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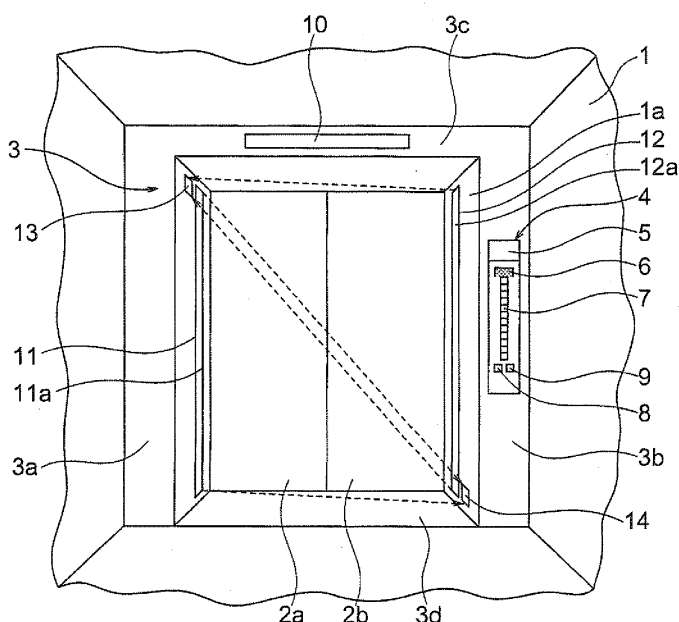
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(54) **SLIDE DOOR DEVICE AND ELEVATOR**

(57) In a slide door device in which a first light emitter and first imaging means are provided on a first side of a doorway and a second light emitter and second imaging means are provided on a second side. The first light emitter includes a first light-emitting surface. The second light emitter includes a second light-emitting surface opposing

the first light-emitting surface. A controller controls the first and second light emitters and the first and second imaging means to detect an obstacle in vicinity of the doorway, and controls opening and closing of a door according to presence and absence of an obstacle. Further, the controller turns ON the first light emitter and the second light emitter at timings shifted from each other.

FIG. 1



Description

Technical Field

[0001] The present invention relates to a sliding door device for automatically moving a door in a horizontal direction and to an elevator using the same.

Background Art

[0002] A conventional sliding door device includes a pair of light emitters, each having an elongated and continuous light-emitting surface, and a pair of cameras, each being for imaging the light-emitting surface of the light emitter opposed thereto, in which sets of the light emitters and the cameras are respectively provided to right and left vertical frames of a doorway. In this manner, the entire doorway is covered as a monitored area (for example, see Patent Document 1).

[0003]

Patent Document 1: JP 2004-338846 A

Disclosure of the Invention

Problem to Be Solved by the Invention

[0004] In the conventional sliding door device as described above, both the light emitters simultaneously emit light beams. Therefore, the light beam reflected by an obstacle is incident on one of the cameras, making it difficult to detect that the light beam emitted from the light emitter opposed thereto is blocked by the obstacle. As a result, there is a fear of lowering detection accuracy.

[0005] The present invention has been made to solve the problem described above, and it is an object of the present invention to provide a sliding door device capable of more reliably detecting an obstacle while covering a wide area to be monitored and an elevator using the same.

Means for Solving the Problem

[0006] According to the present invention, there is provided a sliding door device including: a door being horizontally moved to open and close a doorway; a first light emitter which is provided on a first side of the doorway and includes a first light-emitting surface; a second light emitter which is provided on a second side of the doorway and includes a second light-emitting surface opposing the first light-emitting surface; first imaging means provided on the first side of the doorway; second imaging means provided on the second side of the doorway; and a controller for controlling the first light emitter, the second light emitter, the first imaging means, and the second imaging means to detect an obstacle in vicinity of the doorway and for controlling opening and closure of the door according to presence and absence of the obstacle,

in which the controller turns ON the first light emitter and the second light emitter at timings shifted from each other. Further, according to the present invention, there is provided a sliding door device including: a door being horizontally moved to open and close a doorway; a first light emitter which is provided on a first side of the doorway and includes a first light-emitting surface; a second light emitter which is provided on a second side of the doorway and includes a second light-emitting surface opposing the first light-emitting surface; first imaging means which is provided on the first side of the doorway, for imaging the second light-emitting surface; second imaging means which is provided on the second side of the doorway, for imaging the first light-emitting surface; and a controller for controlling the first light emitter, the second light emitter, the first imaging means, and the second imaging means to detect an obstacle in vicinity of the doorway and for controlling opening and closure of the door according to presence and absence of the obstacle, in which: the first light emitter and the second light emitter emit light beams having wavelengths different from each other; and each of the first imaging means and the second imaging means images the light beam having a corresponding one of the wavelengths.

Further, according to the present invention, there is provided an elevator including: a car raised and lowered in a hoistway; an elevator door being horizontally moved to open and close a doorway provided between the car and a landing; a first light emitter which is provided on a first side of the doorway and includes a first light-emitting surface; a second light emitter which is provided on the second side of the doorway and includes a second light-emitting surface opposing the first light-emitting surface; first imaging means provided on the first side of the doorway; second imaging means provided on the second side of the doorway; and a controller for controlling the first light emitter, the second light emitter, the first imaging means, and the second imaging means to detect an obstacle in vicinity of the doorway and for controlling opening and closure of the elevator door according to presence and absence of the obstacle, in which the controller turns ON the first light emitter and the second light emitter at timings shifted from each other.

Further, according to the present invention, there is provided an elevator including: a car raised and lowered in a hoistway; an elevator door being horizontally moved to open and close a doorway provided between the car and a landing; a first light emitter which is provided on a first side of the doorway and includes a first light-emitting surface; a second light emitter which is provided on a second side of the doorway and includes a second light-emitting surface opposing the first light-emitting surface; first imaging means provided on the first side of the doorway; second imaging means provided on the second side of the doorway; and a controller for controlling the first light emitter, the second light emitter, the first imaging means, and the second imaging means to detect an obstacle in vicinity of the doorway and for controlling opening and

closure of the elevator door according to presence and absence of the obstacle, in which: the first light emitter and the second light emitter emit light beams having wavelengths different from each other; and each of the first imaging and the second imaging means images the light beam having a corresponding one of the wavelengths.

Brief Description of the Drawings

[0007]

FIG. 1 is a front view illustrating a car door device for an elevator according to a first embodiment of the present invention, as viewed from the interior of a car.

FIG. 2 is a schematic block diagram illustrating a control circuit of the car door device illustrated in FIG. 1.

FIG. 3 is an explanatory view illustrating turn-ON timing of a first light emitter, that of a second light emitter, imaging timing of a first camera, and that of a second camera by a main control section illustrated in FIG. 2. FIG. 4 is an explanatory view illustrating a differential image obtained by an image processing determination section illustrated in FIG. 2 when no obstacle is present in an area to be monitored.

FIG. 5 is an explanatory view illustrating a first example of a differential image obtained by the image processing determination section illustrated in FIG. 2 when an obstacle is present in the area to be monitored.

FIG. 6 is an explanatory view illustrating a second example of a differential image obtained by the image processing determination section illustrated in FIG. 2 when an obstacle is present in the area to be monitored.

FIG. 7 is a flowchart showing an operation of the main control section illustrated in FIG. 2 at the time of opening of the doors.

FIG. 8 is a flowchart showing an operation of the main control section illustrated in FIG. 2 at the time of closing of the doors.

FIG. 9 is an explanatory view illustrating the turn-ON timing of the first light emitter, that of the second light emitter, the imaging timing of the first camera, and that of the second camera according to a second embodiment of the present invention.

FIG. 10 is a front view of a landing door device for the elevator according to a third embodiment of the present invention as viewed from a landing.

FIG. 11 is a rear view illustrating the car door device for the elevator according to a fourth embodiment of the present invention, as viewed from a landing side.

FIG. 12 is a plan view illustrating the car door device and the landing door device for the elevator, which are illustrated in FIG. 11.

Best Mode for Carrying Out the Invention

[0008] Hereinafter, preferred embodiments of the present invention are described referring to the drawings.

First Embodiment

[0009] FIG. 1 is a front view illustrating a car door device (sliding door device) for an elevator according to a first embodiment of the present invention, as viewed from the interior of a car. In the drawing, a car 1, which is raised and lowered in a hoistway, is provided with a car doorway 1a. The car doorway 1a is opened and closed by a first car door 2a and a second car door 2b corresponding to elevator doors which are horizontally moved. Around the car doorway 1a, a car doorway frame 3 is provided.

[0010] The car doorway frame 3 includes: a first vertical frame 3a and a second vertical frame 3b, which are respectively provided on the left and the right of the car doorway 1a; an upper horizontal frame 3c provided between an upper end portion of the first vertical frame 3a and an upper end portion of the second vertical frame 3b; and a lower horizontal frame 3d provided to a floor portion of the car doorway 1a.

[0011] A car operating panel 4 is provided on a front surface of the second vertical frame 3b. On the car operating panel 4, there are provided a display device 5, a warning device 6, a plurality of floor buttons 7, a door-open button 8, and a door-close button 9. On a front surface of the upper horizontal frame 3c, an indicator lamp 10 is provided.

[0012] A first light emitter 11 is provided on a side surface of the first vertical frame 3a, which opposes the second vertical frame 3b. The first light emitter 11 has a first light-emitting surface 11a which is vertically elongated and continuous. A second light emitter 12 is provided on a side surface of the second vertical frame 3b, which opposes the first vertical frame 3a. The second light emitter 12 has a second light-emitting surface 12a which is vertically elongated and continuous. The first light-emitting surface 11a and the second light-emitting surface 12a are provided over almost the entire height of the car doorway 1a and oppose each other with the car doorway 1a interposed therebetween.

[0013] A first camera 13 serving as first imaging means for imaging the second light-emitting surface 12a is provided in an upper end portion of the side surface of the first vertical frame 3a, the side surface opposing the second vertical frame 3b. The first camera 13 is provided so as to be adjacent to an upper end portion of the first light-emitting surface 11a. A second camera 14 serving as second imaging means for imaging the first light-emitting surface 11a is provided in a lower end portion of the side surface of the second vertical frame 3b, the side surface opposing the first vertical frame 3a. The second camera 14 is provided so as to be adjacent to a lower end portion of the second light-emitting surface 12a.

[0014] FIG. 2 is a schematic block diagram illustrating

a control circuit of the car door device illustrated in FIG. 1. In the drawing, an operation of opening and closing the car doors 2a and 2b is controlled by an opening/closing control section 15. The opening/closing control section 15 is provided on the car 1.

[0015] Signals from the first camera 13 and the second camera 14 are transmitted to an image processing determination section 16. The image processing determination section 16 determines, based on the signals from the first camera 13 and the second camera 14, whether or not the light beams emitted from the first light emitter 11 and the second light emitter 12 are blocked by an obstacle at the time of opening/closure of the first car door 2a and the second car door 2b.

[0016] The first light emitter 11, the second light emitter 12, the first camera 13, the second camera 14, the opening/closing control section 15, and the image processing determination section 16 are controlled by a main control section 17. The main control section 17 controls the first light emitter 11 and the second light emitter 12 to emit the light beams so as to monitor whether or not the obstacle is present in the vicinity of the car doorway 1a at the time of opening/closure of the car doors 2a and 2b. The main control section 17 also transmits a command of opening or closing the car doors 2a and 2b to the opening/closing control section 15 according to the presence or absence of the obstacle.

[0017] Each of the opening/closing control section 15, the image processing determination section 16, and the main control section 17 consists of a microcomputer. At least two of the opening/closing control section 15, the image processing determination section 16, and the main control section 17 may consist of the same computer. A controller includes the opening/closing control section 15, the image processing determination section 16, and the main control section 17.

[0018] Next, a specific method of detecting the obstacle is described. FIG. 3 is an explanatory view illustrating turn-ON timing of the first light emitter 11, that of the second light emitter 12, imaging timing of the first camera 13, and that of the second camera 14 by the main control section 17 illustrated in FIG. 2. The main control section 17 performs turn-ON and imaging in the order of Steps 1, 2, and 3. When the obstacle is to be monitored continuously. Steps 1 to 3 are repeatedly carried out in a predetermined cycle (for example, 30 msec).

[0019] First, in Step 1, the first light emitter 11 is turned ON. The first light-emitting surface 11a is imaged by the second camera 14. Then, acquired data, specifically, a first ON-time image is transmitted to the image processing determination section 16. At this time, the second light emitter 12 is left in an OFF state.

[0020] Next, in Step 2, the second light emitter 12 is turned ON. The second light-emitting surface 12a is imaged by the first camera 13. Then, acquired data, specifically, a second ON-time image is transmitted to the image processing determination section 16. At this time, the first light emitter 11 is left in an OFF state.

[0021] Thereafter, in Step 3, both the first light emitter 11 and the second light emitter 12 are turned OFF. Then, the first light-emitting surface 11a and the second light-emitting surface 12a are respectively imaged by the second camera 14 and the first camera 13. Then, acquired data, specifically, a first OFF-time image and a second OFF-time image are transmitted to the image processing determination section 16.

[0022] The image processing determination section 16 obtains a differential image between the first ON-time image and the first OFF-time image and a differential image between the second ON-time image and the second OFF-time image. After the differential processing described above, an image of the first light-emitting surface 11a and an image of the second light-emitting surface 12a remain as the differential images. Therefore, when no obstacle is present in two triangular areas to be monitored, that is, one having the camera 14 as a top and the light-emitting surface 11a as a base and the other having the camera 13 as a top and the light-emitting surface 12a as a base, one linear continuous light-emitting surface image as illustrated in FIG. 4 remains as each of the differential images.

[0023] On the other hand, when there is an obstacle in the areas to be monitored, a light-emitting surface as illustrated in FIG. 5 or 6 remains as the differential image because the light beam emitted from the light emitter 11 or 12 is partially blocked. Specifically, in the case of the differential image illustrated in FIG. 5, the light-emitting surface image is divided into a plurality of discontinuous images. In the case of the differential image illustrated in FIG. 6, a length of the light-emitting surface image is shorter than a normal length. When detecting that the light-emitting surface image has become discontinuous or shorter or has disappeared, the image processing determination section 16 determines the presence of the obstacle and transmits a signal indicating the presence of the obstacle to the main control section 17.

[0024] Next, FIG. 7 is a flowchart showing an operation of the main control section 17 illustrated in FIG. 2 at the time of opening of the doors. The main control section 17 starts the operation of detecting the obstacle as described above a predetermined time before (for example, several seconds before) the start of the actual door-opening operation of the car doors 2a and 2b (Step S1) so as to determine whether or not the obstacle is present (Step S2). If no obstacle is detected at this time, a normal door-opening is started (Step S3).

[0025] On the other hand, if any obstacle is detected, a warning is issued by the warning device 6 so that a passenger inside the car 1 steps away from the car doors 2a and 2b. Specifically, a prestored voice, for example, an announcement such as "Doors will open. Please step away from the doors" is made by the warning device 6. Thereafter, whether or not the obstacle is present is determined again (Step S5). If the obstacle is not present any longer, the normal door-opening is started (Step S3).

[0026] When the normal door-opening is started, the

first light emitter 11 and the second light emitter 12 are turned OFF to stop the operation of detecting the obstacle (Step S6). Then, the normal door-opening operation is continued until the doors are fully opened (Step S7).

[0027] On the other hand, if the obstacle is detected again even after the issuance of the warning, a warning such as "Doors will open" is issued again by the warning device 6 (Step S8). Then, the door-opening operation at a speed lower than normal is started (Step S9).

[0028] When the normal door-opening is started, the first light emitter 11 and the second light emitter 12 are turned OFF to stop the operation of detecting the obstacle (Step S10). Then, the lower door-opening operation is continued until the doors are fully opened (Step S11).

[0029] Next, FIG. 8 is a flowchart showing an operation of the main control section 17 illustrated in FIG. 2 at the time of closure of the doors. The main control section 17 starts the operation of detecting the obstacle as described above a predetermined time before (for example, one second before) the start of the actual door-opening operation of the car doors 2a and 2b (Step S12) so as to determine whether or not the obstacle is present (Step S13). If no obstacle is detected, a door-closing is started (Step S14). If the obstacle is detected, a standby state is maintained until the obstacle is not present any longer. When the obstacle is not present any longer, the door-closing is started.

[0030] During the door-closing operation, the determination for the presence of the obstacle is continued (Step S15). If the obstacle is not detected, the door-closing operation is continued (Step S16). Then, it is confirmed whether or not each of the car doors 2a and 2b has reached a fully-closed position (Step S17). Specifically, during the door-closing operation, whether or not the obstacle is present is repeatedly determined until the doors are brought into a fully-closed state.

[0031] If the obstacle is detected during the door-closing operation, the movement of the doors is reversed so that the car doors 2a and 2b are opened (Step S18). Then, the processing returns to the first operation. During the reverse movement for opening the doors, the first light emitter 11 and the second light emitter 12 are turned OFF to stop the operation of detecting the obstacle. If the fully-closed state of the doors is achieved while the obstacle remains undetectable, the first light emitter 11 and the second light emitter 12 are turned OFF to stop the operation of detecting the obstacle (Step S19). Then, the operation shown in FIG. 8 is terminated.

[0032] In the car door device as described above, the turn-ON timing of the first light emitter 11 and that of the second light emitter 12 are shifted from each other. As a result, the wide area to be monitored is covered through arranging the first light emitter 11 and the first camera 13, and the second light emitter 12, and the second camera 14 respectively on the two sides of the car doorway 1a. At the same time, while one of the first light emitter 11 and the second light emitter 12 is in an ON state, the effects of the light beam emitted from the other are elim-

inated so as to more reliably detect the obstacle.

[0033] Moreover, when the first light emitter 11 is turned ON, the first light-emitting surface 11a is imaged by the second camera 14 while the second light emitter 12 is brought into the OFF state. When the second light emitter 12 is turned ON, the second light-emitting surface 12a is imaged by the first camera 13 while the first light emitter 11 is brought into the OFF state. Therefore, the effects of the light beam reflected by the obstacle are eliminated to more reliably detect the obstacle.

[0034] Further, the first light emitter 11 and the second light emitter respectively have the first light-emitting surface 11a and the second light-emitting surface 12a, each being vertically elongated and continuous. Thus, the obstacle can be detected completely over a wide range.

[0035] Further, if the obstacle is detected before the start of the door-opening, the warning is issued or the doors are opened at a lower speed. Therefore, the clothes or luggage of a passenger can be more reliably prevented from getting stuck between the car doors 2a and 2b and the vertical frames 3a and 3b during the door-opening.

Moreover, if the obstacle is detected during the door-closing, the doors are brought into a standby state while being fully opened or the movement of the doors is reversed so that the doors are opened. Therefore, the passenger or luggage can be more reliably prevented from being caught between the car doors 2a and 2b.

30 Second Embodiment

[0036] Next, FIG. 9 is an explanatory view illustrating the turn-ON timing of the first light emitter, that of the second light emitter, the imaging timing of the first camera, and that of the second camera according to a second embodiment of the present invention. In the second embodiment, Steps 2 and 3 in the first embodiment (FIG. 3) are interchanged. The remaining configuration and controlling method are the same as those of the first embodiment.

[0037] As described above, even if the first and second OFF-time images are acquired before the acquisition of the second ON-time image, the effects of the light beam reflected by the obstacle can be eliminated to more reliably detect the obstacle as in the case of the first embodiment.

Third Embodiment

[0038] Next, FIG. 10 is a front view of a landing door device (sliding door device) for the elevator according to a third embodiment of the present invention as viewed from a landing. In the drawing, a landing doorway 21 is provided to the landing. The landing doorway 21 is opened and closed by a first landing door 22a and a second landing door 22b corresponding to elevator doors which are horizontally moved in conjunction with the car doors 2a and 2b. Around the landing doorway 21, a land-

ing doorway frame 23 is provided.

[0039] The landing doorway frame 23 includes: a first vertical frame 23a and a second vertical frame 23b which are respectively provided on the right and left of the landing doorway 21; an upper horizontal frame 23c provided between an upper end portion of the first vertical frame 23a and an upper end portion of the second vertical frame 23b; and a lower horizontal frame 23d provided to a floor portion of the landing doorway 21.

[0040] On a front surface of the first vertical frame 23a, a display device 24, a warning device 25, an up-call button 26, and a down-call button 27 are provided. On a front surface of the upper horizontal frame 23c, an indicator lamp 28 is provided.

[0041] On a side surface of the first vertical frame 23a, which opposes the second vertical frame 23b, the first light emitter 11 is provided. On a side surface of the second vertical frame 23b, which opposes the first vertical frame 23a, the second light emitter 12 is provided. The first camera 13 for imaging the second light-emitting surface 12a is provided in a lower end portion of the side surface of the first vertical frame 23a, the side surface opposing the second vertical frame 23b. The second camera 14 for imaging the first light-emitting surface 11a is provided in an upper end portion of the side surface of the second vertical frame 23b, the side surface opposing the first vertical frame 23a. The remaining configuration and controlling method are the same as those of the first embodiment.

[0042] Even when the obstacle detecting device is provided to the landing door device as described above, the effects of the light beam reflected by the obstacle can be eliminated to more reliably detect the obstacle.

Fourth Embodiment

[0043] Next, FIG. 11 is a rear view illustrating the car door device for the elevator according to a fourth embodiment of the present invention, as viewed from a landing side, and FIG. 12 is a plan view illustrating the car door device and the landing door device for the elevator, which are illustrated in FIG. 11. In the drawings, the first light emitter 11 and the first camera 13 are provided in the vicinity of a door pocket of the first car door 2a of the car 1 (on the landing side of the first car door 2a). The second light emitter 12 and the second camera 14 is provided in the vicinity of a door pocket of the second car door 2b of the car 1 (on the landing side of the second car door 2b). The first light emitter 11 and the second light emitter 12 radiate light beams into a space between the car doors 2a and 2b and the landing doors 22a and 22b so that the light beams are parallel to the direction in which the car doors 2a and 2b are opened and closed. The remaining configuration and controlling method are the same as those of the first embodiment.

[0044] Even when the light beams are radiated from the first light emitter 11 and the second light emitter 12 into the space between the car doors 2a and 2b and the

landing doors 22a and 22b as described above, the effects of the light beam reflected by the obstacle can be eliminated to more reliably detect the obstacle.

Moreover, the obstacle, which may actually be caught between the doors 2a and 2b or 22a and 22b, can be more reliably detected.

Fifth Embodiment

[0045] Next, a fifth embodiment of the present invention is described. In this example, light beams having wavelengths different from each other are emitted from the first light emitter 11 and the second light emitter 12. Then, each of the first camera 13 and the second camera 14 images the light beam having the corresponding wavelength. The turn-ON timing of the first light emitter 11 and the turn-ON timing of the second light emitter 12 may be shifted from each other as in the case of the first embodiment or may not be shifted from each other.

[0046] Specifically, the first light emitter 11 emits a light beam having a wavelength λ_1 , whereas the second light emitter 12 emits a light beam having a wavelength λ_2 . The second camera 14 for imaging the first light-emitting surface 11a has an optical filter for transmitting the light beam having the wavelength λ_1 therethrough and blocking the light beam having the wavelength λ_2 . The first camera 13 for imaging the second light-emitting surface 12a has an optical filter for transmitting the light beam having the wavelength λ_2 therethrough and blocking the light beam having the wavelength λ_1 . As a result, each of the first camera 13 and the second camera 14 images the light beam from the corresponding one of the light emitters 11 and 12. The remaining configuration and controlling method are the same as those of the first embodiment.

[0047] In the above-mentioned car door device the effects of the light beam reflected by the obstacle can be eliminated to more reliably detect the obstacle.

[0048] Although the obstacle is detected based on the interrupted or reduced light-emitting surface image resulting from the light beam blocked by the obstacle in the examples described above, the method of detecting the obstacle is not limited thereto. For example, a time-differential image corresponding to a difference between the latest differential image and a differential image obtained a predetermined time before may be obtained so as to determine whether or not a value equal to or larger than a predetermined value is present in the time-differential image. According to this method, the time-differential image has a value of approximately zero over the entire image when the obstacle is not present. On the other hand, when a moving obstacle is present, a portion having the predetermined value or larger appears in the time-differential image. Therefore, the presence of the portion having the predetermined value or larger allows the determination of the presence of the obstacle. According to the aforementioned method, an immovable dust adhering to the light-emitting surfaces 11a and 12a

can be prevented from being erroneously determined as the obstacle. As a result, only the moving obstacle such as the passenger can be efficiently detected.

[0049] The light beams emitted from the light emitters 11 and 12 may be visible light beams. In this case, the passenger inside the car 1 or in the landing can visually perceive the light-emitting surfaces 11a and 12a. Thus, the operations of the doors 2a, 2b, 22a, and 22b can be visually presented to the passenger. For example, in the case of the flowchart of FIG. 7, the operation of detecting the obstacle is started before the start of the door-opening, and the light emitters 11 and 12 flash. Therefore, the passenger can be informed of the start of the door-opening in advance. In the case of the flowchart of FIG. 8, the operation of detecting the obstacle is started before the start of the door-closing, and the light emitters 11 and 12 flash. Therefore, the passenger can be informed of the start of the door-closing in advance.

[0050] Further, the turn-ON timing and the imaging timing are not limited to those described in the aforementioned examples. For example, the first camera 13 may perform imaging while the second light emitter 12 is brought into the OFF state when the first light emitter 11 is turned ON, and the second camera 14 may perform imaging while the first light emitter 11 is brought into the OFF state when the second light emitter 12 is turned ON. In this case, the light beam reflected by the obstacle is detected by the first camera 13 and the second camera 14 when the obstacle is present. Even with the method described above, while one of the first light emitter 11 and the second light emitter 12 is in the ON state, the effects of the light beam from the other can be eliminated. As a result, the obstacle can be more reliably detected.

[0051] Further, although the double-side sliding door device is described in the examples described above, the present invention is also applicable to a single-side sliding door device. Moreover, the number of the car door and the landing door is not particularly limited. Although the present invention is applied to the door device for the elevator in the examples described above, the sliding door device of the present invention is also applicable to, for example, a doorway provided to a building, a doorway of a vehicle such as a train, or a doorway of a train to/from a platform.

Claims

1. A sliding door device comprising:

a door being horizontally moved to open and close a doorway;
a first light emitter which is provided on a first side of the doorway and includes a first light-emitting surface;
a second light emitter which is provided on a second side of the doorway and includes a second light-emitting surface opposing the first

light-emitting surface;

first imaging means provided on the first side of the doorway;

second imaging means provided on the second side of the doorway; and

a controller for controlling the first light emitter, the second light emitter, the first imaging means, and the second imaging means to detect an obstacle in vicinity of the doorway and for controlling opening and closure of the door according to presence and absence of the obstacle, wherein, the controller turns ON the first light emitter and the second light emitter at timings shifted from each other.

2. A sliding door device according to claim 1, wherein the controller controls the second imaging means to image the first light-emitting surface while the second light emitter is brought into an OFF state when the first light emitter is turned ON, and controls the first imaging means to image the second light-emitting surface while the first light emitter is brought into an OFF state when the second light emitter is turned ON.

3. A sliding door device according to claim 1, wherein the controller controls the first imaging means to perform imaging while the second light emitter is brought into an OFF state when the first light emitter is turned ON, and controls the second imaging means to perform imaging while the first light emitter is brought into an OFF state when the second light emitter is turned ON.

4. A sliding door device comprising:

a door being horizontally moved to open and close a doorway;

a first light emitter which is provided on a first side of the doorway and includes a first light-emitting surface;

a second light emitter which is provided on a second side of the doorway and includes a second light-emitting surface opposing the first light-emitting surface;

first imaging means which is provided on the first side of the doorway, for imaging the second light-emitting surface;

second imaging means which is provided on a second side of the doorway, for imaging the first light-emitting surface; and

a controller for controlling the first light emitter, the second light emitter, the first imaging means, and the second imaging means to detect an obstacle in vicinity of the doorway and for controlling opening and closure of the door according to presence and absence of the obstacle, where-

in:

the first light emitter and the second light emitter emit light beams having wavelengths different from each other; and
each of the first imaging means and the second imaging means images the light beam having a corresponding one of the wavelengths.

5. A sliding door device according to claim 1 or 4, wherein the first light-emitting surface and the second light-emitting surface are provided respectively to the first light emitter and the second light emitter so that each of the first light-emitting surface and the second light-emitting surface is vertically elongated and continuous.
6. A sliding door device according to claim 1 or 4, wherein the light beams emitted from the first light emitter and the second light emitter are visible light beams.
7. A sliding door device according to claim 6, wherein the controller starts an operation of detecting the obstacle before start of a door-opening.
8. A sliding door device according to claim 6, wherein the controller starts an operation of detecting the obstacle before start of a door-closing.
9. An elevator comprising:

a car raised and lowered in a hoistway;
an elevator door being horizontally moved to open and close a doorway provided between the car and a landing;
a first light emitter which is provided on a first side of the doorway and includes a first light-emitting surface;
a second light emitter which is provided on a second side of the doorway and includes a second light-emitting surface opposing the first light-emitting surface;
first imaging means provided on the first side of the doorway;
second imaging means provided on the second side of the doorway; and
a controller for controlling the first light emitter, the second light emitter, the first imaging means, and the second imaging means to detect an obstacle in vicinity of the doorway and for controlling opening and closure of the elevator door according to presence and absence of the obstacle, wherein,
the controller turns ON the first light emitter and the second light emitter at timings shifted from each other.

10. An elevator comprising:

a car raised and lowered in a hoistway;
an elevator door being horizontally moved to open and close a doorway provided between the car and a landing;
a first light emitter which is provided on a first side of the doorway and includes a first light-emitting surface;
a second light emitter which is provided on a second side of the doorway and includes a second light-emitting surface opposing the first light-emitting surface;
first imaging means provided on the first side of the doorway;
second imaging means provided on the second side of the doorway; and
a controller for controlling the first light emitter, the second light emitter, the first imaging means, and the second imaging means to detect an obstacle in vicinity of the doorway and for controlling opening and closure of the elevator door according to presence and absence of the obstacle, wherein:

the first light emitter and the second light emitter emit light beams having wavelengths different from each other; and
each of the first imaging means and the second imaging means images the light beam having a corresponding one of the wavelengths.

FIG. 1

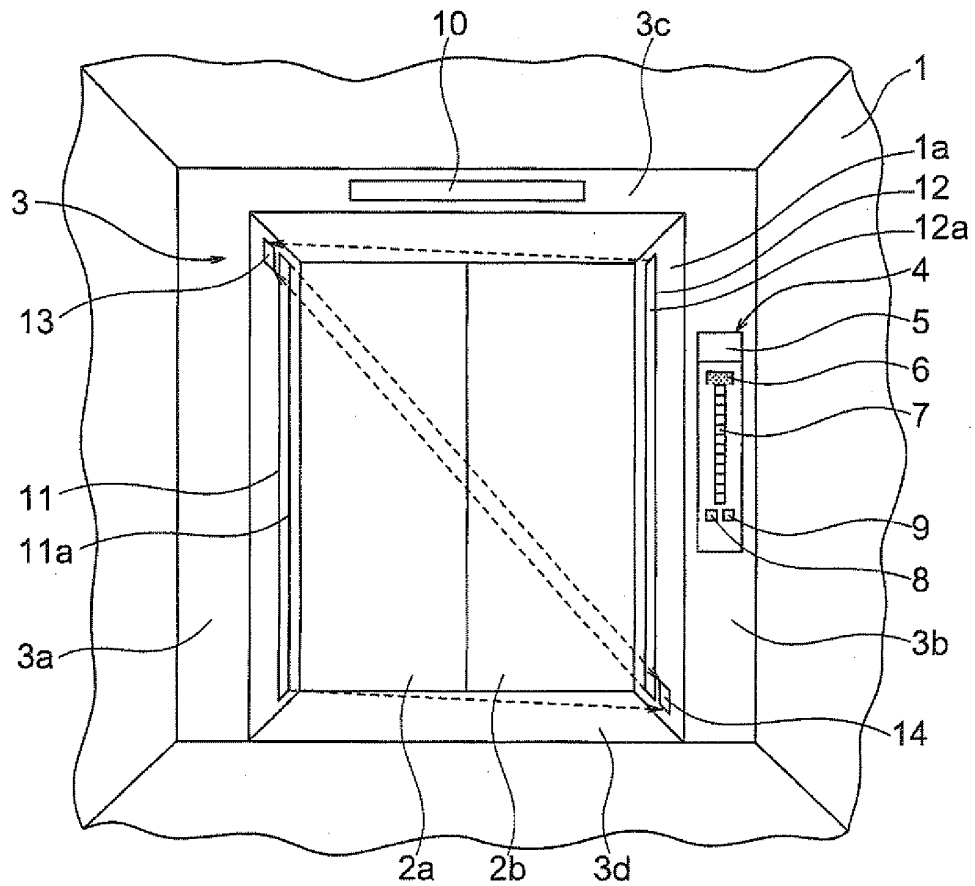


FIG. 2

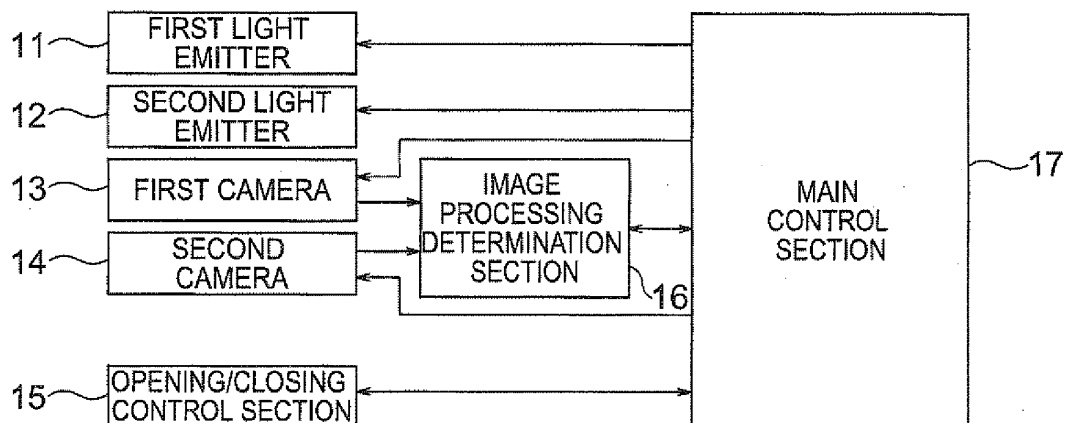


FIG. 3

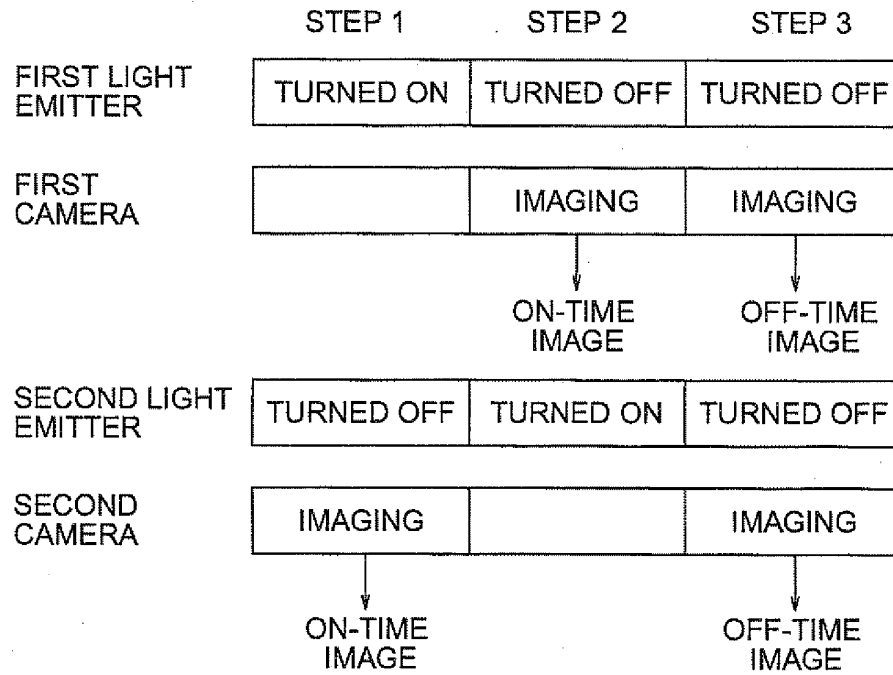


FIG. 4

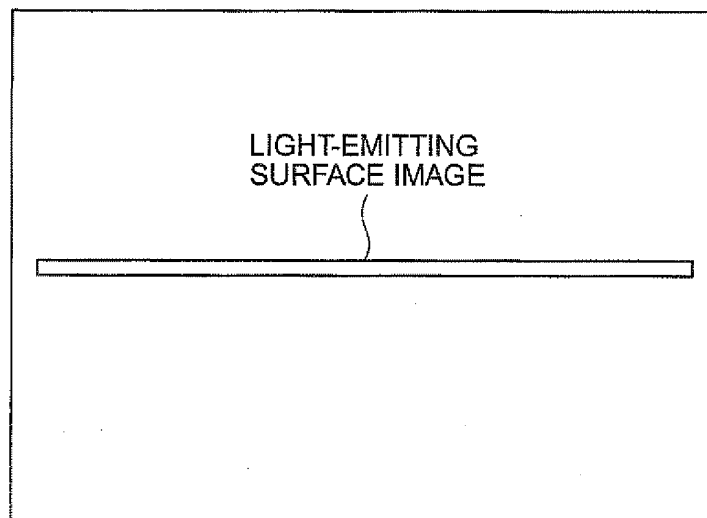


FIG. 5

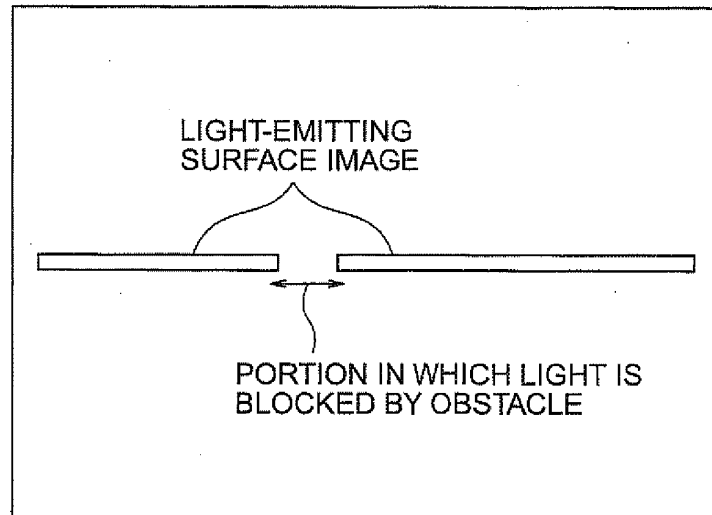


FIG. 6

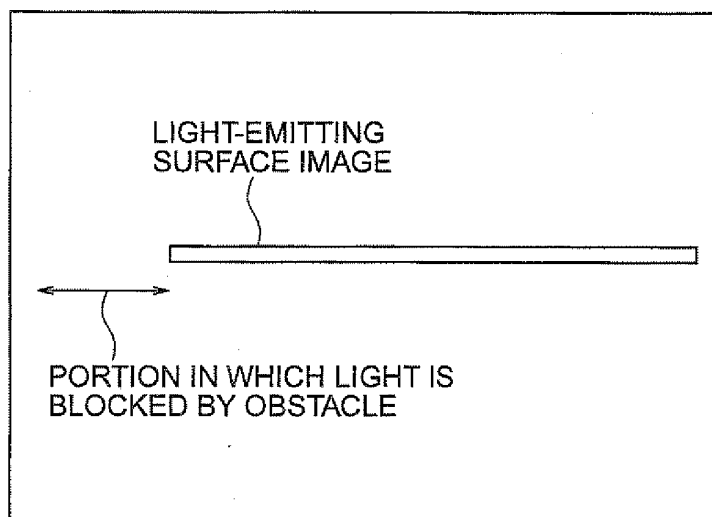


FIG. 7

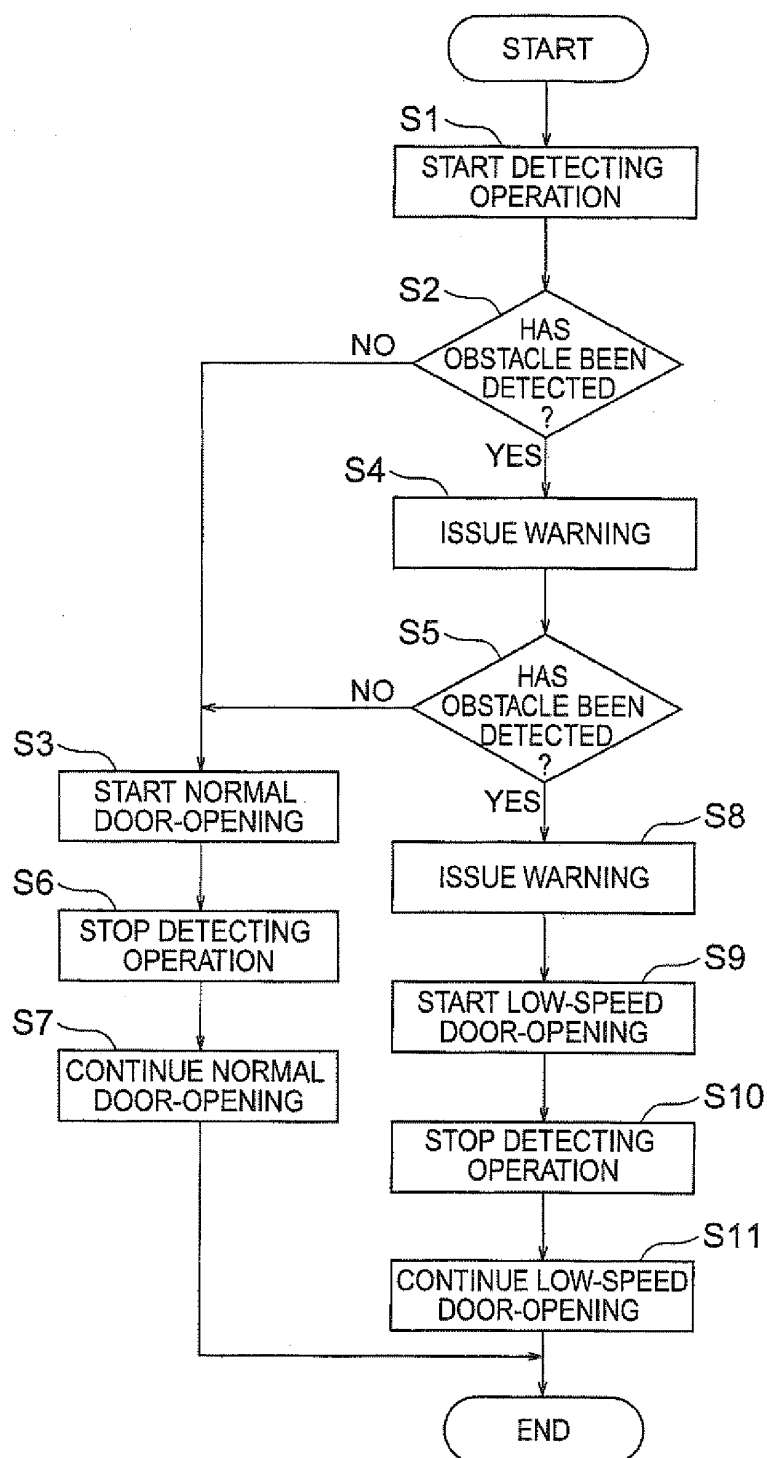


FIG. 8

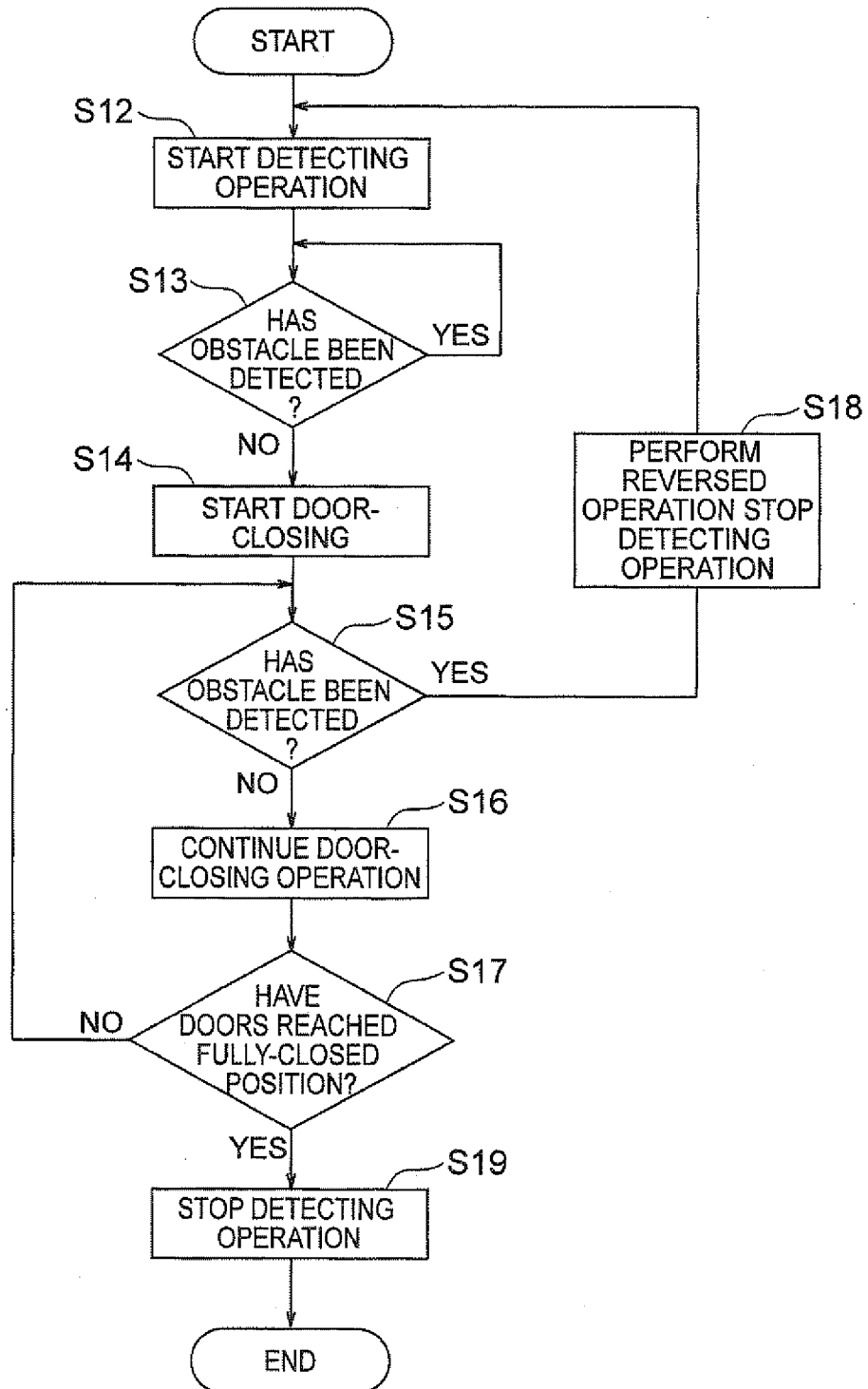


FIG. 9

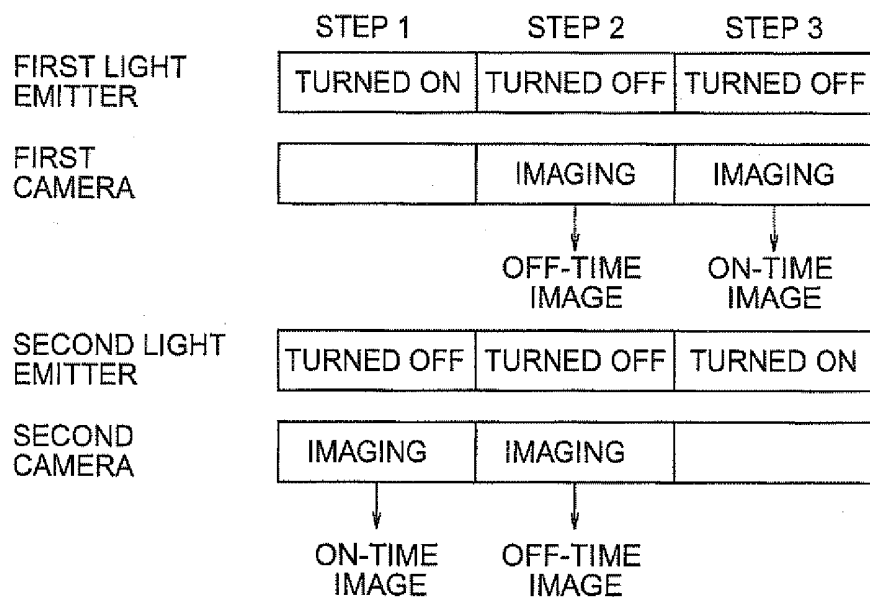


FIG. 10

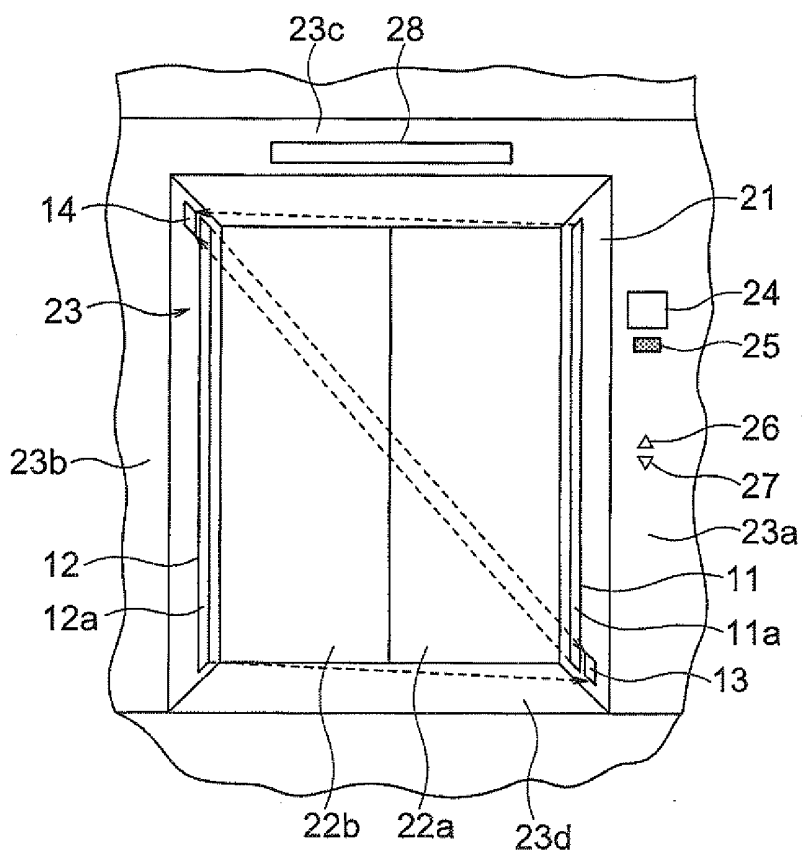


FIG. 11

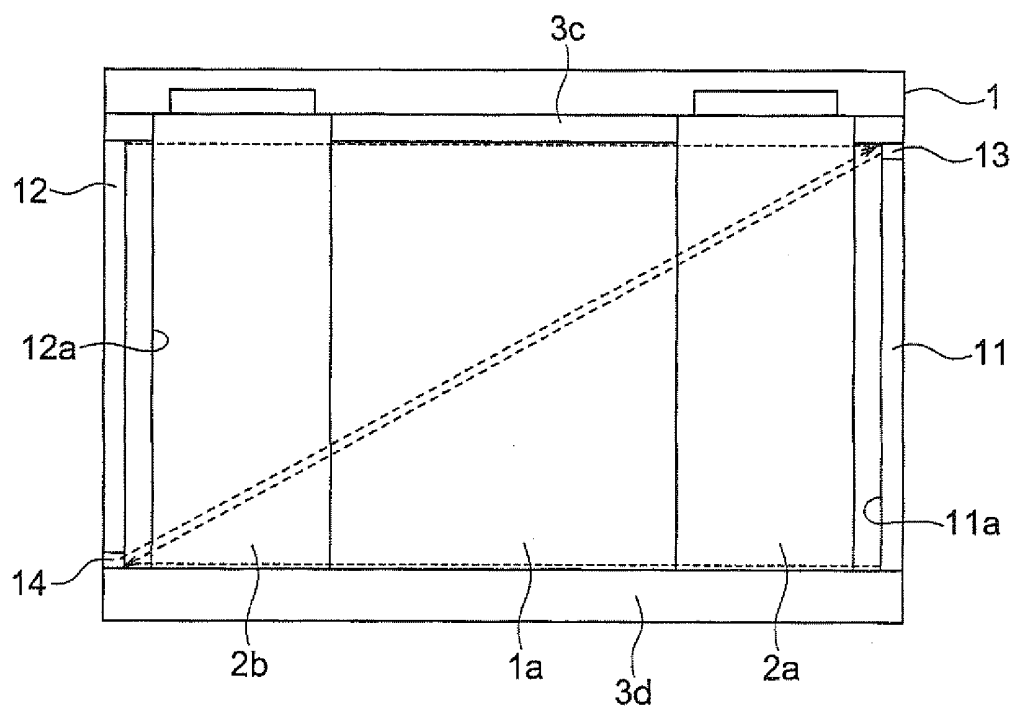
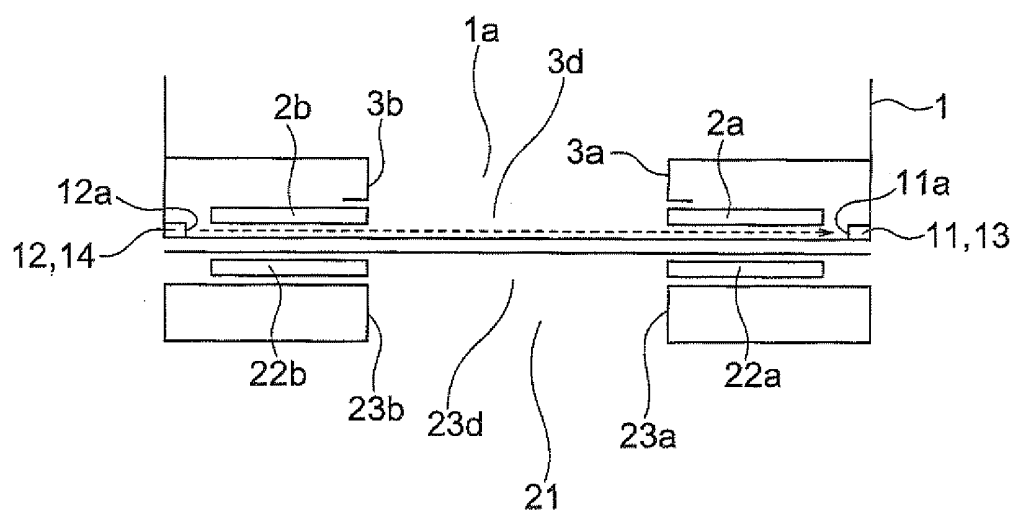


FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/057749

A. CLASSIFICATION OF SUBJECT MATTER

B66B13/26 (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)

B66B13/26

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 1996-2009

Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

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.
Y	JP 2004-338846 A (Mitsubishi Electric Corp.), 02 December, 2004 (02.12.04), (Family: none)	1-10
Y	JP 07-069571 A (Otis Elevator Co.), 14 March, 1995 (14.03.95), Par. Nos. [0019] to [0020], [0024], [0032] to [0034]; Figs. 1 to 6 & US 5410149 A	1-10
Y	JP 11-311061 A (Kabushiki Kaisha Tsuden), 09 November, 1999 (09.11.99), Par. Nos. [0013] to [0014]; Figs. 11 to 15 (Family: none)	1-10

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

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Date of the actual completion of the international search

09 January, 2009 (09.01.09)

Date of mailing of the international search report

20 January, 2009 (20.01.09)

Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/057749

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2006-512260 A (Otis Elevator Co.), 13 April, 2006 (13.04.06), Page 1, lower column & US 2006/0157304 A1 & EP 1606209 A1 & WO 2004/058622 A1 & CN 1720190 A	1-10

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2004338846 A [0003]