



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
23.10.2013 Bulletin 2013/43

(51) Int Cl.:
B66B 13/22 (2006.01)

(21) Application number: **10860697.1**

(86) International application number:
PCT/JP2010/072538

(22) Date of filing: **15.12.2010**

(87) International publication number:
WO 2012/081090 (21.06.2012 Gazette 2012/25)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(72) Inventor: **KITAZAWA, Masaya**
Tokyo 100-8310 (JP)

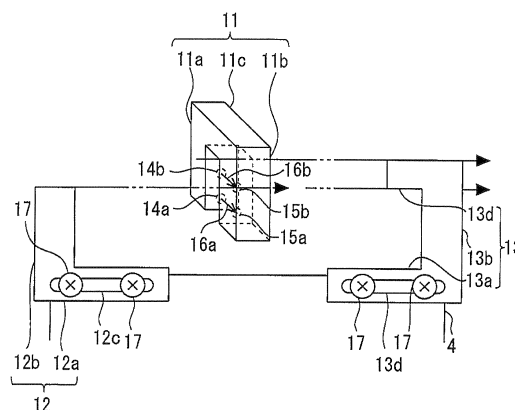
(71) Applicant: **Mitsubishi Electric Corporation**
Tokyo 100-8310 (JP)

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

(54) **ELEVATOR DOOR DEVICE**

(57) Provided is a door operator of an elevator capable of discriminating between a fully open condition and a fully closed condition of a door of the elevator by one position switch. For this purpose, the door operator of an elevator includes a position switch in which two sets of phototransmitter/photoreceiver devices are arranged side by side in a vertical direction; a first intercepting body which intercepts or reflects light from a lower side phototransmitter to a lower side photoreceiver when the door has come to one of a fully closed condition and a fully open condition; and a second intercepting body which simultaneously intercepts or reflects light from the lower side phototransmitter to the lower side photoreceiver and light from an upper side phototransmitter to an upper side photoreceiver when the door has come to the other of the fully closed condition and the fully open condition. In this door operator of an elevator, the second intercepting body has: a first intercepting portion which intercepts or reflects light from the lower side phototransmitter to the lower side photoreceiver when the door has come to the other of the fully closed condition and the fully open condition; and a second intercepting portion which is formed to be wider than the first intercepting portion in the opening and closing direction of the door in such a manner as to intercept or reflect light from the upper side phototransmitter to the upper side photoreceiver while the first intercepting portion is intercepting or reflecting light from the lower side phototransmitter to the side lower photoreceiver.

FIG. 3



Description

Technical Field

[0001] The present invention relates to a door operator of an elevator.

Background Art

[0002] In recent years, machine-room-less elevators have been in widespread use. In a machine-room-less elevator, a traction machine is arranged in a shaft. For this reason, space saving of elevator equipment in the shaft is required. As a result of this, also in a door operator of an elevator, a compact and multifunctional door operator is required.

[0003] In a door operator of an elevator, the torque of a door motor and the like is transmitted to a door panel via a transmission mechanism. As a result of this, the door panel opens and closes automatically in a horizontal direction. It is necessary that the door panel come to a standstill in a fully open position and in a fully closed position. For this reason, it is necessary to recognize a fully open condition and a fully closed condition of the door panel.

[0004] A position switch which uses the interception and reflection of light is widely used to recognize these conditions. Compared to switches of other types, this position switch has high accuracy and is resistant to dust, water and the like.

[0005] As a door operator provided with a position switch using light, there has been proposed a door operator in which two intercepting plates are provided on a door panel for one position switch. In this door operator, it is possible to recognize that the door panel is arranged in a fully open position or in a fully closed position.

[0006] However, the light receiving condition of the position switch is the same in whichever of a fully open position and a fully closed position the door panel may be arranged. For this reason, it is impossible to discriminate between a fully open condition and a fully closed condition of the door panel.

[0007] In contrast to this, there has been proposed a door operator in which a plurality of position switches are arranged side by side in the opening and closing direction of the door panel. In this door switch, one or more intercepting plates provided on a door panel traverse each phototransmitter/photoreceiver device of the position switches, whereby it is possible to discriminate between a fully open condition and a fully closed condition of the door panel (refer to Patent Literature 1, for example).

Citation List

Patent Literature

[0008] Patent Literature 1: Japanese Patent No. 60-218282

Summary of Invention

Technical Problem

[0009] However, in the door operator provided in Patent Literature 1, it is necessary to use expensive position switches in a plurality of numbers.

[0010] The present invention was made to solve the problem described above, and the object of the invention is to provide a door operator of an elevator capable of discriminating between a fully open condition and a fully closed condition of a door of the elevator by one position switch.

Means for Solving the Problems

[0011] A door operator of an elevator of the present invention includes a position switch which is provided in the vicinity of a door of the elevator and in which two sets of phototransmitter/photoreceiver devices, each having a phototransmitter and a photoreceiver, are arranged side by side in a vertical direction; a first intercepting body provided on the door in such a manner as to intercept or reflect light from a lower side phototransmitter to a lower side photoreceiver when the door has come to one of a fully closed condition and a fully open condition; and a second intercepting body provided on the door in such a manner as to simultaneously intercept or reflect light from the lower side phototransmitter to the lower side photoreceiver and light from an upper side phototransmitter to an upper side photoreceiver when the door has come to the other of the fully closed condition and the fully open condition; wherein the second intercepting body has: a first intercepting portion which is formed in such a manner as to intercept or reflect light from the lower side phototransmitter to the lower side photoreceiver when the door has come to the other of the fully closed condition and the fully open condition; and a second intercepting portion which is formed to be wider than the first intercepting portion in an opening and closing direction of the door in such a manner as to intercept or reflect light from the upper side phototransmitter to the upper side photoreceiver while the first intercepting portion is intercepting or reflecting light from the lower side phototransmitter to the lower side photoreceiver.

Advantageous Effects of Invention

[0012] According to the present invention, it is possible to discriminate between a fully open condition and a fully closed condition of the door of an elevator by one position switch.

Brief Description of the Drawings

[0013]

Figure 1 is a front view to explain the condition in

which a door panel of the door operator of an elevator in Embodiment 1 of the present invention is fully open.

Figure 2 is a front view to explain the condition in which a door panel of the door operator of an elevator in Embodiment 1 of the present invention is fully closed.

Figure 3 is a principal-part structural diagram of the door operator of an elevator in Embodiment 1 of the present invention.

Figure 4 is a front view to explain the positional relationship between the position switch and the intercepting plates obtained when the door operator of an elevator in Embodiment 1 of the present invention is fully open.

Figure 5 is a front view to explain the positional relationship between the position switch and the intercepting plates obtained when the door operator of an elevator in Embodiment 1 of the present invention is fully closed.

Figure 6 is a perspective view of a position switch used in the door operator of an elevator in Embodiment 2 of the present invention.

Figure 7 is a cross-sectional view of the position switch used in the door operator of an elevator in Embodiment 2 of the present invention.

Figure 8 is a perspective view of a position switch used in the door operator of an elevator in Embodiment 3 of the present invention.

Description of Embodiments

[0014] Embodiments for carrying out the present invention will be described with reference to the accompanying drawings. In each of the drawings, like numerals refer to like or corresponding parts and overlaps of description of these parts are appropriately simplified or omitted.

Embodiment 1

[0015] Figure 1 is a front view to explain the condition in which a door panel of the door operator of an elevator in Embodiment 1 of the present invention is fully open. Figure 2 is a front view to explain the condition in which a door panel of the door operator of an elevator in Embodiment 1 of the present invention is fully closed.

[0016] Figures 1 and 2 are front views obtained when an upper part of an entrance (not shown) of a car (not shown) is seen from outside the car. In Figures 1 and 2, reference numeral 1 denotes a support beam. The support beam 1 is provided above the entrance of the car. A rail 2 is provided in the lower part of the support beam 1 in such a manner as to extend in a horizontal direction along an upper edge part of the entrance of car. A strap metal 3 is provided in the middle of the rail 2 and at one end thereof. A pair of door hangers 4 is provided in the rail 2 in such a manner as to be movable in a horizontal

direction. A stopper 5 is provided on both sides of one door hanger 4. A door panel 6 is suspended from each of the door hangers 4.

[0017] A motor 7 is provided in an upper part of one side of the support beam 1. A pulley 8 is provided in an upper part of the other side of the support beam 1. An endless toothed belt 9 is wound onto the motor 7 and the pulley 8. An appropriate tension is applied to the toothed belt 9.

[0018] An upper side of the toothed belt 9 is connected to an upper part of one belt gripper 10. A lower part of one belt gripper 10 is connected to one door hanger 4. A lower side of the toothed belt 9 is connected to the other belt gripper 10. A lower part of the other belt gripper 10 is connected to the other door hanger 4.

[0019] A position switch 11 is provided on one side of the support beam 1 above one door hanger 4. A door control device (not shown) is connected to the output of the position switch 11. A first intercepting plate (a first intercepting body) 12 is provided in a door stopper side upper part of one door hanger 4. A second intercepting plate (a second intercepting body) 13 is provided in a door pocket side upper part of one door hanger 4. The first intercepting plate 12 and the second intercepting plate 13 are arranged on the same plane in such a manner as to be parallel to the door panel 6.

[0020] In this door operator, the toothed belt 9 moves due to the rotation of the motor 7. As a result of this movement, a pair of belt grippers 10 in turn moves in a horizontal direction, in directions reverse to each other. As a result of this movement, a pair of door hangers 4 in turn moves in a horizontal direction, in directions reverse to each other. As a result of this movement, a pair of door panels 6 opens and closes in turn in a horizontal direction, in directions reverse to each other.

[0021] When the door panel 6 is fully open, the door pocket side strap metal 3 and the stopper 5 come into contact with each other. At this time, the first intercepting plate 12 is detected by the position switch 11. On the other hand, when the door panel 6 is fully closed, the door stopper side strap metal 3 and the stopper 5 come into contact with each other. At this time, the second intercepting plate 13 is detected by the position switch 11. On the basis of these detection results of the position switch 11, the door control device discriminates between a fully open condition and a fully closed condition of the door panel 6.

[0022] Next, with the aid of Figure 3 a description will be given of the position switch 11, the first intercepting plate 12, and the second intercepting plate 13.

Figure 3 is a principal-part structural diagram of the door operator of an elevator in Embodiment 1 of the present invention.

[0023] The position switch 11 opens downward. Specifically, the position switch 11 is provided with a first holding portion 11a, a second holding portion 11b, and a connecting portion 11c. The first holding portion 11a is attached to the support beam 1. The second holding por-

tion 11b is arranged nearer to the external side of the car than the first holding portion 11a. The connecting portion 11c connects an upper end of the first holding portion 11a and an upper end of the second holding portion 11b.

[0024] A pair of phototransmitters 14a and 14b is held side by side on an inner side surface of the first holding portion 11a in a vertical direction. The phototransmitters 14a and 14b are arranged, with the light emitting surfaces thereof facing the external side of the car. A pair of photoreceivers 15a and 15b is held side by side on an inner side surface of the second holding portion 11b in a vertical direction. The photoreceivers 15a and 15b are arranged, with the light receiving surfaces thereof facing the car side.

[0025] Light emitted by the lower side phototransmitter 14a is received by the lower side photoreceiver 15a. As a result of this, a first optical axis 16a which extends in a horizontal direction is formed between the lower side phototransmitter 14a and the lower side photoreceiver 15a. Light emitted by the upper side phototransmitter 14b is received by the upper side photoreceiver 15b. A second optical axis 16b which extends in a horizontal direction is formed between the upper side phototransmitter 14b and the upper side photoreceiver 15b.

[0026] In this manner, the lower side phototransmitter 14a and the lower side photoreceiver 15a function as one phototransmitter/photoreceiver device. Similarly, also the upper side phototransmitter 14b and the upper side photoreceiver 15b function as one phototransmitter/photoreceiver device.

[0027] The first intercepting plate 12 is integrally formed in the shape of the letter L. Specifically, the first intercepting plate 12 is provided with a horizontal portion 12a and a vertical portion 12b. The horizontal portion 12a is arranged in such a manner as to come into contact with the door stopper side of an upper part of the door panel 6. A long hole 12c is formed in the horizontal portion 12a. The long hole 12c is formed, with the longitudinal direction thereof being in a horizontal direction. The vertical portion 12b is formed in such a manner as to extend upward from the door stopper side of the horizontal portion 12a. An upper end of the vertical portion 12b is arranged in such a manner as to be above the first optical axis 16a and below the second optical axis 16b.

[0028] The second intercepting plate 13 is integrally formed in the shape of a hook. Specifically, the second intercepting plate 13 is provided with a horizontal portion 13a and a vertical portion (a first intercepting portion) 13b. The horizontal portion 13a is arranged in such a manner as to come into contact with the door pocket side of an upper part of the door panel 6. A long hole 13c is formed in the horizontal portion 13a. The long hole 13c is formed, with the longitudinal direction thereof being in a horizontal direction. The vertical portion 13b is formed in such a manner as to extend upward from the door pocket side of the horizontal portion 13a. An upper end of the vertical portion 13b is arranged in such a manner as to be above the first optical axis 16a and below the

second optical axis 16b.

[0029] In this embodiment, a protrusion portion (a second intercepting portion) 13d is formed in such a manner as to protrude in a vertical direction from the upper end of the vertical portion 13b to the middle side of the door panel 6. That is, the protrusion portion 13d is formed to be wider in the opening and closing direction of the door panel 6 than in the vertical portion 13b. A lower edge part of the protrusion portion 13d is arranged above the first optical axis 16a and below the second optical axis 16b. An upper edge part of the protrusion portion 13d is arranged above the second optical axis 16b and below a lower surface of the connecting portion 11c of the position switch 11.

[0030] A pair of bolts 17 pierces through each of the long hole 12c of the first intercepting plate 12 and the long hole 13c of the second intercepting plate 13 from the external side of the car. These bolts 17 are screwed into an upper part of the door panel 6. The first intercepting plate 12 and the second intercepting plate 13 are fixed by these bolts 17 to the upper part of the door panel 6. By loosening these bolts 17, the positions of the first intercepting plate 12 and the second intercepting plate 13 can be adjusted in the opening and closing direction of the door panel 6.

[0031] Next, with the aid of Figure 4 a description will be given of a method of discriminating a fully open condition of the door panel 6.

Figure 4 is a front view to explain the positional relationship between the position switch and the intercepting plates obtained when the door operator of an elevator in Embodiment 1 of the present invention is fully open.

[0032] As shown in Figure 4, when the door panel 6 is fully open, the first intercepting plate 12 is arranged on the internal side of the position switch 11. The upper end of the vertical portion 12b of the first intercepting plate 12 is arranged above the first optical axis 16a and below the second optical axis 16b. For this reason, the first intercepting plate 12 intercepts only the first optical axis 16a. In this case, only the lower side photoreceiver 15a ceases to receive light. In this condition, the door control device determines that the door panel 6 is fully open.

[0033] Next, with the aid of Figure 5 a description will be given of a method of discriminating a fully closed condition of the door panel 6.

Figure 5 is a front view to explain the positional relationship between the position switch and the intercepting plates obtained when the door operator of an elevator in Embodiment 1 of the present invention is fully closed.

[0034] As shown in Figure 5, when the door panel 6 is fully closed, the second intercepting plate 13 is arranged on the internal side of the position switch 11. At this time, the upper end of the vertical portion 13b of the second intercepting plate 13 is arranged above the first optical axis 16a and below the second optical axis 16b. For this reason, the vertical portion 13b of the second intercepting plate 13 intercepts the first optical axis 16a.

[0035] In contrast to this, the lower edge part of the

protrusion portion 13d of the second intercepting plate 13 is arranged above the first optical axis 16a and below the second optical axis 16b. The upper edge part of the protrusion portion 13d of the second intercepting plate 13 is above the second optical axis 16b and below the lower surface of the connecting portion 11c of the position switch 11. For this reason, the protrusion portion 13d of the second intercepting plate 13 intercepts the second optical axis 16b.

[0036] Therefore, immediately before the full closing of the door panel 6, the protrusion portion 13d of the second intercepting plate 13 intercepts the second optical axis 16b. On the other hand, the vertical portion 13b of the second intercepting plate 13 does not intercept the first optical axis 16a. After that, when the door panel 6 becomes fully closed, the protrusion portion 13d of the second intercepting plate 13 maintains the condition of intercepting the second optical axis 16b. On the other hand, the vertical portion 13b of the second intercepting plate 13 intercepts the first optical axis 16a. In this case, both the lower side photoreceiver 15a and the upper side photoreceiver 15b cease to receive light. In this condition, the door control device determines that the door panel 6 is fully closed.

[0037] According to Embodiment 1 described above, the light receiving condition of the position switch 11 differs from the condition in which the door panel 6 is fully open to the condition in which the door panel 6 is fully closed. For this reason, with one position switch 11, it is possible to discriminate between a fully open condition and a fully closed condition of the door of an elevator. That is, with an inexpensive system, it is possible to discriminate between a fully open condition and a fully closed condition of the door of an elevator.

[0038] Besides, the protrusion portion 13d of the second intercepting plate 13 is formed to be wider than the vertical portion 13b in the opening and closing direction of the door panel 6. For this reason, even when the second intercepting plate 13 is attached somewhat aslant, the protrusion portion 13d always intercepts the second optical axis 16b while the vertical portion 13b is intercepting the first optical axis 16a. Therefore, it is possible to obtain a high-reliability system which prevents a wrong determination on the position of the door panel 6.

[0039] Furthermore, the protrusion portion 13d of the second intercepting plate 13 protrudes to the middle side of the door panel 6. For this reason, it is possible to minimize the distance between the outer sides of the first intercepting plate 12 and the second intercepting plate 13. As a result of this, even if the configuration is such that the second intercepting plate 13 protrudes from the door pocket side of the door operator when the door panel 6 is fully open, it is possible to minimize the protruding amount. That is, it is possible to minimize the effect of the second intercepting plate 13 on the necessary front size of the shaft.

[0040] And the photoreceivers 15a and 15b are arranged, with the light receiving surfaces thereof facing

the car side. That is, the light receiving surfaces of the photoreceivers 15a and 15b face the side opposite to the hall. For this reason, disturbance light such as sunlight is prevented from directly entering the photoreceivers 15a and 15b. As a result of this, it is possible to prevent a wrong determination on the position of the door panel 6.

[0041] The position of the first intercepting plate 12 and the position of the second intercepting plate 13 may be reversed. In this case, when the door panel 6 is fully open, the second intercepting plate 13 intercepts the first optical axis 16a and the second optical axis 16b. On the other hand, when the door panel 6 is fully closed, the first intercepting plate 12 intercepts only the first optical axis 16a. Even in the case of this arrangement of the first intercepting plate 12 and the second intercepting plate 13, it is possible to obtain the same effect as in Embodiment 1.

[0042] The position switch 11 may be a phototransmitter/photoreceiver device in which the reflection of light is used. In this case, the phototransmitter and the photoreceiver are arranged on the same side with respect to the intercepting plate. And light emitted by the phototransmitter is reflected on the intercepting plate and received by the photoreceiver. If the door control device determines the position of the panel door 6 according to the light receiving condition of this photoreceiver, the same effect as in Embodiment 1 can be obtained.

Embodiment 2

[0043] Figure 6 is a perspective view of a position switch used in the door operator of an elevator in Embodiment 2 of the present invention. Figure 7 is a cross-sectional view of the position switch used in the door operator of an elevator in Embodiment 2 of the present invention. Incidentally, like numerals refer to like or corresponding parts as in Embodiment 1 and description of these parts are omitted.

[0044] As shown in Figures 6 and 7, in the position switch 11 of Embodiment 2, a first holding portion 11a is formed to be wider than a second holding portion 11b in the opening and closing direction of the door panel 6. At least the first holding portion 11a is formed with the property of suppressing the reflection of disturbance light 18. For example, the surface of the first holding portion 11a is colored black. A concave portion is formed on an inner side surface of the second holding portion 11b. Photoreceivers 15a and 15b are attached to a bottom surface of the concave portion. As a result of this, the photoreceivers 15a and 15b are arranged in a manner recessed from the inner side surface of the second holding portion 11b.

[0045] According to Embodiment 2 described above, the photoreceivers 15a and 15b are arranged in a manner recessed from the inner side surface of the second holding portion 11b. For this reason, it is possible to suppress disturbance light 18 such as sunlight from directly entering the photoreceivers 15a and 15b. Consequently, it is possible to prevent a wrong determination on the ar-

rangement of the door panel 6 due to the disturbance light 18.

[0046] The first holding portion 11a of the position switch 11 is formed to be wider than the second holding portion 11b in the opening and closing direction of the door panel 6. For this reason, it is possible to intercept the disturbance light 18 reflected from the support beam 1 and the like entering the photoreceivers 15a and 15b by means of the side edge part of the first holding portion 11a. Furthermore, at least the first holding portion 11a is formed with the property of suppressing the reflection of disturbance light 18. That is, the reflection of disturbance light 18 in the first holding portion 11a is suppressed. Consequently, it is possible to prevent a wrong determination on the position of the door panel 6.

Embodiment 3

[0047] Figure 8 is a perspective view of a position switch used in the door operator of an elevator in Embodiment 3 of the present invention. Incidentally, like numerals refer to like or corresponding parts as in Embodiment 1 and description of these parts are omitted.

[0048] In Embodiment 3, an indication device 19 is provided on a surface, facing to the outside of the car, of a second holding portion 11b of a position switch 11. The indication device 19 indicates the light receiving condition of a lower side photoreceiver 15a. For example, the indication device 19 lights up or blinks when the first optical axis 16a is intercepted.

[0049] According to Embodiment 3 described above, the indication device 19 indicates the light receiving condition of the lower side photoreceiver 15a. For this reason, when the door panel 6 is fully open, it is possible to easily carry out the position adjustment of the position switch 11 and the first intercepting plate 12. Furthermore, when the door panel 6 is fully closed, it is possible to easily carry out the position adjustment of the position switch 11 and the second intercepting plate 13.

[0050] During the position adjustment of the position switch 11, the first intercepting plate 12, and the second intercepting plate 13, the operator can make a judgment easily as to whether the door panel 6 is fully open or fully closed. For this reason, it is unnecessary to indicate a fully open condition and a fully closed condition of the door panel 6 in a discriminated manner. That is, it is possible to reduce the number of the indication states and the number of the indication devices 19 compared to the case where the light receiving condition of the lower side photoreceiver 15a and the upper side photoreceiver 15b are indicated in a discriminated manner. Consequently, it is possible to adjust the positions of the position switch 11, the first intercepting plate 12, and the second intercepting plate 13 using an inexpensive indication device 19.

Industrial Applicability

[0051] As described above, the door operator of an elevator of the present invention can be used in an elevator which discriminates between a fully open condition and a fully closed condition of the door.

Description of symbols

- [0052]**
- 1 support beam
 - 2 rail
 - 3 strap metal
 - 4 door hanger
 - 5 stopper
 - 6 door panel
 - 7 motor
 - 8 pulley
 - 9 toothed belt
 - 10 belt gripper
 - 11 position switch
 - 11a first holding portion
 - 11b second holding portion
 - 11c connecting portion
 - 12 first intercepting plate
 - 12a horizontal portion
 - 12b vertical portion
 - 12c long hole
 - 13 second intercepting plate
 - 13a horizontal portion
 - 13b vertical portion
 - 13c long hole
 - 13d protrusion portion
 - 14a, 14b phototransmitter
 - 15a, 15b photoreceiver
 - 16a first optical axis
 - 16b second optical axis
 - 17 bolt
 - 18 disturbance light
 - 19 indication device

Claims

1. A door operator of an elevator, comprising:

a position switch which is provided in the vicinity of a door of the elevator and in which two sets of phototransmitter / photoreceiver devices, each having a phototransmitter and a photoreceiver, are arranged side by side in a vertical direction;

a first intercepting body provided on the door in such a manner as to intercept or reflect light from a lower side phototransmitter to a lower side photoreceiver when the door has come to one of a fully closed condition and a fully open con-

dition; and

a second intercepting body provided on the door in such a manner as to simultaneously intercept or reflect light from the lower side phototransmitter to the lower side photoreceiver and light from an upper side phototransmitter to an upper side photoreceiver when the door has come to the other of the fully closed condition and the fully open condition;

wherein the second intercepting body has:

a first intercepting portion which is formed in such a manner as to intercept or reflect light from the lower side phototransmitter to the lower side photoreceiver when the door has come to the other of the fully closed condition and the fully open condition; and a second intercepting portion which is formed to be wider than the first intercepting portion in an opening and closing direction of the door in such a manner as to intercept or reflect light from the upper side phototransmitter to the upper side photoreceiver while the first intercepting portion is intercepting or reflecting light from the lower side phototransmitter to the lower side photoreceiver.

2. The door operator of an elevator, wherein the position switch is arranged above the door, wherein the first intercepting body is provided in an upper part of the door on one of a door stopper side and a door pocket side, wherein the second intercepting body is provided in an upper part of the door on the other of the door stopper side or the door pocket side, and wherein the second intercepting portion is formed in such a manner as to protrude from an upper part of the first intercepting portion to the middle side of the door.

3. The door operator of an elevator according to claim 1 or 2, wherein a light receiving surface of each photoreceiver faces to the car side of the elevator.

4. The door operator of an elevator according to any of claims 1 to 3, wherein each photoreceiver is arranged in a concave portion of the position switch and is arranged in such a manner as to be recessed from the surface of the position switch.

5. The door operator of an elevator according to any of claims 1 to 4, wherein the position switch comprises:

a first holding portion which holds the phototransmitters which emits light toward an external side of the car of the elevator; and a second holding portion which holds the pho-

toreceivers light receiving surfaces of which face to the car side,

wherein the first holding portion has property of suppressing the reflection of disturbance light and is formed to be wider than the second holding portion in the opening and closing direction of the door.

6. The door operator of an elevator according to any of claims 1 to 5, further comprising:

an indication device which is provided on the surface of the position switch and indicates the light receiving condition of the lower side photoreceiver.

FIG. 1

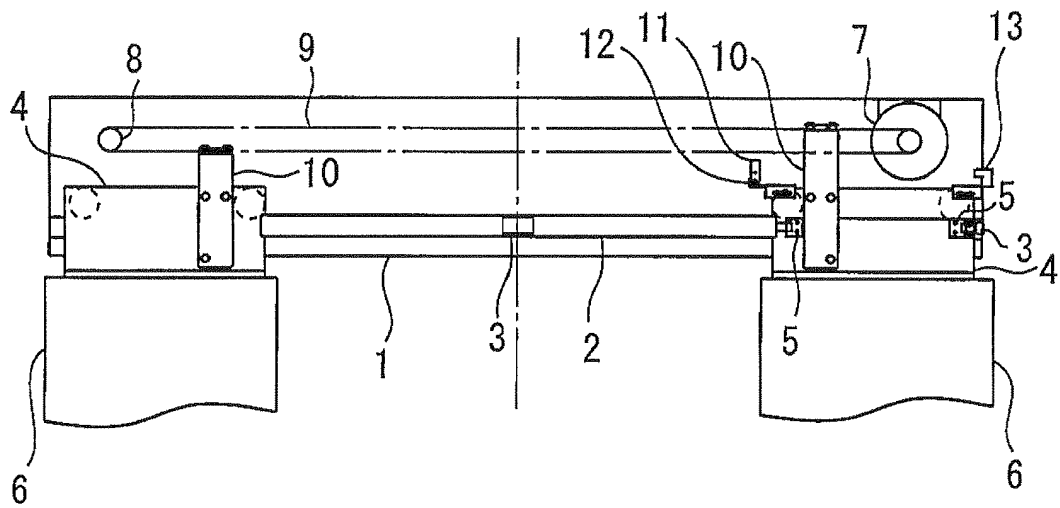


FIG. 2

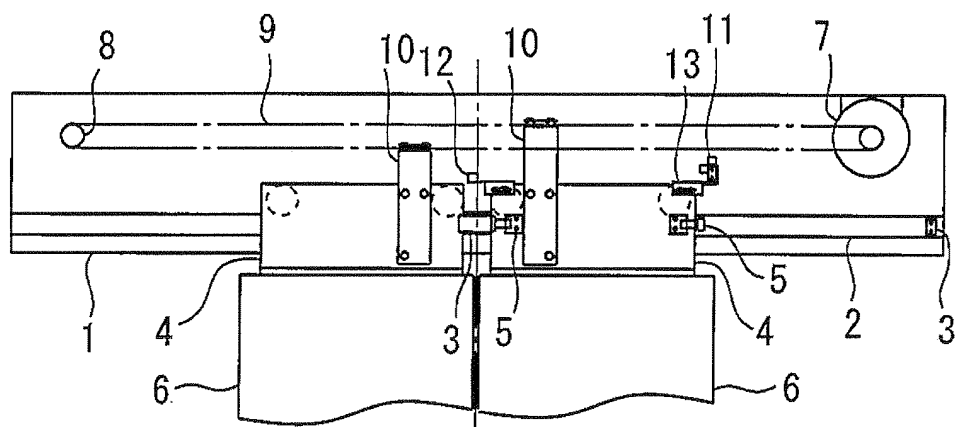


FIG. 3

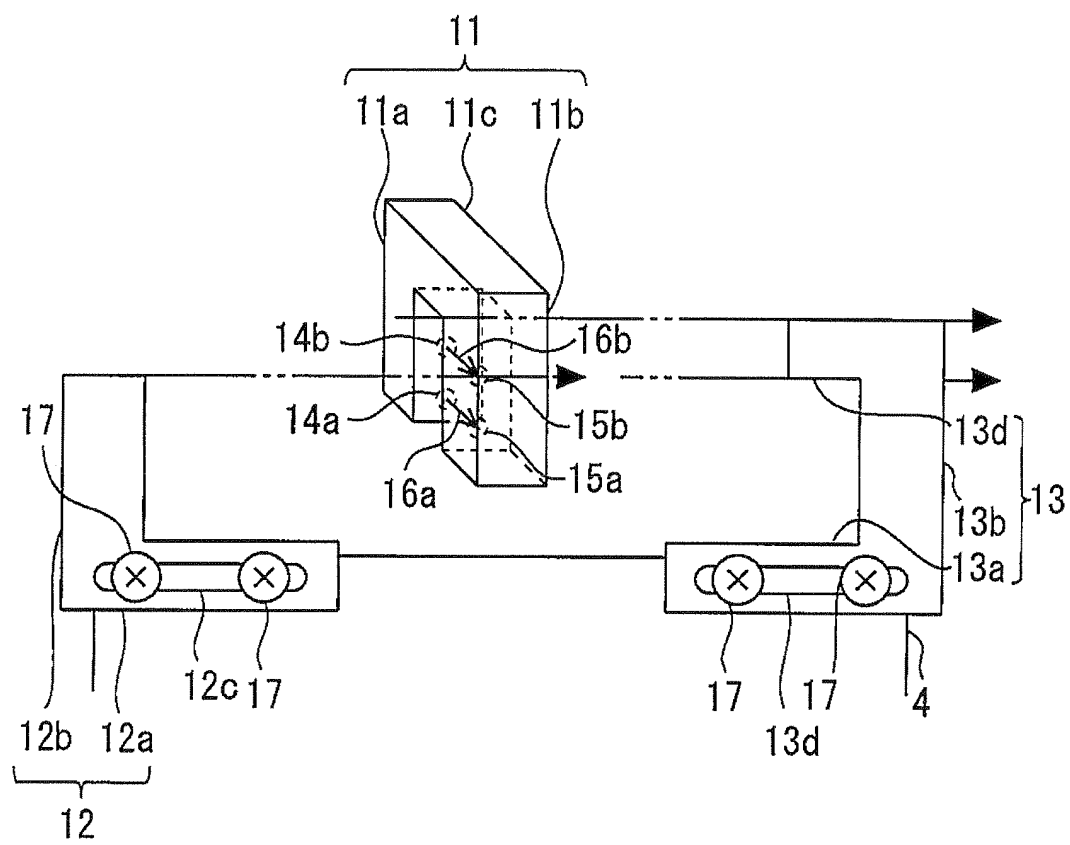


FIG. 4

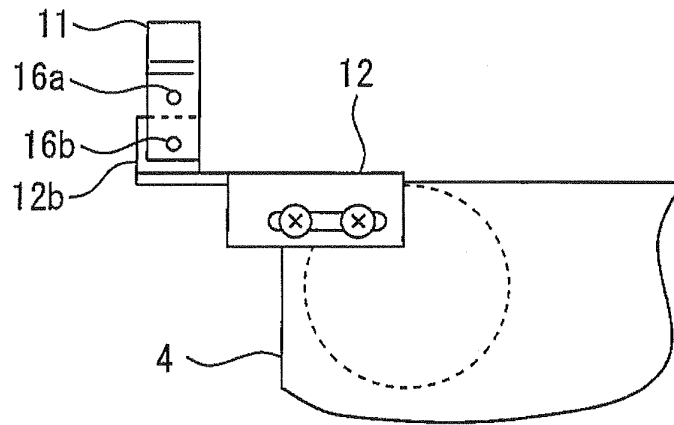


FIG. 5

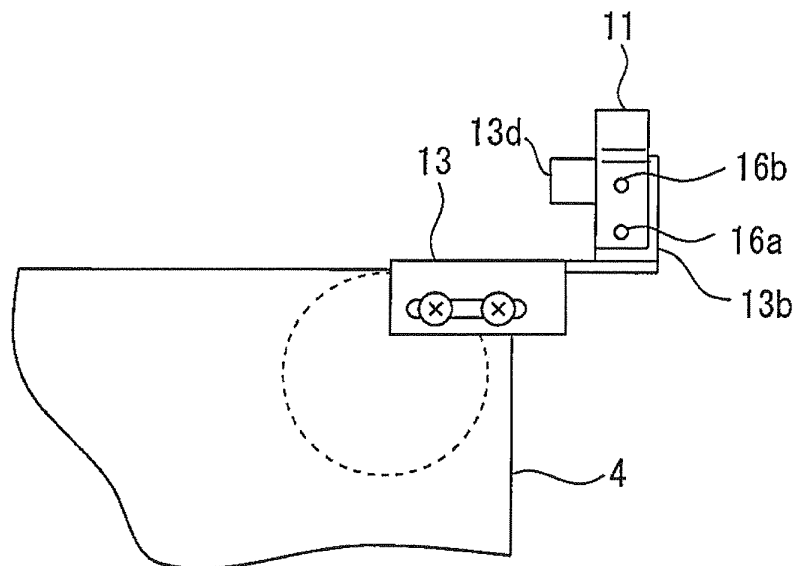


FIG. 6

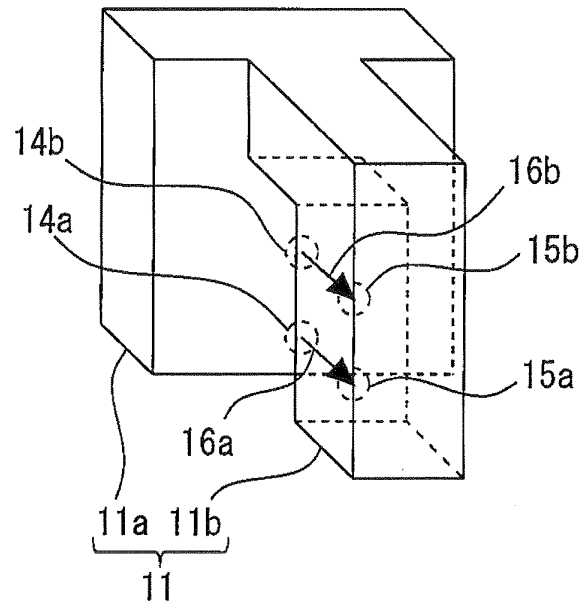


FIG. 7

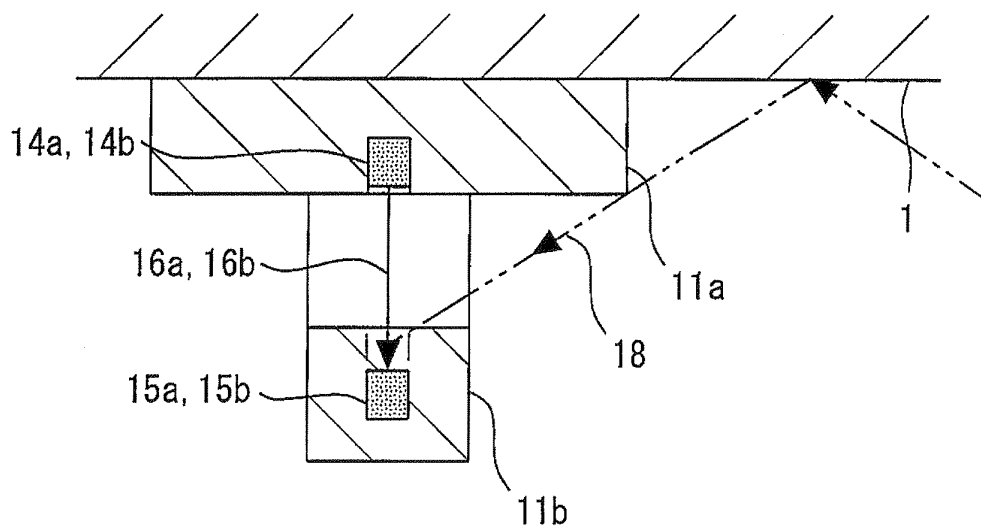
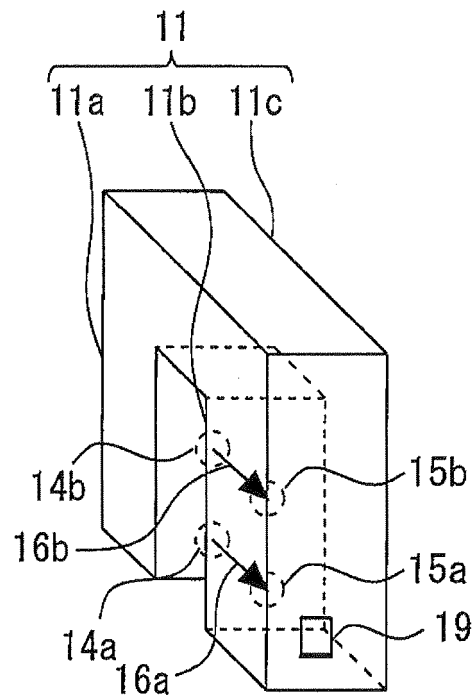


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/072538

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	1996-2011
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 2010-137956 A (Toshiba Elevator and Building Systems Corp.), 24 June 2010 (24.06.2010), paragraphs [0009] to [0010], [0025] to [0035]; fig. 3 to 5 (Family: none)	1-6
A	JP 3-186596 A (Mitsubishi Electric Corp.), 14 August 1991 (14.08.1991), page 1, lower left column, line 20 to page 2, upper left column, line 2; fig. 4 & US 5170865 A & KR 10-1993-0009960 B1 & CN 1052461 A	1-6

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
17 March, 2011 (17.03.11)Date of mailing of the international search report
29 March, 2011 (29.03.11)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/072538

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 2001-294376 A (Hitachi Building Systems Co., Ltd.), 23 October 2001 (23.10.2001), paragraph [0006]; fig. 5 (Family: none)	3
A	JP 2008-24395 A (Hitachi, Ltd., Hitachi Mito Engineering Co., Ltd.), 07 February 2008 (07.02.2008), paragraphs [0015] to [0022]; fig. 1 & CN 101108708 A	4

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

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/072538

Although the invention in claim 2 is set forth as an independent form, it is not considered that all features essential for defining the invention in claim 2 are clearly set forth (the invention in claim 2 may be deemed to be an invention dependent on the invention in claim 1).

Consequently, this search has been carried out on assumption that the invention in claim 2 is deemed to be an invention dependent on the invention in claim 1.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 60218282 A [0008]