch provided in only one location along the travel direction of the door panel. For this purpose, an elevator door control device, which controls the opening/closing operation of the door panel which opens and closes an elevator entrance in the right-and-left direction, includes one position switch; first and second light transmitters and first and second light receivers, which are provided on the position switch; a first shield plate and a second shield plate, which are provided on the door panel; and a door control device body that judges, based on a signal carring information about the light receiving state of the first and second light receivers outputted from the position switch, whether or not the door panel lies at the full open position and the full close position. When the door panel is fully opened, the first shield plate shields one or more predetermine light beams of first and second light beams, and when the door panel is fully closed, the second shield plate shields one or more predetermined light beams of the first and second light beams different from the predetermined light beams shielded by the first shield plate.

fig. 1



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Description

Technical Field

[0001] The present invention relates to an elevator door control device.

Background Art

[0002] In recent years, with more widespread use of a so-called machine room-less elevator in which an elevator traction machine is disposed in an elevator shaft, the space for elevator equipment in the shaft has been required to be saved. Therefore, for the elevator door control device as well, a more compact and higher-function device has been demanded.
Usually, the elevator door control device is a device in which the torque of a door motor or the like is transmitted to a door panel via a transmission mechanism, and thereby a car door is automatically opened and closed in the horizontal direction.

[0003] To stop the door panel at a full-open position and a full-close position, it is necessary to recognize both of the full-open position and the full-close position. Therefore, a position switch for detecting that the door panel lies at the full-open position and the full-close position is generally provided.
Concerning this position switch, a light switch (light transmitting/receiving device), which detects the full-open position and the full-close position by utilizing light shield (shading) or reflection, has been widely used because of being highly accurate as compared with switches of other types such as a mechanical switch and being relatively invulnerable to foreign matters, water, and the like.

[0004] The conventional elevator door control device has been a device in which the position of elevator door is detected by this light switch (light transmitting/receiving device). This control device is designed to prevent the door panel from being operated at a high speed by malfunction occurring on account of the hindrance of light passage caused by dust, oil, and the like sticking to the detecting element of the light switch. As the control device as described above, there has been known a control device that is provided with a total of three light switches: one light switch for detecting, by shading, that the door panel lies at the full-open position, and two light switches for detecting, by shading, that the door panel comes close to the full-close position, and these light switches control the travel speed of door panel so as to become slow when the light switch is shaded by a light shielding plate provided on the door panel (for example, refer to Patent Literature 1).

[0005] Also, as an elevator door control device that is a control device for likewise detecting the door position by using a light switch (light transmitting/receiving device), and is designed to prevent the malfunction of door occurring on account of the irradiation of external light even in the case where the light switch is irradiated with external light, there has been known an elevator door control device, including a full close detecting light switch for detecting the full close position of door panel due to shading, a full open detecting light switch for detecting the full open position thereof, and a position calculation counter for detecting the position of door panel from the full close position or the full open position by resetting the enumerated value as the result of shading detection of the full close detecting light switch and the full open detecting light switch, in which the opening/closing speed of the door motor is controlled based on the position of door panel detected by the position calculation counter, wherein the control device is provided with a protection network for de-energizing the door motor when both of the full close detecting light switch and the full open detecting light switch detect photoreception although the enumerated value of the position calculation counter is a fixed value continuously for a predetermined time period (for example, refer to Patent Literature 2).

[0006] Further, as an elevator door control device that is designed to cause the direction of rotation of door motor to coincide with the opening/closing direction before the opening/closing drive of door panel, there is also known a control device configured so that the door panel is driven by rotating the door motor toward the predetermined direction at a low speed, the relation between the direction of rotation of door motor and the opening/closing direction of door panel is detected depending on which of a full close position sensor and a full open position sensor is activated by the driven door panel, and the door motor is rotated based on the detection result in response to an opening/closing instruction signal sent from a control panel, whereby the entrance is opened or closed (for example, refer to Patent Literature 3).

Citation List

Patent Literature

[0007]

Patent Literature 1: Japanese Patent Laid-Open No. 60-218282
Patent Literature 2: Japanese Patent Laid-Open No. 2002-053280
Patent Literature 3: Japanese Patent Laid-Open No. 2001-354379

Summary of Invention

Technical Problem

[0008] Thus, in the conventional elevator door control device disclosed in the above-described Patent Literatures, the door position can be recognized by one or more shield plates provided on the door panel traversing the light transmitting/receiving devices of a plurality of position switches provided along the travel direction of door

panel. In this configuration, since the plural numbers of position switches, which are the light transmitting/receiving devices that are generally more expensive than the shield plates, are used, the elevator door control device has a problem in that the whole of the control device also becomes expensive, and the cost increases.

[0009] A configuration in which one position switch and two shield plates are provided, and thereby the full open position and the full close position of door panel are detected is also conceivable. In such a configuration, even when the door panel lies at either of the full open position and the full close position, the same detection signal is generated from the position switch. Therefore, this configuration has a problem that the control device and the like cannot judge which of the full open position and the full close position is the position of door panel.

[0010] The present invention has been made to solve the above-described problems, and accordingly an object thereof is to provide an elevator door control device, which is capable of making detection so as to be capable of judging which of the full open position and the full close position is the position of a door panel by using a position switch provided in only one location along the travel direction of the door panel.

Means for Solving the Problems

[0011] An elevator door control device according to the present invention, which controls the opening/closing operation of a door panel which opens and closes an elevator entrance in the right-and-left direction, comprises: one position switch which detects that the door panel lies at the full open position and at the full close position; a first light transmitter provided on the position switch to transmit a first light beam; a first light receiver provided at a position opposed to the first light transmitter on the position switch to receive the first light beam; a second light transmitter provided on the position switch to transmit a second light beam; a second light receiver provided at a position opposed to the second light transmitter on the position switch to receive the second light beam; a first shield plate and a second shield plate, which are provided on the door panel; and a door control device body which judges, based on a signal carring information about the light receiving state of the first and second light receivers outputted from the position switch, whether or not the door panel lies at the full open position and the full close position and which controls the opening/closing operation of the door panel, and is characterized in that when the door panel lies at either one of the full open position and the full close position, the first shield plate shields one or more predetermined light beams of the first and second light beams, and when the door panel lies at the other of the full open position and the full close position, the second shield plate shields one or more predetermined light beams of the first and second light beams different from the predetermined light beams shielded by the first shield plate.

Advantageous Effect of Invention

[0012] The elevator door control device in accordance with the present invention achieves an effect of making detection so as to be capable of judging which of the full open position and the full close position is the position of a door panel by using a position switch provided in only one location along the travel direction of the door panel.

Brief Description of the Drawings

[0013]

Figure 1 is a front view showing the general configuration of an elevator door control device related to first to tenth embodiments of the present invention.

Figure 2 is a schematic view for explaining a common configuration of a door panel position detecting section of the elevator door control device related to first to tenth embodiments of the present invention.

Figure 3 is a schematic view for explaining a configuration of the door panel position detecting section of the elevator door control device related to a first embodiment of the present invention.

Figure 4 is a schematic view for explaining a configuration of the door panel position detecting section of the elevator door control device related to a second embodiment of the present invention.

Figure 5 is a schematic view for explaining a configuration of the door panel position detecting section of the elevator door control device related to a third embodiment of the present invention.

Figure 6 is a schematic view for explaining a configuration of the door panel position detecting section of the elevator door control device related to a fourth embodiment of the present invention.

Figure 7 is a flowchart showing an operation of the elevator door control device related to a fourth embodiment of the present invention.

Figure 8 is a sectional view showing a configuration of the position switch of the elevator door control device related to a sixth embodiment of the present invention.

Figure 9 is a perspective view showing a configuration of the position switch of the elevator door control device related to a seventh embodiment of the present invention.

Figure 10 is a perspective view showing one example of a configuration of the position switch of the elevator door control device related to an eithth embodiment of the present invention.

Figure 11 is a perspective view showing another example of a configuration of the position switch of the elevator door control device related to an eithth embodiment of the present invention.

Figure 12 is schematic perspective and sectional views showing a configuration of the door panel position detecting section of the elevator door control

device related to a tenth embodiment of the present invention.

Description of Embodiments

[0014] Embodiments for carrying out the present invention will now be described with reference to the accompanying drawings. In the drawings, the same reference signs are applied to the same or equivalent parts, and the duplicated explanation thereof is simplified or omitted as appropriate.

First embodiment

[0015] Figures 1 to 3 relate to a first embodiment of the present invention. Figure 1 is a front view showing the general configuration of an elevator door control device, Figure 2 is a schematic view for explaining a common configuration of a door panel position detecting section of the elevator door control device, and Figure 3 is a schematic view for explaining a configuration of the door panel position detecting section of the elevator door control device.

[0016] In Figure 1, reference sign 1 denotes a car entrance provided on the front surface of a car that is elevatably disposed in an elevator shaft, not shown, and moves up and down while having users and the like on board.

At this car entrance 1, car door panels 2 constituting a pair of right and left car doors are provided so as to be freely opened and closed in the substantially horizontal direction. In the upper end portion of each of the car door panels 2, a car door hanger 2a is installed, and in the upper portion of the car door hanger 2a, car door rollers 2b are provided so that each of them is rotatable around a shaft.

[0017] Above the car entrance 1, a beam 3 is provided, and the beam 3 is mounted with a car door rail 4 extending along the opening/closing direction of the car door panel 2, that is, in the substantially horizontal direction. The car door rollers 2b are rollably engaged with this car door rail 4, so that the paired right and left car door panels 2 are hung on the car door rail 4 via the car door hangers 2a and the car door rollers 2b. By the door rollers 2b that are rolled by being guided by the door rail 4, the right and left door panels 2 open and close the car entrance 1.

[0018] The opening/closing operation of the door panel 2 is performed by driving a door driving unit 5 disposed above the door rail 4 of the beam 3. This door driving unit 5 has a door motor 6 provided on one side of the right-and-left direction (that is, the direction parallel with the door opening/closing direction, this also applies to the following description) of the beam 3, and a driving wheel 7 is fixed to the rotating shaft of the door motor 6.

Also, to the other side of the right-and-left direction of the beam 3, a driven wheel 8 is attached rotatably. Around the driving wheel 7 and the driven wheel 8, an endless toothed belt 9 is wound. On the inside of the toothed belt 9, concavities and convexities are produced at equal intervals to form teeth, and on the driving wheel 7 and the driven wheel 8, concavities and convexities engaging with the teeth are produced.

Thus, there is formed the door driving unit 5 that is a winding transmission mechanism such that the teeth of the toothed belt 9 engages with the concavities and convexities of the driving wheel 7 and the driven wheel 8, whereby the rotational drive of the door motor 6 is transmitted to the circulating movement of the toothed belt 9.

[0019] To the upper end of the door hanger 2a of each of the door panels 2, a locking member 10 is attached. Of these locking members 10, the locking member 10 provided on one door panel 2 of the paired right and left door panels 2 is locked to one side of the upper and lower sides of the toothed belt 9. The locking member 10 provided on the other door panel 2 is locked to the other side of the upper and lower sides of the toothed belt 9. Therefore, the rotational drive in both the normal and reverse directions of the door motor 6 of the door driving unit 5 is converted into the circulating movement in both the directions of the toothed belt 9 via a speed reducing mechanism, not shown, and thereby the paired right and left door panels 2 are moved in the directions reverse to each other and the car entrance 1 is opened and closed.

Also, on the beam 3, stoppers 11 are provided to restrain the door panels 2 from moving beyond the full open state and the full close state. The stoppers 11 are disposed at positions at which the end portions of the door hanger 2a come into contact with the stoppers 11 when the door panel 2 is in the full open state and the full close state.

[0020] At a position on the beam 3 above the door hanger 2a of either one door panel 2 of the paired right and left door panels 2, a position switch 14 of a substantially U-shape as viewed from the side between which a first shield plate 12 and a second shield plate 13, both described later, are arranged is installed. In the upper end portion of the door hanger 2a of the same one door panel 2, the first shield plate 12 and the second shield plate 13 are mounted.

The first shield plate 12 is arranged so that when the door panel 2 lies at the full open position, the first shield plate 12 is located on the inside of the U-shape of the position switch 14. Also, the second shield plate 13 is arranged so that when the door panel 2 lies at the full close position, the second shield plate 13 is located on the inside of the U-shape of the position switch 14.

[0021] The position switch 14 detects that the shield plate is located on the inside of the U-shape thereof, and generates a signal. Therefore, the configuration is made such that by the locating of the first shield plate 12 or the second shield plate 13, it can be detected that the door panel 2 lies at the full open position or the full close position, respectively.

The opening/closing operation of the elevator door, that is, the paired right and left door panels 2 is controlled by a door control device body 18.

On the rotating shaft of the door motor 6, there is provided

a pulse encoder, not shown, that detects the rotation angle of the rotating shaft and generates a rotation angle information signal. The door control device body 18 grasps the position of the door panel 2 based on the rotation angle information signal sent from the pulse encoder and the detection signal of full open position and full close position generated from the position switch 14, and controls the rotation of the door motor 6 to open or close the door panel 2 in the horizontal direction.

[0022] The door panel position detecting section, that is, the position switch 14 for detecting the full close position and the full open position of the door panel 2, and the first and second shield plates 12 and 13 are configured as shown in Figure 3.

As described above, the position switch 14 takes a substantially U-shape as viewed from the side, and is installed on the beam 3. In one projecting portion of the U-shape, a light transmitter 15 consisting of, for example, a light-emitting diode (LED) is provided, and in the other projecting portion of the U-shape, a light receiver 16 consisting, for example, a photodiode is provided. The light transmitter 15 and the light receiver 16 are arranged so as to be opposed to each other, and at the normal time, a light beam 17 emitted from the light transmitter 15 is received by the light receiver 16.

[0023] The first shield plate 12 and the second shield plate 13 each are mounted in the upper end portion of the door hanger 2a of one door panel 2 via a j oint part 19 so as to project upward.

The joint part 19 is formed with an elongated hole 19a having a major axis in the right-and-left direction, and each of the shield plate 12 and the second shield plate 13 is threadedly mounted to the door hanger 2a by bolts 19b inserted through the elongated hole 19a.

By changing the threadedly mounting position of the bolts 19b in the elongated hole 19a, the mounting position in the right-and-left direction of the first shield plate 12 or the second shield plate 13 is regulated.

[0024] Concerning the mounting positions of the first shield plate 12 and the second shield plate 13, specifically, the position of the first shield plate 12 is adjusted so that when the door panel 2 lies at the full open position, the first shield plate 12 is located on the inside of the U-shape of the position switch 14, and the position of the second shield plate 13 is adjusted so that when the door panel 2 lies at the full close position, the second shield plate 13 is located on the inside of the U-shape of the position switch 14 as described above.

Therefore, when the door panel 2 lies at the full open position, the light beam 17 transmitted from the light transmitter 15 is shielded by the first shield plate 12, and the light receiver 16 does not receive the light beam 17, so that it can be detected that the door panel 2 lies at the full close position. Likewise, when the door panel 2 lies at the full close position, the light beam 17 transmitted from the light transmitter 15 is shielded by the second shield plate 13, and the light receiver 16 does not receive the light beam 17, so that it can be detected that the door panel 2 lies at the full close position.

The above is the configuration common to embodiments of the present invention described hereinafter.

[0025] In this embodiment, the door panel detecting section is configured as shown in Figure 3.

The position switch 14 has a first light transmitter 15a and a second light transmitter 15b that are arranged in the up-and-down direction (that is, the direction that perpendicularly intersects the door opening/closing direction and is in the same plane as the door panel, this also applies to the following description). At a position opposed to the first light transmitter 15a, a first light receiver 16a is provided, and at a position opposed to the second light transmitter 15b, a second light receiver 16b is provided so that these receivers are arranged likewise in the up-and-down direction.

A first light beam 17a transmitted from the first light transmitter 15a is received by the first light receiver 16a, and the position of the door panel 2 is detected by the presence of the received light. The position of the door panel 2 is also detected by the presence of a second light beam 17b transmitted from the second light transmitter 15b and received by the second light receiver 16b.

[0026] The dimensions in the up-and-down direction of the first and second shield plates 12 and 13 are different from each other. In this embodiment, the vertical dimension of the first shield plate 12 in the position switch 14 at the full open position of the door panel 2 is longer than the vertical dimension of the second shield plate 13 in the position switch 14 at the full close position of the door panel 2.

The first shield plate 12 is adjusted so as to have a vertical dimension capable of shielding both of the first light beam 17a transmitted from the first light transmitter 15a and the second light beam 17b transmitted from the second light transmitter 15b at the same time. In contrast, the second shield plate 13 is adjusted so as to have a vertical dimension such as to shield only the second light beam 17b transmitted from the second light transmitter 15b arranged below and not to shield the first light beam 17a transmitted from the first light transmitter 15a arranged above.

[0027] In the elevator door control device configured as described above, when the door panel 2 comes to the full open position, both of the first light beam 17a transmitted from the first light transmitter 15a and the second light beam 17b transmitted from the second light transmitter 15b are shielded at the same time by the first shield plate 12. Then, from both of the first light receiver 16a and the second light receiver 16b, a signal of not receiving light is generated (or, a signal of receiving light comes to be not generated, this also applies to the following description). On receipt of the signal of not receiving light from both of the first light receiver 16a and the second light receiver 16b, the door control device body 18 judges that the door panel 2 lies at the full open position, and carries out the door opening/closing control such as the rotational drive control of the door motor 6 based on this

judgment.

[0028] When the door panel 2 comes to the full close position, although the second light beam 17b transmitted from the second light transmitter 15b is shielded by the second shield plate 13, the second light beam 17b transmitted from the second light transmitter 15b is not shielded. Therefore, the signal of not receiving light is not generated from the first light receiver 16a, and on the other hand, the signal of not receiving light is generated from the second light receiver 16b. On receipt of the signal of receiving light from the first light receiver 16a and the signal of not receiving light from the second light receiver 16b, the door control device body 18 judges that the door panel 2 lies at the full close position, and carries out the door opening/closing control such as the rotational drive control of the door motor 6 based on this judgment.

[0029] The elevator door control device configured as described above includes one position switch for detecting that the door panel lies at the full open position and at the full close position; the first light transmitter provided on the position switch to transmit the first light beam; the first light receiver provided at a position opposed to the first light transmitter on the position switch to receive the first light beam; the second light transmitter provided on the position switch to transmit the second light beam; the second light receiver provided at a position opposed to the second light transmitter on the position switch to receive the second light beam; the first shield plate and the second shield plate, which are provided on the door panel; and the door control device body that judges, based on a signal carring information about the light receiving state of the first and second light receivers outputted from the position switch, whether or not the door panel lies at the full open position and the full close position, and controls the opening/closing operation of the door panel. When the door panel lies at either one of the full open position and the full close position, the first shield plate shields one or more predetermined light beams of the first and second light beams; and when the door panel lies at the other of the full open position and the full close position, the second shield plate shields one or more predetermined light beams of the first and second light beams different from the predetermined light beams shielded by the first shield plate.

[0030] Therefore, by the position switch provided in only one location along the travel direction of the door panel, detection can be made so as to be capable of judging which of the full open position and the full close position is the position of door panel, so that the whole of the device can be low in price and small in size.

One or more predetermined light beams shielded by the first shield plate when the door panel lies at the full open position or the full close position mean one or more combinations of the first and second light beams. One or more predetermined light beams different from the predetermined light beams shielded by the first shield plate, which are shielded by the second shield plate, may be common to the predetermined light beams shielded by the first shield plate if the combination of light beams is different.

[0031] Also, the elevator door control device in this embodiment is configured so that the first light transmitter and the second light transmitter are arranged in the up-and-down direction; the vertical dimension of one shield plate of the first and second shield plates is longer than the vertical dimension of the other shield plate; when the door panel lies at either one of the full open position and the full close position, the one shield plate shields both of the first light beam and the second light beam; and when the door panel lies at the other of the full open position and the full close position, the other shield plate shields either one of the first light beam and the second light beam.

Therefore, the same effect as described above can be achieved.

Second embodiment

[0032] Figures 1 and 4 relate to a second embodiment of the present invention. Figure 1 is the front view showing the general configuration of the elevator door control device, and Figure 4 is a schematic view for explaining a configuration of the door panel position detecting section of the elevator door control device.

In the above-described first embodiment, by making the vertical dimensions of the two shield plates different from each other, the number of light beams transmitted from the light transmitters that are to be shielded is made different, whereby the output signal sent from the position switch in the door full open state and the door full close state is changed to distinguish these states. In the second embodiment explained hereunder, by making the vertical mounting positions of the two shield plates different from each other, the light beams transmitted from the light transmitters that are to be shielded are changed, whereby the output signal sent from the position switch in the door full open state and the door full close state is changed to distinguish these states.

[0033] The first shield plate 12 and the second shield plate 13 are mounted to the door hanger 2a via an arm part 12a for the first shield plate and an arm part 13a for the second shield plate, which are provided so as to project upward from the joint part 19, respectively.

The vertical dimensions of the arm part 12a for the first shield plate and the arm part 13a for the second shield plate are different from each other. In this embodiment, the vertical dimension of the arm part 12a for the first shield plate is longer than that of the arm part 13a for the second shield plate. At the upper end of the arm part 12a for the first shield plate, the first shield plate 12 is mounted, and at the upper end of the arm part 13a for the second shield plate, the second shield plate 13 is mounted.

[0034] The vertical dimension of the arm part 12a for the first shield plate is adjusted so that the first shield plate 12 shields only the first light beam 17a transmitted from the first light transmitter 15a arranged above and does not shield the second light beam 17b transmitted

from the second light transmitter 15b arranged below. In contrast, the vertical dimension of the arm part 13a for the second shield plate is adjusted so that the second shield plate 13 shields only the second light beam 17b transmitted from the second light transmitter 15b arranged below and does not shield the first light beam 17a transmitted from the first light transmitter 15a arranged above.

Other configurations are the same as those of the first embodiment, and therefore the detailed explanation thereof is omitted.

[0035] In the elevator door control device configured as described above, when the door panel 2 comes to the full open position, the first light beam 17a transmitted from the first light transmitter 15a is shielded by the first shield plate 12, but the second light beam 17b transmitted from the second light transmitter 15b is not shielded. Therefore, a signal of not receiving light is generated from the first light receiver 16a, and on the other hand, a signal of not receiving light is not generated from the second light receiver 16b. On receipt of the signal of not receiving light from the first light receiver 16a and a signal of receiving light from the second light receiver 16b, the door control device body 18 judges that the door panel 2 lies at the full open position, and carries out the door opening/closing control such as the rotational drive control of the door motor 6 based on this judgment.

[0036] When the door panel 2 comes to the full close position, the second light beam 17b transmitted from the second light transmitter 15b is shielded by the second shield plate 13, but the first light beam 17a transmitted from the first light transmitter 15a is not shielded. Therefore, a signal of not receiving light is not generated from the first light receiver 16a, and on the other hand, a signal of not receiving light is generated from the second light receiver 16b. On receipt of a signal of receiving light from the first light receiver 16a and the signal of not receiving light from the second light receiver 16b, the door control device body 18 judges that the door panel 2 lies at the full close position, and carries out the door opening/closing control such as the rotational drive control of the door motor 6 based on this judgment.

[0037] The elevator door control device configured as described above is configured so that the first light transmitter and the second light transmitter are arranged in the up-and-down direction; the first shield plate and the second shield plate are arranged at positions different from each other in the up-and-down direction; when the door panel lies at either one of the full open position and the full close position, the first shield plate shields only either one of the first light beam and the second light beam; and when the door panel lies at the other of the full open position and the full close position, the second shield plate shields only the other of the first light beam and the second light beam. Therefore, the same effect as that of the first embodiment can be achieved.

Third embodiment

[0038] Figures 1 and 5 relate to a third embodiment of the present invention. Figure 1 is the front view showing the general configuration of the elevator door control device, and Figure 5 is a schematic view for explaining a configuration of the door panel position detecting section of the elevator door control device.

In the third embodiment explained hereunder, by arranging the two light transmitters and two light receivers in the right-and-left direction, and by making the light beams transmitted from the light transmitters, which are shielded by two shield plates, different, the output signal sent from the position switch in the door full open state and the door full close state is changed to distinguish these states.

[0039] The position switch 14 has the first light transmitter 15a and the second light transmitter 15b that are arranged in the right-and-left direction. At a position opposed to the first light transmitter 15a, the first light receiver 16a is provided, and at a position opposed to the second light transmitter 15b, the second light receiver 16b is provided so that these light receivers are arranged likewise in the right-and-left direction. At this time, the first light transmitter 15a and the first light receiver 16a are relatively positioned on the first shield plate 12 side, and the second light transmitter 15b and the second light receiver 16b are relatively positioned on the second shield plate 13 side.

The vertical dimensions of the arm part 12a for the first shield plate and the arm part 13a for the second shield plate, which support the first shield plate 12 and the second shield plate 13, respectively, are approximately equal to each other.

[0040] The mounting position in the right-and-left direction of the first shield plate 12 is adjusted so that when the door panel 2 lies at the full open position, only the first light beam 17a transmitted from the first light transmitter 15a arranged on the first shield plate 12 side is shielded by the first shield plate 12, and the second light beam 17b transmitted from the second light transmitter 15b arranged on the side opposite to first shield plate 12 (the second shield plate 13 side) is not shielded. In contrast, the mounting position in the right-and-left direction of the second shield plate 13 is adjusted so that only the second light beam 17b transmitted from the second light transmitter 15b arranged on the second shield plate 13 side is shielded by the second shield plate 13, and the first light beam 17a transmitted from the first light transmitter 15a arranged on the side opposite to second shield plate 13 (the first shield plate 12 side) is not shielded.

Other configurations are the same as those of the first embodiment, and therefore the detailed explanation thereof is omitted.

[0041] In the elevator door control device configured as described above, when the door panel 2 comes to the full open position, the first light beam 17a transmitted from the first light transmitter 15a is shielded by the first shield plate 12, but the second light beam 17b transmitted

from the second light transmitter 15b is not shielded. Therefore, a signal of not receiving light is generated from the first light receiver 16a, and on the other hand, a signal of not receiving light is not generated from the second light receiver 16b. On receipt of the signal of not receiving light from the first light receiver 16a and a signal of receiving light from the second light receiver 16b, the door control device body 18 judges that the door panel 2 lies at the full open position, and carries out the door opening/closing control such as the rotational drive control of the door motor 6 based on this judgment.

[0042] When the door panel 2 comes to the full close position, the second light beam 17b transmitted from the second light transmitter 15b is shielded by the second shield plate 13, but the first light beam 17a transmitted from the first light transmitter 15a is not shielded. Therefore, a signal of not receiving light is not generated from the first light receiver 16a, and on the other hand, a signal of not receiving light is generated from the second light receiver 16b. On receipt of a signal of receiving light from the first light receiver 16a and the signal of not receiving light from the second light receiver 16b, the door control device body 18 judges that the door panel 2 lies at the full close position, and carries out the door opening/closing control such as the rotational drive control of the door motor 6 based on this judgment.

[0043] In this embodiment, the light transmitters and the light receivers are arranged so as to be shifted in the right-and-left direction. However, the light transmitters and the light receivers may be arranged so as to be shifted not only in the right-and-left direction but also in the up-and-down direction. That is, the two sets of light transmitters and light receivers may be arranged in the slantwise direction.

Also, the transverse dimension of either one of the two shield plates may be made longer to shield the light beams of both the two sets of light transmitters and light receivers.

[0044] The elevator door control device configured as described above is configured so that the first light transmitter and the second light transmitter are arranged in the right-and-left direction; when the door panel lies at either one of the full open position and the full close position, the first shield plate shields only either one of the first light beam and the second light beam; and when the door panel lies at the other of the full open position and the full close position, the second shield plate shields only the other of the first light beam and the second light beam. Therefore, in addition to being capable of achieving the same effect as that of the first embodiment, the vertical dimension of the position switch can be decreased.

Fourth embodiment

[0045] Figure 1 and Figures 6 and 7 relate to a fourth embodiment of the present invention. Figure 1 is the front view showing the general configuration of the elevator door control device, Figure 6 is a schematic view for explaining a configuration of the door panel position detecting section of the elevator door control device, and Figure 7 is a flowchart showing an operation of the elevator door control device.

The fourth embodiment explained hereunder is configured so that, in the configuration of the third embodiment, the transverse dimension of one shield plate is made longer than the space dimension in the right-and-left direction of the two sets of light transmitters and light receivers, and also by adding the light shield order of the two sets of light transmitters and light receivers using the shield plate having the longer dimension, it is judged which of the full open position and the full close position is the position of door panel.

[0046] The transverse dimension of either one of the first shield plate 12 and the second shield plate 13, in this example, the second shield plate 13, is adjusted so as to be longer than the space dimension in the right-and-left direction between the first light transmitter 15a and the second light transmitter 15b. In other words, the transverse dimension of the second shield plate 13 is long enough to be capable of shielding both of the first light beam 17a transmitted from the first transmitter 15a and the second light beam 17b transmitted from the second transmitter 15b.

Other configurations are the same as those of the third embodiment, and therefore the detailed explanation thereof is omitted.

[0047] In the elevator door control device configured as described above, the judgment operation at the time when the door panel comes to the full open position is the same as that in the third embodiment, and therefore the explanation thereof is omitted.

The judgment operation for judging whether or not the door panel 2 comes to the full close position is performed by following the flow shown in Figure 7.

In the flowchart of Figure 7, the door control device body 18 checks, based on the signal generated from the position switch 14, whether or not both of the first light receiver 16a and the second light receiver 16b are in the state of not receiving light. In this check, if it is confirmed that both of the first light receiver 16a and the second light receiver 16b are in the state of not receiving light, the process proceeds to Step S2.

[0048] In Step S2, concerning the order in which the first light receiver 16a and the second light receiver 16b become in the state of not receiving light (the light shield order), the door control device body 18 checks whether or not the second light receiver 16b on the second shield plate 13 side is first, and the first light receiver 16a on the side opposite to the second shield plate 13 is second. In this check, if it is confirmed that, concerning the light shield order, the second light receiver 16b is first and the first light receiver 16a is second, the process proceeds to Step S3, where the door control device body 18 judges that the door panel 2 is in the full close state, and the process returns to Step S1.

[0049] On the other hand, in the check in Step S2, if it is not confirmed that, concerning the light shield order, the second light receiver 16b is first and the first light receiver 16a is second, the process proceeds to Step S4. In Step S4, the door control device body 18 judges that an abnormality such that both of the first light receiver 16a and the second light receiver 16b are caused to be in the state of not receiving light by the occurrence of abnormality, such as power source abnormality, cable breaking of the position switch, or the like, has occurred, and the process returns to Step S1.

[0050] The elevator door control device configured as described above is configured so that the first light transmitter and the second light transmitter are arranged in the right-and-left direction; the transverse dimension of one shield plate of the first and second shield plates is longer than that of the other shield plate; when the door panel lies at either one of the full open position and the full close position, the one shield plate shields both of the first light beam and the second light beam; when the door panel lies at the other of the full open position and the full close position, the other shield plate shields either one of the first light beam and the second light beam; and the door control device body judges, based on the order in which the first light receiver and the second light receiver become in the state of not receiving light, whether or not the door panel lies at either one of the full open position and the full close position.

Therefore, in addition to being capable of achieving the same effect as that of the third embodiment, it can be detected that an abnormality such that both of the first light receiver and the second light receiver are caused to be in the state of not receiving light by the occurrence of abnormality, such as power source abnormality, cable breaking of the position switch, or the like, has occurred.

Fifth embodiment

[0051] A fifth embodiment explained hereunder is configured so that, in the configurations of the first to fourth embodiments, the light receiver is provided on the side separating from the door driving unit, that is, separating from the beam of the two projecting portions of the U-shape of the position switch.

In other words, since the light transmitter is provided on the side opposed to the light receiver, the light transmitter is provided on the door driving unit side, that is, on the beam side of the two projecting portions of the U-shape of the position switch.

[0052] As described above, the position switch 14 takes a substantially U-shape as viewed from the side, and is installed on the beam 3. In the projecting portion on the door driving unit 5 side, that is, on the beam 3 side of the two projecting portions of the U-shape, the light transmitter 15 is provided. Also, in the projecting portion on the side separating from the door driving unit 5, that is, separating from the beam 3 of the two projecting portions of the U-shape, the light receiver 16 is provided so as to be opposed to the light transmitter 15.

Other configurations and operation are the same as those of any one of the first to fourth embodiments, and therefore the detailed explanation thereof is omitted.

[0053] The elevator door control device configured as described above is configured so that the position switch takes a substantially U-shape as viewed from the side, and is installed on the beam provided above the entrance so that one projecting portion of the substantially U-shape is on the beam side; and the first light receiver and the second light receiver are provided in the other projecting portion of the substantially U-shape on the side separating from the beam. Therefore, in addition to being capable of achieving the same effect as that of any one of the first to fourth embodiments, disturbance light such as sunlight is less liable to directly fall on the light receiver, so that malfunction can be restrained.

Sixth embodiment

[0054] Figure 8 relating to a sixth embodiment of the present invention is a sectional view showing a configuration of the position switch of the elevator door control device.

The sixth embodiment explained hereunder is configured so that, in the configurations of the first to fifth embodiments, the light transmitters and/or the light receivers are provided at positions retreating from the inside surface of the U-shape of the position switch.

[0055] As described above, the position switch 14 takes a substantially U-shape as viewed from the side, and is installed on the beam 3. In one projecting portion of the U-shape, the light transmitters 15 are provided at the positions retreating from the inside surface of the U-shape. Also, in the other projecting portion of the U-shape, the light receivers 16 are provided at the positions retreating from the inside surface of the U-shape so as to be opposed to the light transmitters 15.

[0056] In this example, both of the light transmitters 15 and the light receivers 16 are provided at the positions retreating from the inside surface of the U-shape. However, only either of the light transmitters 15 and the light receivers 16 may be provided at the position retreating from the inside surface of the U-shape.

Other configurations and operation are the same as those of any one of the first to fifth embodiments, and therefore the detailed explanation thereof is omitted.

[0057] The elevator door control device configured as described above is configured so that the position switch takes a substantially U-shape as viewed from the side, and is installed on the beam provided above the entrance; and the first and second light transmitters and/or the first and second light receivers are arranged at positions retreating from the inside surface of the substantially U-shape. Therefore, in addition to being capable of achieving the same effect as that of any one of the first to fifth embodiments, the straightness of light beam transmitted from the transmitter can be improved to decrease the

influence on another light receiver, and also disturbance light such as sunlight is less liable to directly fall on the light receivers, so that malfunction can be restrained.

Seventh embodiment

[0058] Figure 9 relating to a seventh embodiment of the present invention is a perspective view showing a configuration of the position switch of the elevator door control device.
The seventh embodiment explained hereunder is configured so that, in the configurations of the first to sixth embodiments, in outside surface portions on the side on which the position switch separates from the beam, a light receiving indicator for displaying the light receiving state of the light receiver provided on the position switch is provided.

[0059] As described above, the position switch 14 takes a substantially U-shape as viewed from the side, and is installed on the beam 3. In the outside surface portions on the side on which the position switch 14 separates from the beam 3, a light receiving indicator 20 that displays the light receiving state, that is, whether or not the light receiver 16 provided on the position switch 14 receives a light beam.
The position switch shown in Figure 9 is an example of the case where the first light receiver 16a and the second light receiver 16b are arranged in the up-and-down direction. Therefore, as the light receiving indicator 20, two indicators of a first light receiving indicator 20a that displays the light receiving state of the first light receiver 16a and a second light receiving indicator 20b that displays the light receiving state of the second light receiver 16b are provided.

[0060] In this embodiment, an example of arrangement in which the light receivers are arranged in the up-and-down direction is shown. However, the configuration can be employed for other arrangements.
Other configurations and operation are the same as those of any one of the first to sixth embodiments, and therefore the detailed explanation thereof is omitted.

[0061] The elevator door control device configured as described above is configured so that the elevator door control device further includes a light receiving indicator that is provided on the outside surface of the position switch to display the light receiving states of the first and second light receivers. Therefore, in addition to being capable of achieving the same effect as that of any one of the first to sixth embodiments, in the work for adjusting the position switch and the shield plates at the door full open and full close position, the worker can easily know the light receiving states of the light receivers, so that the efficiency of that work can be improved.

Eighth embodiment

[0062] Figures 10 to 11 relate to an eighth embodiment of the present invention. Figure 10 is a perspective view showing one example of a configuration of the position switch of the elevator door control device, and Figure 11 is a perspective view showing another example of a configuration of the position switch of the elevator door control device.

[0063] The eighth embodiment explained hereunder is configured so that, in the configurations of the first to seventh embodiments, on both sides in the right-and-left direction of the position switch, an external light shielding part for preventing disturbance light from falling on the light receivers is provided so as not become a hindrance to the movement of shield plates.

[0064] As one example of this embodiment, as shown in Figure 10, on both sides in the right-and-left direction of the position switch 14, light shielding covers 21a, which are external light shielding parts 21, are provided so as not become a hindrance to the movement of the first and second shield plates 12 and 13.
Also, as another example of this embodiment, as shown in Figure 11, the external light shielding parts 21 are formed by making a transverse dimension 14a of the position switch 14 longer than that of other embodiments.
Other configurations and operation are the same as those of any one of the first to seventh embodiments, and therefore the detailed explanation thereof is omitted.

[0065] The elevator door control device configured as described above is configured so that the elevator door control device further includes the external light shielding parts that are provided on both sides in the right-and-left direction of the position switch to prevent disturbance light from falling on the first and second light receivers. Therefore, in addition to being capable of achieving the same effect as that of any one of the first to seventh embodiments, disturbance light such as sunlight is less liable to directly fall on the light receivers, so that malfunction can be restrained.

Ninth embodiment

[0066] A ninth embodiment explained hereunder is configured so that, in the configurations of the first to eighth embodiments, the surfaces of the shield plates each are covered with a paint or member that is black in color or has a low light reflectance.
The surfaces of the first and second shield plates 12 and 13 each are covered with a paint or member that is black in color or has a low light reflectance. Other configurations and operation are the same as those of any one of the first to eighth embodiments.

[0067] The elevator door control device configured as described above is configured so that the surfaces of the first and second shield plates each are covered with a paint or member that is black in color or has a low light reflectance. Therefore, in addition to being capable of achieving the same effect as that of any one of the first to eighth embodiments, the light reflected by the shield plates is less liable to directly fall on the light receivers, so that malfunction can be restrained.

Tenth embodiment

[0068] Figure 12 relating to a tenth embodiment of the present invention is schematic perspective and sectional views showing a configuration of the door panel position detecting section of the elevator door control device.
The tenth embodiment explained hereunder is configured so that, in the configurations of the first to ninth embodiments, the joint part has a substantially L-shape as viewed from the side to shield disturbance light entering from the downside by using this joint part.

[0069] As shown in Figure 12, the joint part 19 takes a substantially L-shape as viewed from the side. A substantially horizontal surface is formed by being bent substantially at right angles to the door driving unit 5 side (the beam 3 side) from the surface that is threadedly mounted to the door hanger 2a by using the elongated hole 19a and the bolts 19b, and on upper surface of this substantially horizontal surface, the first shield plate 12 or the second shield plate 13 is erected.
The installation position of the position switch 14 is also adjusted so as to match the mounting positions of the first and second shield plates 12 and 13.
Other configurations and operation are the same as those of any one of the first to ninth embodiments, and therefore the detailed explanation thereof is omitted.

[0070] The elevator door control device configured as described above is configured so that the elevator door control device further includes the joint part having a substantially L-shape as viewed from the side, to which the first shield plate and the second shield plate are attached; and the first shield plate and the second shield plate are erected on the upper surface of the substantially horizontal surface formed by the joint part. Therefore, in addition to being capable of achieving the same effect as that of any one of the first to ninth embodiments, disturbance light entering into the light receivers from the downside of the position switch is shielded, so that malfunction can be restrained.

Industrial Applicability

[0071] The present invention can be applied to an elevator door control device, which carries out door opening/closing control by detecting the full open position and the full close position of the elevator door.

Description of Symbols

[0072]

1	car entrance
2	car door panels
2a	car door hanger
2b	car door rollers
3	beam
4	car door rail
5	door driving unit
6	door motor
7	driving wheel
8	driven wheel
9	toothed belt
10	locking member
11	stoppers
12	first shield plate
12a	arm part for the first shield plate
13	second shield plate
13a	arm part for the second shield plate
14	position switch
14a	transverse dimension of the position switch
15	light transmitter
15a	first light transmitter
15b	second light transmitter
16	light receiver
16a	first light receiver
16b	second light receiver
17	light beam
17a	first light beam
17b	second light beam
18	door control device body
19	joint part
19a	elongated hole
19b	bolts
20	light receiving indicator
20a	first light receiving indicator
20b	second light receiving indicator
21	external light shielding parts
21a	light shielding covers

Claims

1. An elevator door control device, which controls the opening/closing operation of a door panel which opens and closes an elevator entrance in the right-and-left direction, comprising:

one position switch which detects that the door panel lies at the full open position and at the full close position;
a first light transmitter provided on the position switch to transmit a first light beam;
a first light receiver provided at a position opposed to the first light transmitter on the position switch to receive the first light beam;
a second light transmitter provided on the position switch to transmit a second light beam;
a second light receiver provided at a position opposed to the second light transmitter on the position switch to receive the second light beam;
a first shield plate and a second shield plate, which are provided on the door panel; and
a door control device body which judges, based on a signal carring information about the light receiving state of the first and second light receivers outputted from the position switch,

whether or not the door panel lies at the full open position and the full close position and which controls the opening/closing operation of the door panel, **characterized in that**
when the door panel lies at either one of the full open position and the full close position, the first shield plate shields one or more predetermined light beams of the first and second light beams, and
when the door panel lies at the other of the full open position and the full close position, the second shield plate shields one or more predetermined light beams of the first and second light beams different from the predetermined light beams shielded by the first shield plate.

2. The elevator door control device according to claim 1, **characterized in that**
the first light transmitter and the second light transmitter are arranged in the up-and-down direction;
the vertical dimension of one shield plate of the first and second shield plates is longer than the vertical dimension of the other shield plate;
when the door panel lies at either one of the full open position and the full close position, the one shield plate shields both of the first light beam and the second light beam; and
when the door panel lies at the other of the full open position and the full close position, the other shield plate shields either one of the first light beam and the second light beam.

3. The elevator door control device according to claim 1, **characterized in that**
the first light transmitter and the second light transmitter are arranged in the up-and-down direction;
the first shield plate and the second shield plate are arranged at positions different from each other in the up-and-down direction;
when the door panel lies at either one of the full open position and the full close position, the first shield plate shields only either one of the first light beam and the second light beam; and
when the door panel lies at the other of the full open position and the full close position, the second shield plate shields only the other of the first light beam and the second light beam.

4. The elevator door control device according to claim 1, **characterized in that**
the first light transmitter and the second light transmitter are arranged in the right-and-left direction;
when the door panel lies at either one of the full open position and the full close position, the first shield plate shields only either one of the first light beam and the second light beam; and
when the door panel lies at the other of the full open position and the full close position, the second shield plate shields only the other of the first light beam and the second light beam.

5. The elevator door control device according to claim 1, **characterized in that**
the first light transmitter and the second light transmitter are arranged in the right-and-left direction;
the transverse dimension of one shield plate of the first and second shield plates is longer than that of the other shield plate;
when the door panel lies at either one of the full open position and the full close position, the one shield plate shields both of the first light beam and the second light beam;
when the door panel lies at the other of the full open position and the full close position, the other shield plate shields either one of the first light beam and the second light beam; and
the door control device body judges, based on the order in which the first light receiver and the second light receiver become in the state of not receiving light, whether or not the door panel lies at either one of the full open position and the full close position.

6. The elevator door control device according to any one of claims 1 to 5, **characterized in that**
the position switch takes a substantially U-shape as viewed from the side, and is installed on the beam provided above the entrance so that one projecting portion of the substantially U-shape is on the beam side; and
the first light receiver and the second light receiver are provided in the other projecting portion of the substantially U-shape on the side separating from the beam.

7. The elevator door control device according to any one of claims 1 to 6, **characterized in that**
the position switch takes a substantially U-shape as viewed from the side, and is installed on the beam provided above the entrance; and
the first and second light transmitters and/or the first and second light receivers are arranged at positions retreating from the inside surface of the substantially U-shape.

8. The elevator door control device according to any one of claims 1 to 7, **characterized in that** the elevator door control device further comprises a light receiving indicator which is provided on the outside surface of the position switch to display the light receiving states of the first and second light receivers.

9. The elevator door control device according to any one of claims 1 to 8, **characterized in that** the elevator door control device further comprises external light shielding parts which are provided on both sides in the right-and-left direction of the position switch to

prevent disturbance light from falling on the first and second light receivers.

10. The elevator door control device according to any one of claims 1 to 9, **characterized in that** the surfaces of the first and second shield plates each are covered with a paint or member which is black in color or has a low light reflectance.

11. The elevator door control device according to any one of claims 1 to 10, **characterized in that**
the elevator door control device further comprises a joint part having a substantially L-shape as viewed from the side, to which the first shield plate and the second shield plate are attached; and
the first shield plate and the second shield plate are erected on the upper surface of a substantially horizontal surface formed by the joint part.

fig. 1

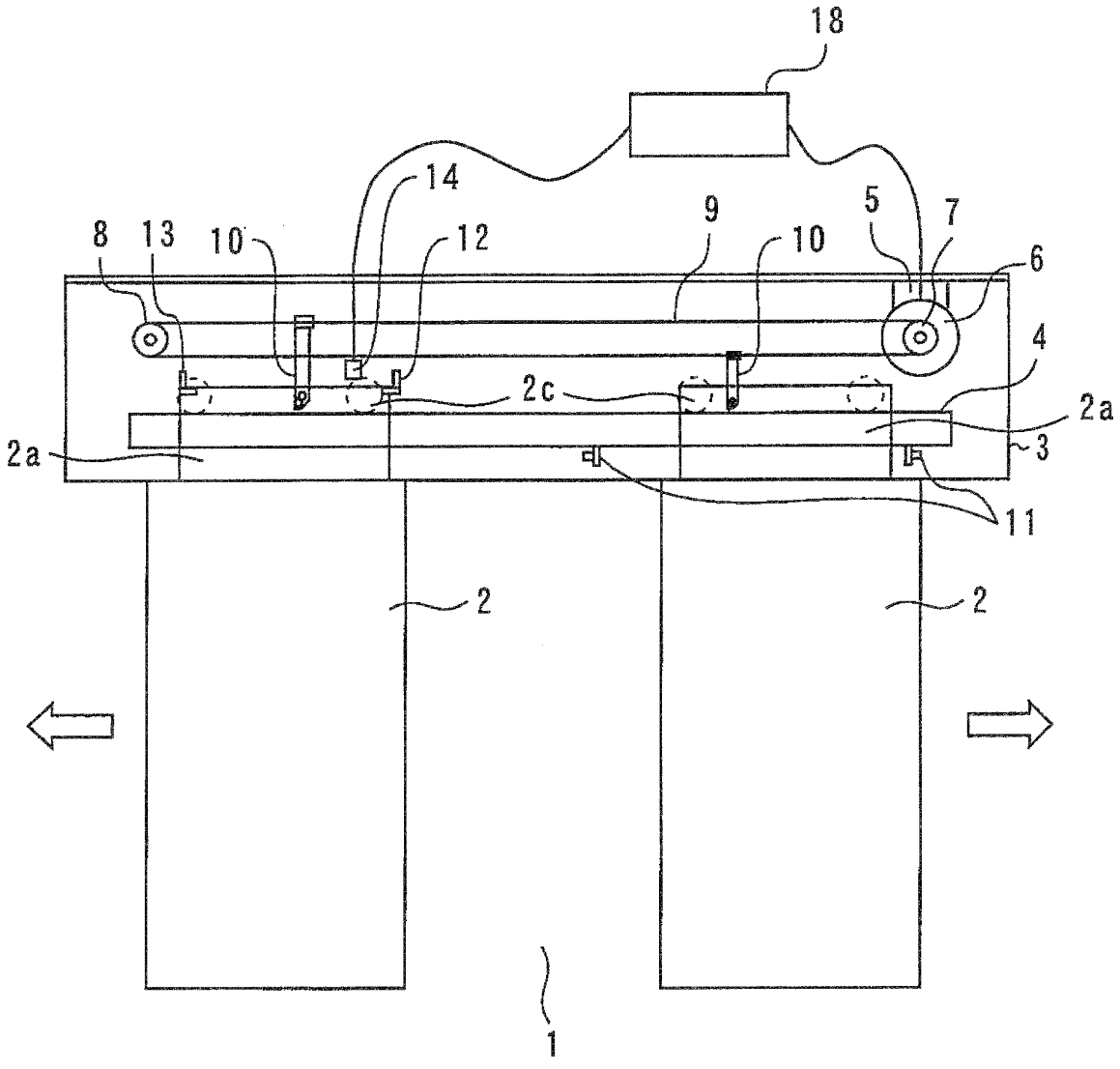


fig. 2

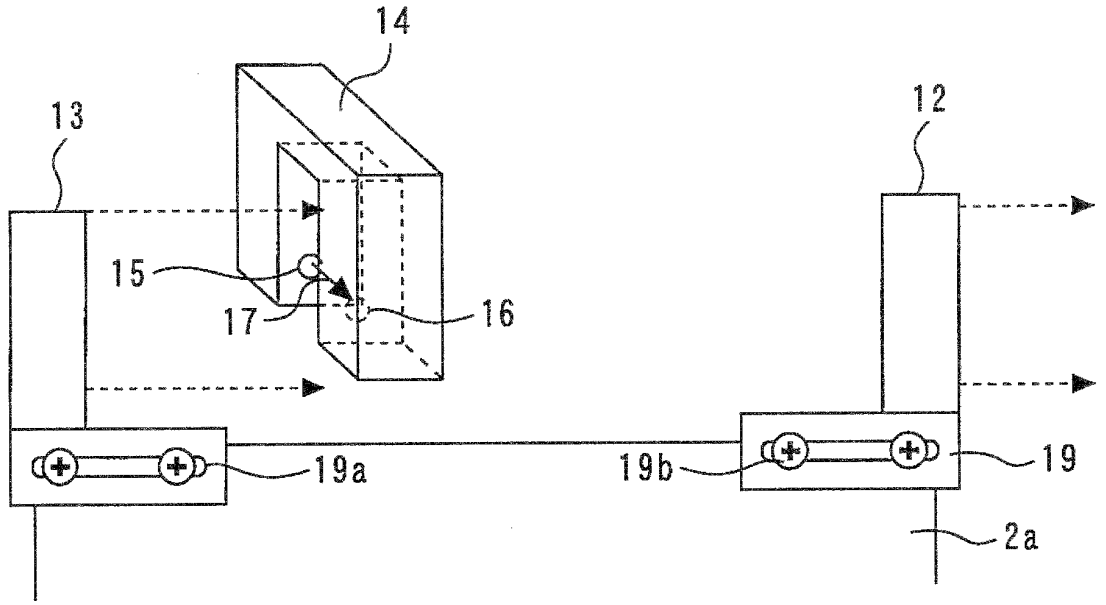


fig. 3

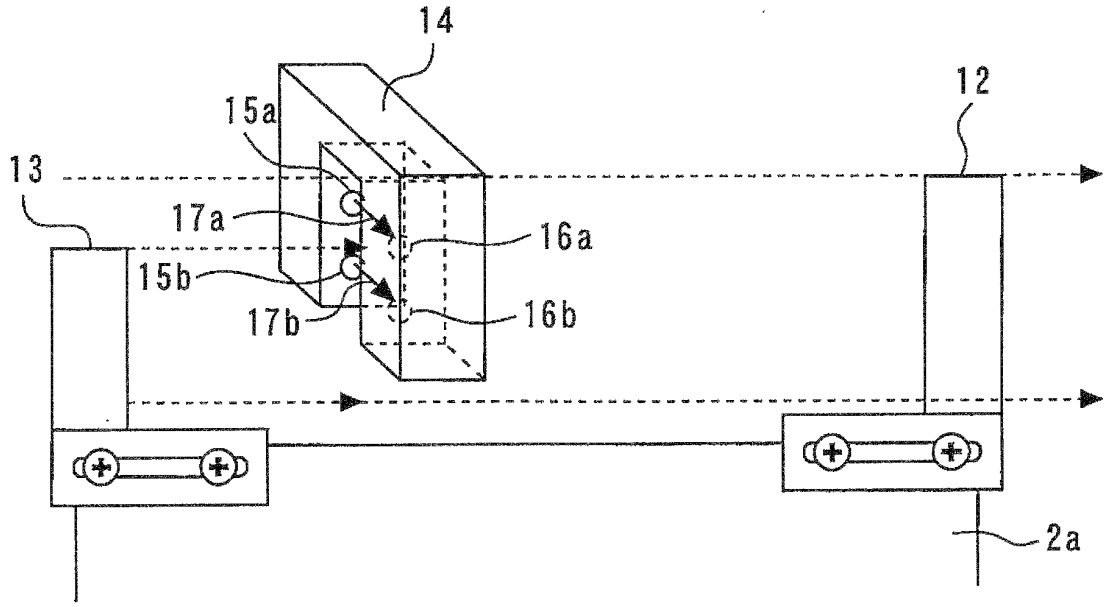


fig. 4

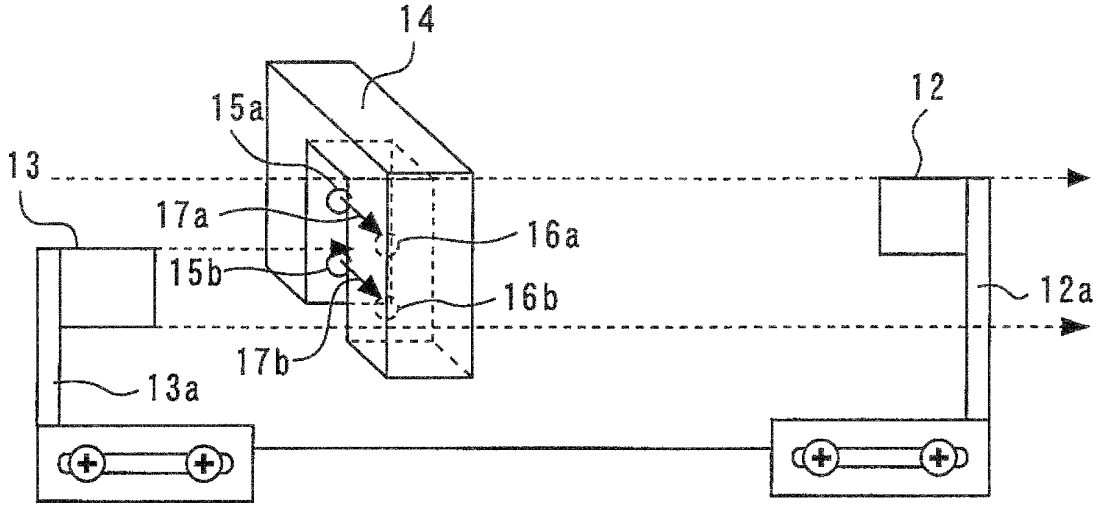

14
15a
12
13
17a
16a
15b
16b
12a
17b
13a

fig. 5

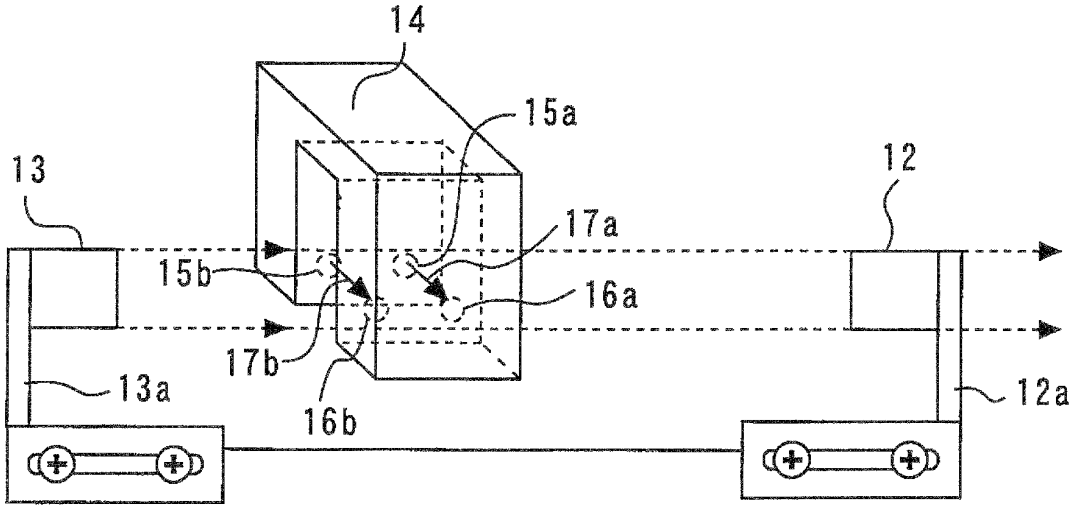

14
15a
13
12
17a
15b
16a
17b
13a
16b
12a

fig. 6

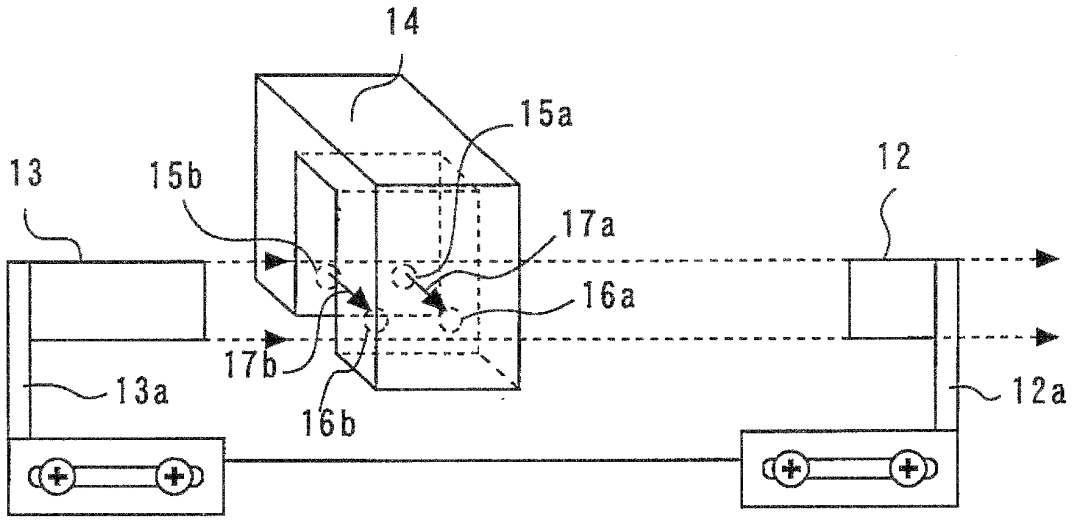
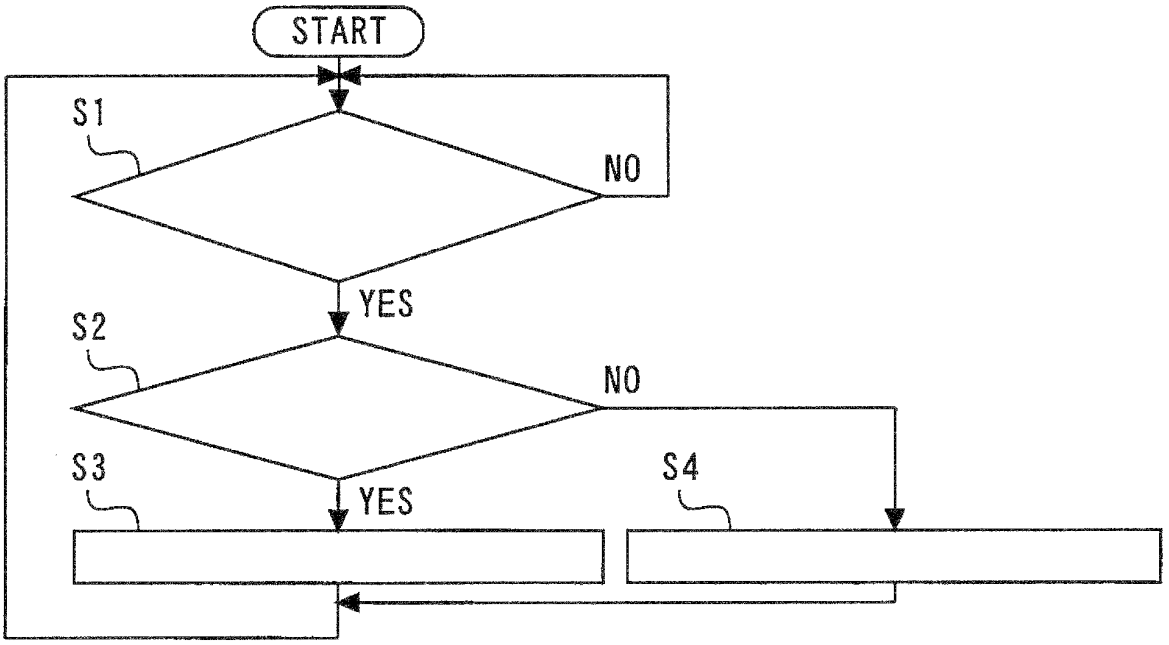


fig. 7



S1: ARE BOTH OF THE FIRST AND SECOND LIGHT RECEIVERS IN THE STATE OF NOT RECEIVING LIGHT?

S2: IS THE LIGHT SHIELD ORDER "THE SECOND → THE FIRST"?

S3: THE FULL CLOSE STATE

S4: AN ABNORMAL STATE

fig. 8

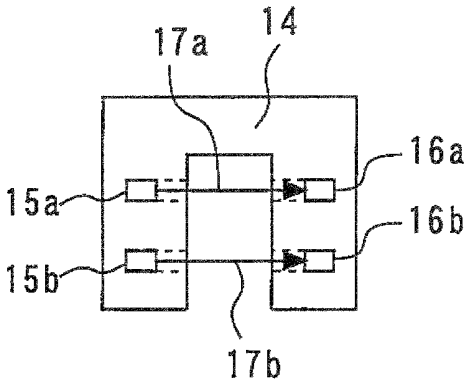


fig. 9

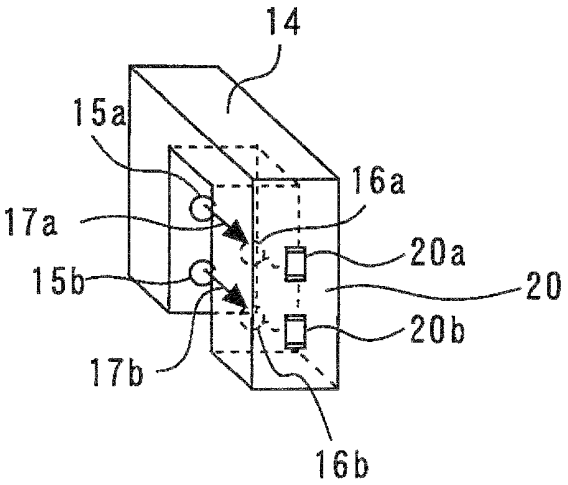


fig. 10

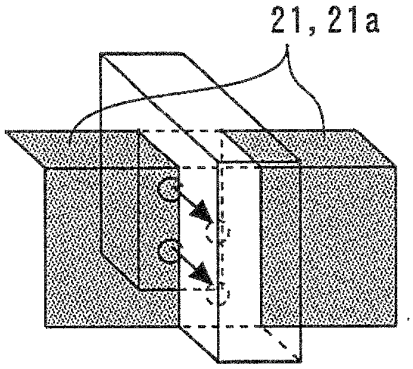


fig. 11

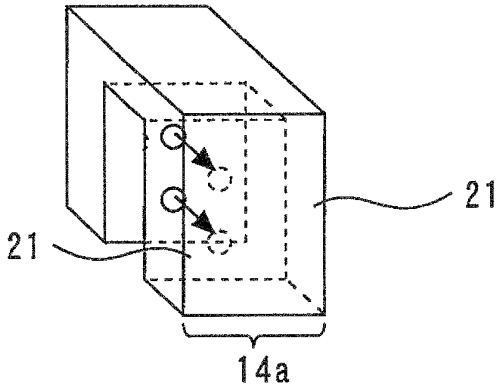
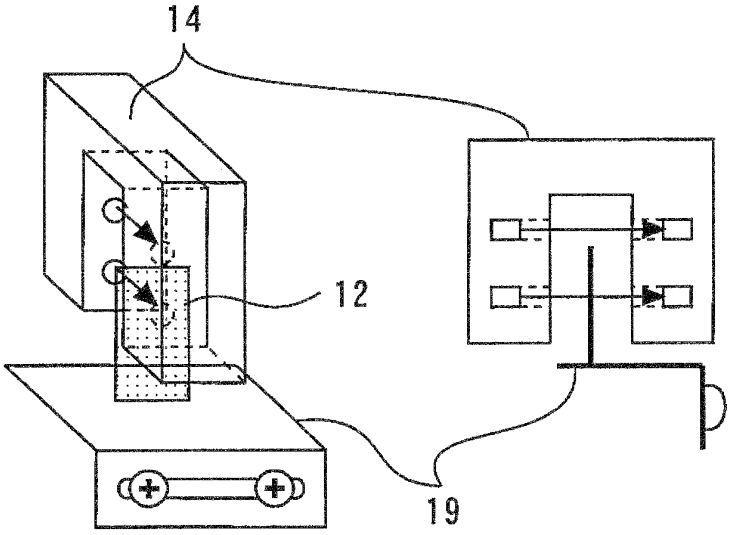


fig. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/069553

A. CLASSIFICATION OF SUBJECT MATTER
B66B13/22(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)
B66B13/22

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2010
Kokai Jitsuyo Shinan Koho	1971-2010	Toroku Jitsuyo Shinan Koho	1994-2010

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003-40563 A (Mitsubishi Electric Corp.), 13 February 2003 (13.02.2003), paragraphs [0037] to [0040]; fig. 14 to 15 (Family: none)	1-11
A	JP 60-218282 A (Mitsubishi Electric Corp.), 31 October 1985 (31.10.1985), entire text; fig. 1 to 5 (Family: none)	1-11
A	JP 6-212860 A (Fuji Electric Co., Ltd.), 02 August 1994 (02.08.1994), entire text; fig. 1 to 7 (Family: none)	1-11

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

* Special categories of cited documents:
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