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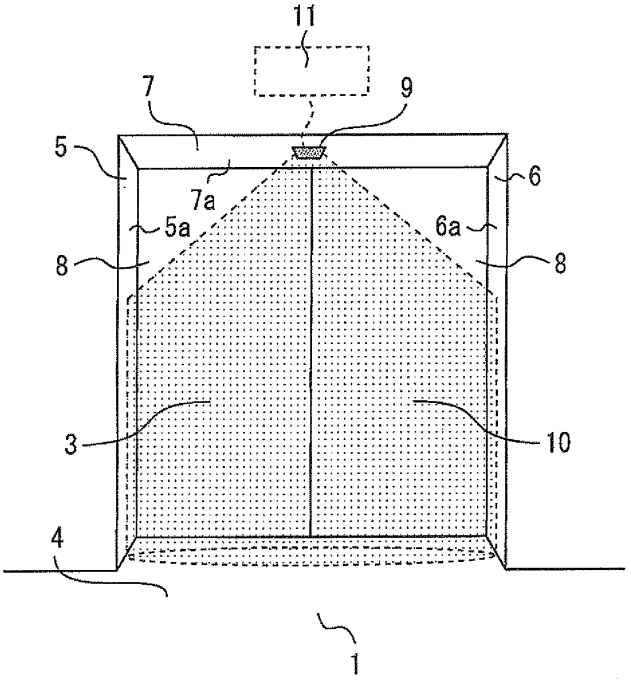
(54) ELEVATOR DOOR DEVICE

(57) There is provided an elevator door system capable of detecting the approach of a user to an elevator door and capable of reliably preventing detection omission and misdetection.

For this purpose, a detecting device is provided on a top plate forming the upper edge of an elevator entrance, and an elevator user who is present within a predetermined detection range is detected by the detecting device. Also, the detection range of the detecting device is set only in a part of a space forming the elevator entrance. Further, predetermined control such as announcement to call the user's attention and door opening/closing operation is carried out based on the detection result of the detecting device.

Fig. 1



EP 2 316 777 A1

Description

Technical Field

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

Background Art

[0002] In recent years, high-rise buildings have been increasingly constructed, and an elevator has become a part of a living flow path for many persons. The conversion of multiple-family dwellings such as apartment buildings to high rises has also advanced, so that the elevator has been used frequently in the general living.
In such a situation, the safety of elevator has become increasingly important. In particular, a door system, in which a movable part (door) may be in direct contact with a user, is required to ensure higher safety, and is required to be provided with various kinds of detecting devices.

[0003] As a prior art of elevator door system, there is proposed, for example, a door system in which a detecting device is provided in an upper part of the car entrance of elevator to detect the approach of a user in the car to the car door in a non-contact manner (refer to Patent Document 1). When the approach of the user is detected by the detecting device during the car door closing operation, the car door is operated reversedly to prevent the user's hand or the like from being pulled in.

[0004]

Patent Document 1: Japanese Patent Laid-Open No. 2006-111393

Disclosure of the Invention

Problems to be Solved by the Invention

[0005] In the elevator door system described in Patent Document 1, as shown in the figure therein, the detection range of the detecting device is set so as to be wide, so that there is a possibility that a person who is present at a position distant from the car door may also be detected by the detecting device. Also, when the detecting device configured as described above is applied to the elevator hall side, a person passing through the vicinity of a hall door is also detected by the detecting device, which may induce malfunction of door system.

[0006] If the detection range of the detecting device is directed to the door side to prevent the above-described malfunction, the detecting device may respond to the opening/closing operation of the door.
If the detection range of the detecting device is narrowed to prevent the above-described malfunction, the detecting function decreases remarkably. In such a case, the user's hand put on the door may become unable to be detected by the detecting device, which may cause an accident of pulled-in and the like.

[0007] The present invention has been made to solve the above-described problems, and the object of the invention is to provide an elevator door system capable of detecting the approach of a user to an elevator door and capable of reliably preventing detection omission and misdetection.

Means for Solving the Problems

[0008] An elevator door system according to the present invention is an elevator door system in which an entrance surrounded by a floor of an elevator car or hall, a pair of vertical pillars erected on the floor, and a top plate provided between the vertical pillars is formed, and a door for opening and closing the entrance is provided on the far side of the entrance, The elevator door system comprises a detecting device provided on the top plate to detect an elevator user who is present within a predetermined detection range, and a control device for carrying out predetermined control based on the detection result of the detecting device. Also, the detection range of the detecting device is set only in part of a space forming the entrance.

Effect of the Invention

[0009] According to the present invention, the approach of a user to an elevator door can be detected, and detection omission and misdetection can be prevented reliably.

Brief of Description of the Drawings

[0010]

Figure 1 is a front view of an elevator door system in a first embodiment according to the present invention.
Figure 2 is a plan view of the elevator door system shown in Figure 1.
Figure 3 is a front view for explaining the effect of the elevator door system shown in Figure 1.
Figure 4 is a plan view of the elevator door system shown in Figure 3.
Figure 5 is a flowchart showing the operation of the elevator door system in the first embodiment according to the present invention.
Figure 6 is a front view of an elevator door system in a second embodiment according to the present invention.
Figure 7 is a plan view of the elevator door system shown in Figure 6.
Figure 8 is a front view of an elevator door system in a third embodiment according to the present invention.

Description of symbols

[0011]

1 hall, 2 car, 3 hall entrance, 4 floor,
5 vertical pillar, 5a side surface, 6 vertical pillar,
6a side surface, 7 top plate, 7a lower surface,
8 hall door, 9 detecting device, 10 detection range,
10a range, 11 control device, 12 car entrance,
13 floor, 14 vertical pillar, 15 vertical pillar,
16 car door, 17 detecting device, 18 detection range,
19 detector, 20 detector, 21 detection range,
22 detection range, 23 control device

Best Mode for Carrying Out the Invention

[0012] The present invention will be described in more detail with reference to the accompanying drawings. Incidentally, in each of the drawings, like numerals refer to like or similar parts and redundant descriptions of these parts are appropriately simplified or omitted.

First embodiment

[0013] Figure 1 is a front view of an elevator door system in a first embodiment according to the present invention, Figure 2 is a plan view of the elevator door system shown in Figure 1, Figure 3 is a front view for explaining the effect of the elevator door system shown in Figure 1, and Figure 4 is a plan view of the elevator door system shown in Figure 3. In Figures 1 and 2, symbol 1 denotes an elevator hall, and 2 denotes an elevator car stopping at the hall 1. Figure 1 is a view viewed from the hall 1 side.

[0014] The hall 1 is formed with a hall entrance 3 that leads to an elevator shaft (the car 2 when the car 2 stops at the hall 1). Specifically, the hall entrance 3 is formed by a floor 4 of the hall 1, a pair of vertical pillars 5 and 6 erected on the floor 4 so as to provide a predetermined clearance therebetween, and a top plate 7 provided between the upper end parts of the vertical pillars 5 and 6. That is, the hall entrance 3 consists of a space surrounded on the left, right ,top and bottom sides by the floor 4, the vertical pillars 5 and 6, and the top plate 7. The lower edge of the hall entrance 3 is formed by the upper surface of the floor 4, one side edge of the hall entrance 3 is formed by a side surface 5a of one vertical pillar 5, the other side edge of the hall entrance 3 is formed by a side surface 6a of the other vertical pillar 6 facing to the side surface 5a, and the upper edge of the hall entrance 3 is formed by a lower surface 7a of the top plate 7 facing to the upper surface of the floor 4.

[0015] Symbol 8 denotes a slide-type hall door for opening and closing the hall entrance 3. The hall door 8 is provided in the hall 1, and is arranged on the far side of the hall entrance 3, that is, on the shaft side of the hall entrance 3.

[0016] In a hall door system having the above-described configuration, a detecting device 9 is provided on the top plate 7. This detecting device 9 is provided to detect the approach of an elevator user to the hall door 8, and has the function of detecting a user who is present in a predetermined detection range 10.

[0017] The detecting device 9 emits light such as near-infrared rays downward, and thereby detects a user within the detection range 10 based on the reflected light of the emitted light. Specifically, by comparing the present reflected light of the emitted light such as near-infrared rays with the previous reflected light thereof, the detecting device 9 judges whether or not a user is present based on the variation of the reflected light. That is, for the detecting device 9 using the above-described detection system, the detection range 10 is a range in which the light such as near-infrared rays can reach and the reflected light thereof can be received.

[0018] The above-described detection range 10 of the detecting device 9 is set only in a part of the space surrounded by the floor 4, the vertical pillars 5 and 6, and the top plate 7, that is, a space forming the hall entrance 3 so as not to protrude from the space. Generally, for the hall entrance 3, the width in the frontage direction (the X direction shown in Figure 2) is greater than the width in the depth direction (the Y direction shown in Figure 2). Therefore, the detecting device 9 emits light such as near-infrared rays downward from the top plate 7 at a larger angle in the frontage direction than in the depth direction so that the detection range 10 is formed into a slender shape in the frontage direction in plan view. The position and angle of the detecting device 9 are set so that the light such as near-infrared rays emitted from the detecting device 9 is not applied directly to elements other than the side surfaces 5a and 6a of the vertical pillars 5 and 6 and the upper surface of the floor 4 forming the hall entrance 3 (the upper surface of a portion located between the vertical pillars 5 and 6, in plan view, of the floor 4). In other words, the light emitted from the detecting device 9 is applied directly to only the side surfaces 5a and 6a and the upper surface of the floor 4 forming the hall entrance 3.

[0019] As shown in Figures 3 and 4, the detection range 10 of the detecting device 9 is set throughout a portion between the vertical pillars 5 and 6 on both sides of the hall entrance 3 without clearance within a predetermined range 10a. That is, the detecting device 9 can detect an elevator user in the entire portion in the frontage direction of the hall entrance 3 within the range 10a having a predetermined height H and a width W between the side surfaces 5a and 6a, Such a configuration can be realized, for example, by proper setting of the detection range 10. That is, the configuration may be made such that the light emitted downward from the detecting device 9 falls directly on the side surfaces 5a and 6a above the range 10a.

[0020] For the detecting device 9 shown in Figures 2 and 4, the light such as near-infrared rays is emitted so as to slightly tilt to the opposite side to the hall door 8. However, this is only one example. For example, the de-

tecting device 9 may be provided in a central portion of the lower surface 7a of the top plate 7 and may be configured so as to emit the light such as near-infrared rays just downward from the detecting device 9. That is, the position and angle of the detecting device 9 are set appropriately depending on the range capable of being set by the detection range 10, the thicknesses of the vertical pillars 5 and 6, the thickness of the top plate 7, and the like to prevent the above-described function from being impaired.

[0021] The detection signal of the detecting device 9 is transmitted to a control device 11. The control device 11 performs the function of carrying out predetermined control based on the detection result of the detecting device 9. For example, when a user is detected by the detecting device 9 at the time of opening/closing operation of the hall door 8, the control device 11 makes announcement to call the user's attention, and further gives instruction to slow down the opening/closing speed of the hall door 8.

[0022] Next, the operation of the elevator door system configured as described above is specifically explained with reference to Figure 5. Figure 5 is a flowchart showing the operation of the elevator door system in the first embodiment according to the present invention.

[0023] When the elevator car 2 stops at a floor, and the door opening operation is started by a driving device (not shown) provided on the car 2 (S1), the control device 11 judges whether or not an elevator user has approached the hall door 8 based on the signal sent from the detecting device 9 (S2). If the elevator user advances into the detection range 10 of the detecting device 9 at the time of door opening/closing operation, and the user is detected by the detecting device 9 (Yes of S2), the control device 1 changes the door opening operation speed to slow, and sounds announcement of, for example, "keep away from door" in the hall 1 to call the user's attention (S3). On the other hand, if the user is not detected by the detecting device 9 in S2, the normal door opening operation is performed continuously (S4), and thereafter the door closing operation is performed.

Although Figure 5 shows only the operation at the door opening time, after the start of door closing as well, the same operation as that shown in S2 to S4 may be performed.

[0024] The above is an explanation on the hall 1 side. On the other hand, the car 2 side is configured in the same manner as the hall 1 side.

That is, the car 2 is formed with a car entrance 12 that leads to the hall 1 (hall entrance 3) when the car 2 stops at the hall 1. Specifically, the car entrance 12 is formed by a floor 13 of the car 2, a pair of vertical pillars 14 and 15 erected on the floor 13, and a top plate (not shown) provided between the vertical pillars 14 and 15. That is, the car entrance 12 consists of a space surrounded by the floor 13, the vertical pillars 14 and 15, and the top plate.

Symbol 16 denotes a slide-type car door for opening and closing the car entrance 12. The car door 16 is provided in the car 2, and is arranged on the far side of the car entrance 12, that is, on the hall 1 side of the car entrance 12.

[0025] In a car door system having the above-described configuration, a detecting device 17 is provided on the top plate forming the upper edge of the car entrance 12. This detecting device 17 is provided to detect the approach of an elevator user to the car door 16, and has the function of detecting a user who is present in a predetermined detection range 18. The detecting device 17 has the same configuration as that of the detecting device 9 on the hall 1 side, and the detection range 18 is also set so as to have the same function as that of the detection range 10. That is, the detection range 18 is set only in a part of the space surrounded by the floor 13, the vertical pillars 14 and 15, and the top plate provided between the vertical pillars 14 and 15, that is, a space forming the car entrance 12 so as not to protrude from the space.

Concerning the detecting device 17 on the car 2 side as well, the same operation as that shown in Figure 5 is performed based on the detection result of the detecting device 17.

[0026] According to the first embodiment of the present invention, at the time of door opening/closing operation, the approach of a user to the elevator door (the hall door 8, the car door 16) can be detected reliably. Also, an error such that a user approaching the door cannot be detected at the time of door opening/closing operation (detection omission) and an error such that the presence of user is detected despite the fact that no user approaches to the door at the time of door opening/closing operation (misdetection) can be prevented reliably.

[0027] That is, for the detecting device 9 provided in the hall 1, the detection range 10 thereof is restricted to within the space forming the hall entrance 3, so that an object that is present in front or rear (on the hall 1 side or on the shaft side) of the hall entrance 3 is not detected as a user. Therefore, malfunction of the detecting device 9, which is caused by the detection or a person passing through the vicinity of the hall entrance 3 or by the detection of the hall door 8 in opening/closing operation, can be prevented reliably.

[0028] The detection range 10 of the detecting device 9 is set in the frontage direction of the hall entrance 3 without clearance within the predetermined range 10a. This configuration can prevent detection omission reliably. In particular, if the range 10a is set so as to have a proper height, an accident such that the child's hand is pulled in can be prevented from occurring.

[0029] On the car 2 side as well, the same effect as described above can be achieved by providing the same configuration as that on the hall 1 side.

[0030] In the above-described embodiment, the case where light such as near-infrared rays is emitted from the detecting device 9 to detect a user by the reflected light thereof has explained mainly. However, this embodiment

shows only one example of the detecting device 9, and a user may be detected by adopting any other detection system. For example, an image-taking means such as a camera may be provided as the detecting device 9 to determine the presence of a user from the image information acquired by the image-taking means.

Second embodiment

[0031] Figure 6 is a front view of an elevator door system in a second embodiment according to the present invention, and Figure 7 is a plan view of the elevator door system shown in Figure 6. The configuration of the door system shown in Figures 6 and 7 is basically the same as that of the door system shown in Figures 1 and 2. However, Figures 6 and 7 show a case where the detection range 10 of the detecting device 9 is wide in the depth direction of the hall entrance 3 as compared with the detection range 10 shown in Figures 1 and 2. In such a case, the thicknesses of the vertical pillars 5 and 6 are increased so as to adapt to the detection range 10 of the detecting device 9, and the detection range 10 is set only in a part of the space forming the hall entrance 3 so as not to protrude from the space. By this configuration, the same effect as that of the first embodiment can be achieved.
In Figures 6 and 7, the configuration on the car 2 side is omitted. However, it is a matter of course that the same effect as described above can be achieved by making the configuration on the car 2 side the same as that on the hall 1 side.

Third embodiment

[0032] Figures 8 is a front view of an elevator door system in a third embodiment according to the present invention. For the door system shown in Figure 8, a plurality of (two in the door system shown in Figure 8) detectors 19 and 20 are provided on the top plate 7 forming the upper edge of the hall entrance 3. The detectors 19 and 20 are provided to detect the approach of an elevator user to the hall door 8. The detector 19 has the function of detecting a user who is present in a predetermined detection range 21, and the detector 20 has the function of detecting a user who is present in a predetermined detection range 22. That is, the detectors 19 and 20 realize the function of the above-described detecting device 9 by the configuration of the plurality of detectors.
[0033] The detectors 19 and 20 detect a user by using the same detection system. For example, the detectors 19 and 20 emit light such as near-infrared rays downward and detect a user who is present within the respective detection ranges 21 and 22 based on the reflected light of the emitted light. The detection ranges 21 and 22 of the detectors 19 and 20, respectively, are set only in a part of the space forming the hall entrance 3 so as not to protrude from the space. Also, the detection ranges 21 and 22 of the detector 19 and 20 are set so that a user can be detected throughout a portion between the vertical pillars 5 and 6 on both sides of the hall entrance 3 within the predetermined range 10a.
[0034] The detection signals of the detectors 19 and 20 are transmitted to a control device 23. The control device 23 performs the function of carrying out predetermined control based on the respective detection signals of the detectors 19 and 20. For example, when a user is detected by either one of the detectors 19 and 20 at the time of opening/closing operation of the hall door 8, the control device 23 makes announcement to call the user's attention, and further gives instruction to slow down the opening/closing speed of the hall door 8.
[0035] According to the third embodiment of the present invention, the function of the detecting device 9 can be realized by the plurality of detectors 19 and 20. Therefore, even in the case where the detection range cannot be set in the entire portion in the frontage direction of the hall entrance 3 by one detector because of restrictions such as the frontage size of the hall entrance 3 and the thicknesses of the vertical pillars 5 and 6, a user can be detected reliably.
Other configurations and effects are the same as those of the first embodiment. In Figure 8, the configuration on the car 2 side is emitted. However, it is a matter of course that, even on the car 2 side, the same effect as described above can be achieved by making the configuration on the car 2 side the same as that on the hall 1 side.

Industrial Applicability

[0036] The elevator door system according to the present invention can be applied to a door system in which the detecting device for detecting a user is provided on the top plate forming the upper edge of an elevator entrance.

Claims

1. An elevator door system in which
an entrance surrounded by a floor of an elevator car or hall, a pair of vertical pillars erected on the floor, and a top plate provided between the vertical pillars is formed; and
a door for opening and closing the entrance is provided on the far side of the entrance;
the elevator door system comprising:

a detecting device provided on the top plate to detect an elevator user who is present within a predetermined detection range; and
a control device for carrying out predetermined control based on the detection result of the detecting device; and
wherein the detection range of the detecting device is set only in part of a space forming the entrance.

2. The elevator door system according to claim 1, wherein the detecting device can detect an elevator user in the entire portion in the frontage direction of the entrance because the detection range of the detecting device is set throughout a portion between the vertical pillars erected on both sides of the entrance within a range having a predetermined height.

3. The elevator door system according to claim 1 or 2, wherein the detecting device emits light downward at a larger angle in the frontage direction of the entrance than in the depth direction thereof, and detects an elevator user based on the reflected light of the emitted light.

4. The elevator door system according to any one of claims 1 to 3, wherein the detecting device is provided with a plurality of detectors for detecting an elevator user, and the detection ranges of the detectors are set only in a part of the space forming the entrance.

5. The elevator door system according to any one of claims 1 to 4, wherein when an elevator user is detected by the detecting device at the time of door opening/closing operation, the control device makes announcement to call the user's attention, and also slows down the door speed.

Fig. 1

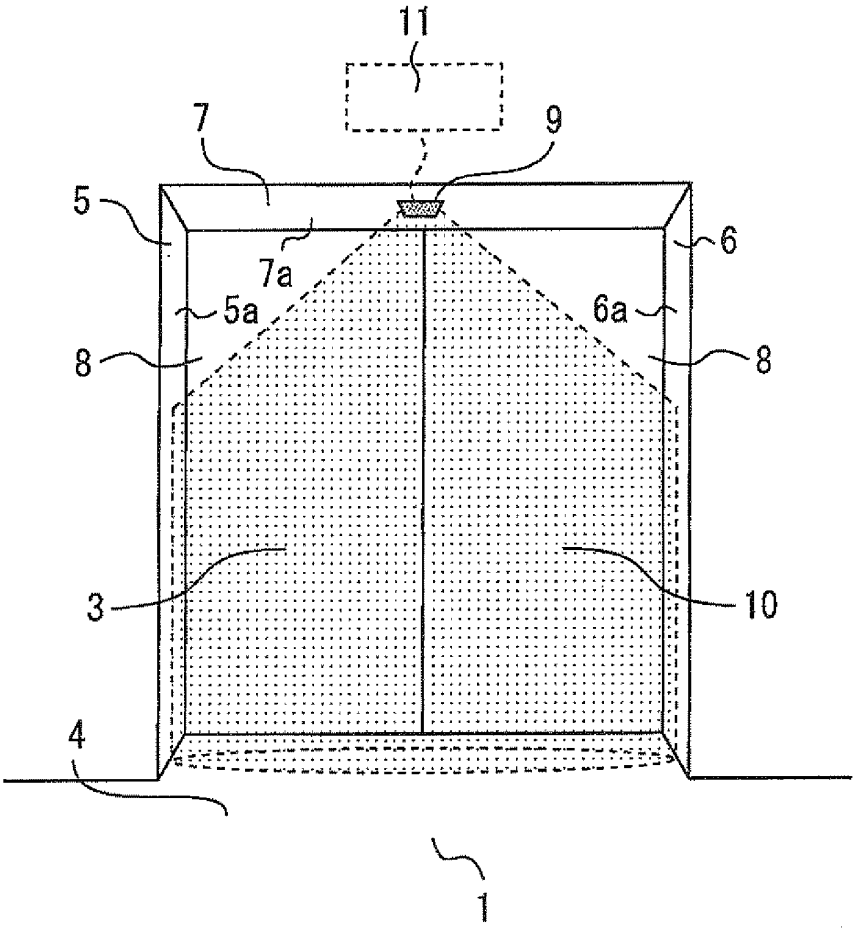


Fig. 2

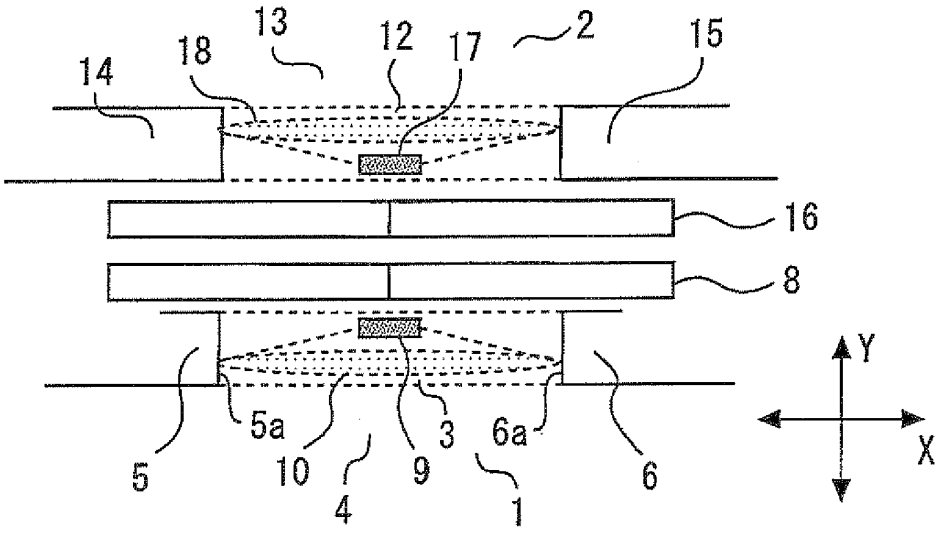


Fig. 3

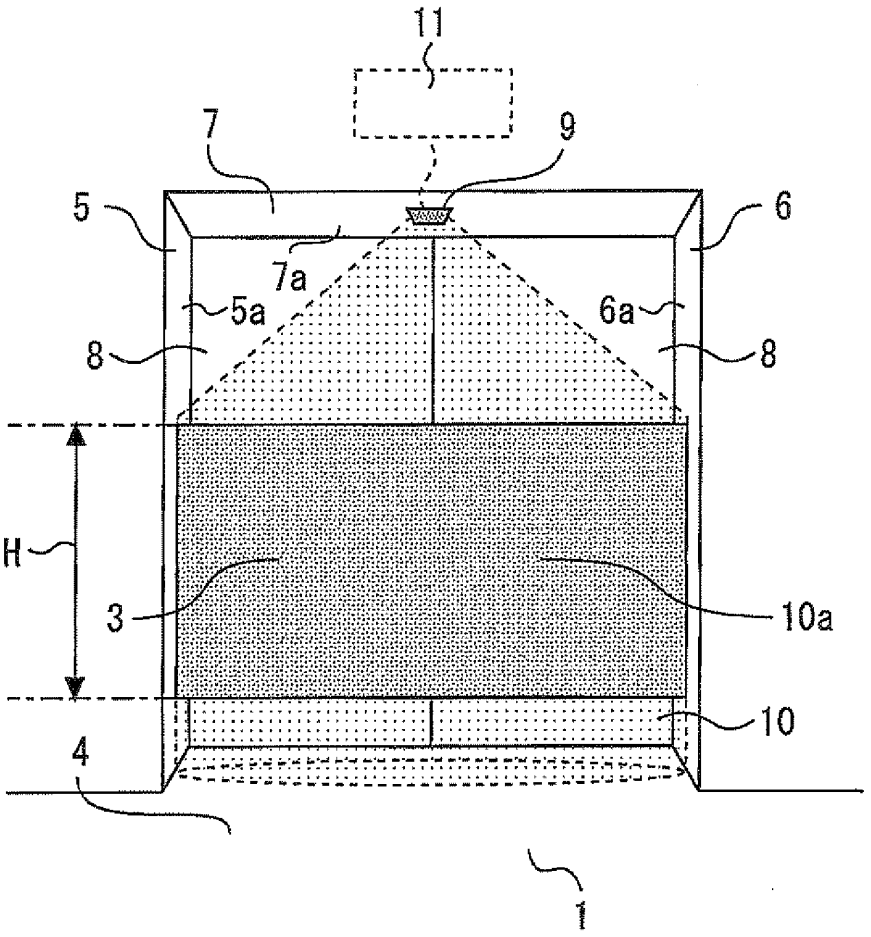


Fig. 4

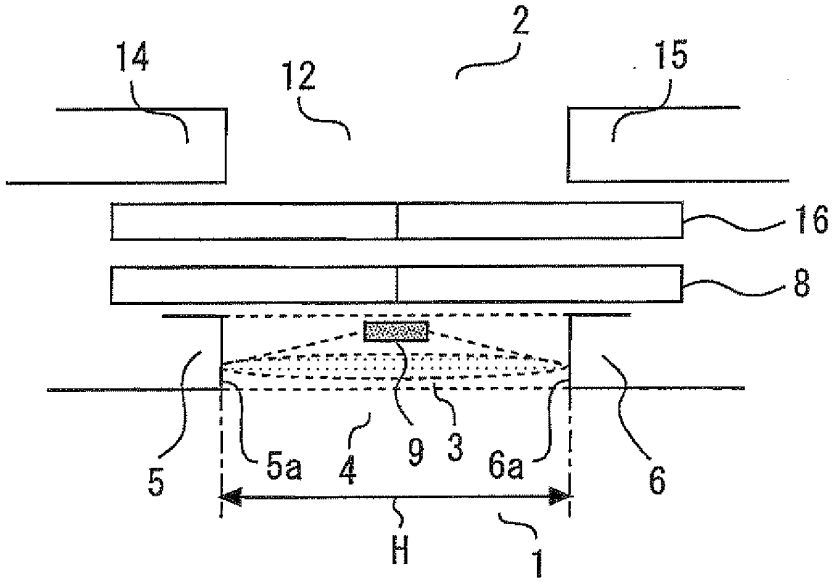


Fig. 5

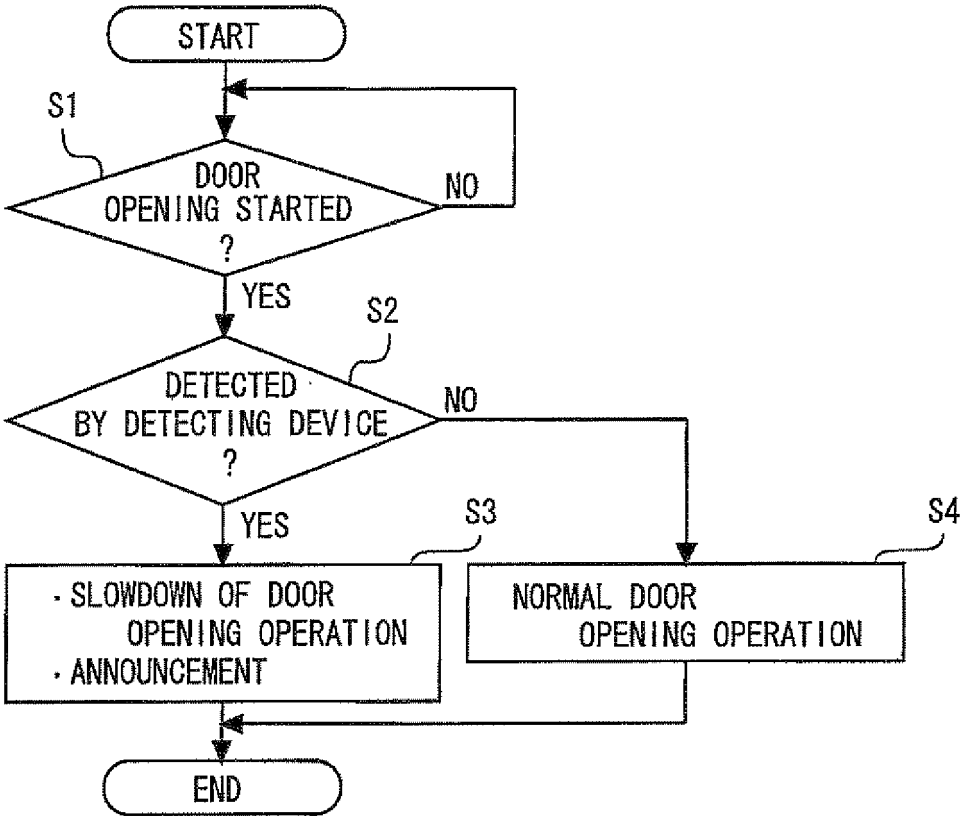

START
S1
DOOR OPENING STARTED ?
NO
YES
S2
DETECTED BY DETECTING DEVICE ?
NO
YES
S3
S4
・SLOWDOWN OF DOOR OPENING OPERATION
・ANNOUNCEMENT
NORMAL DOOR OPENING OPERATION
END

Fig. 6

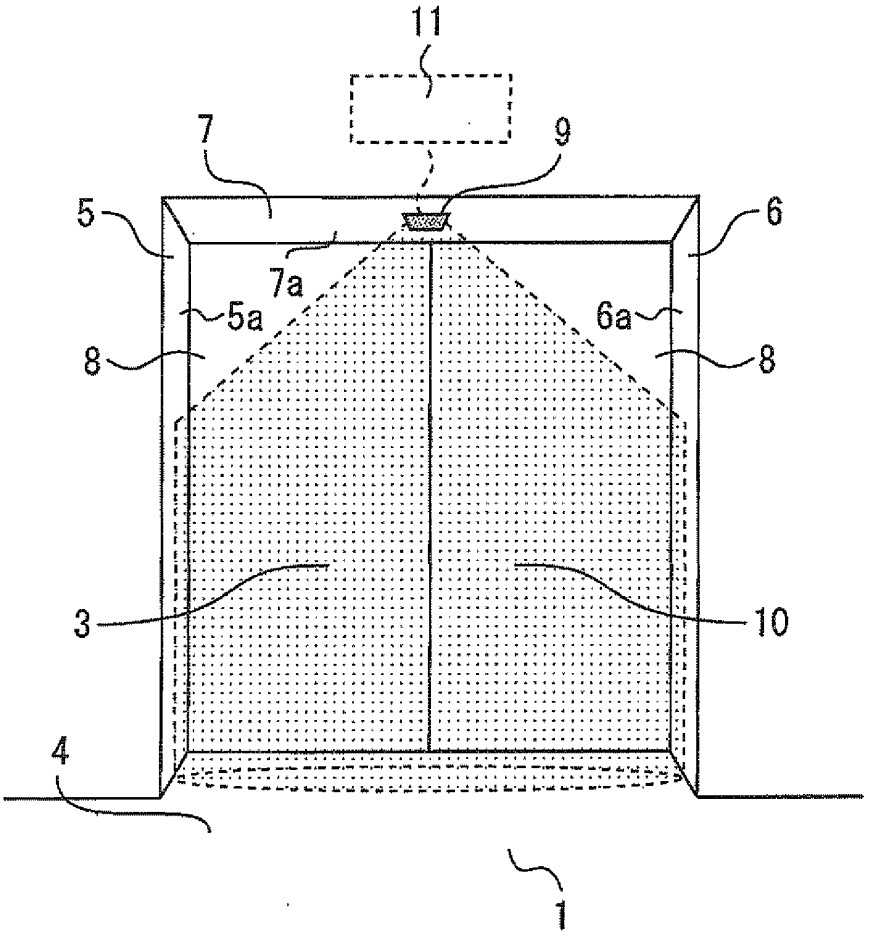


Fig. 7

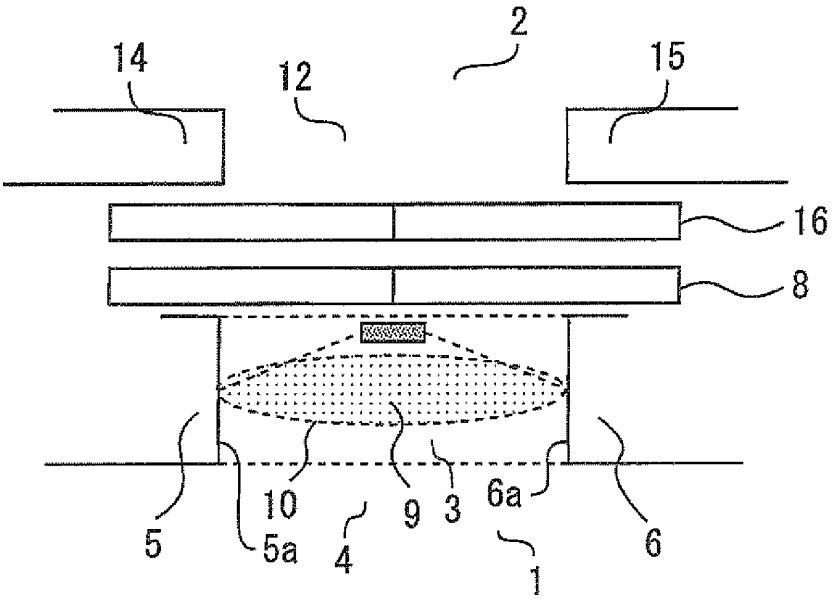
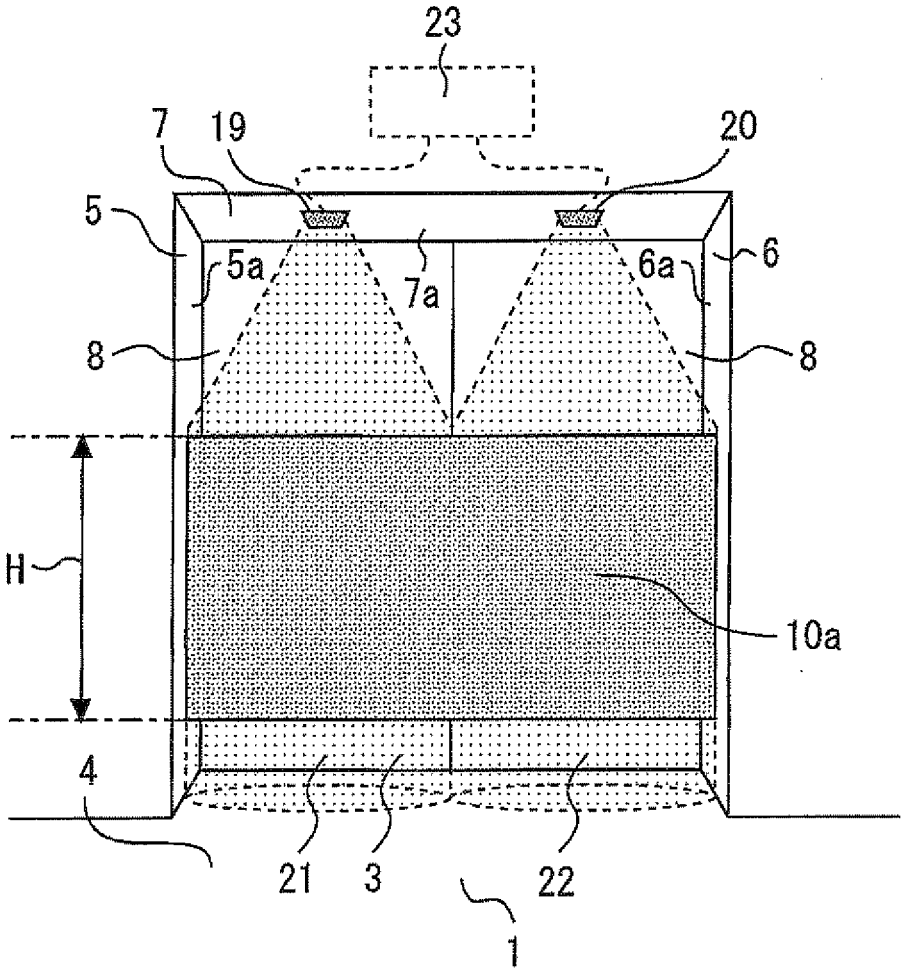


Fig. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/065195

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)
B66B13/00-B66B13/30

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.
A	JP 2006-111393 A (Mitsubishi Electric Corp.), 27 April, 2006 (27.04.06), Par. Nos. [0008] to [0022]; Figs. 1 to 2 (Family: none)	1-5
A	JP 04-358684 A (Mitsubishi Electric Corp.), 11 December, 1992 (11.12.92), Figs. 5 to 6 (Family: none)	1-5
A	JP 2005-194085 A (Mitsubishi Hitachi Home Elevator Corp.), 21 July, 2005 (21.07.05), Par. Nos. [0016] to [0025]; Figs. 1 to 8 (Family: none)	1-2

☒ 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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 March, 2009 (18.03.09)	31 March, 2009 (31.03.09)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/065195

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 2003-040562 A (Mitsubishi Electric Corp.), 13 February, 2003 (13.02.03), Par. No. [0012]; Fig. 1 (Family: none)	4-5

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006111393 A **[0004]**