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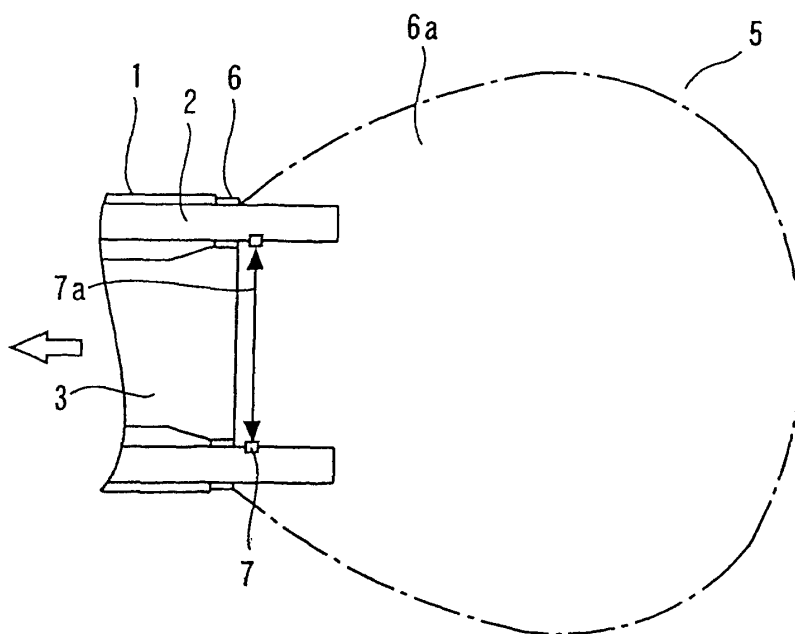
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(54) **AUTOMATIC OPERATING UNIT OF MAN CONVEYOR**

(57) A first detector (6) for detecting a passenger approaching a gate side of a passenger conveyor, and a second detector (7) for detecting the passenger passing just before a step are provided to perform an automatic operation. When the first detector (6) does not detect a passenger and the second detector (7) detects the pas-

senger, actuation of the steps is stopped in a stop-on-standby type of passenger conveyor. In a low-speed-operation-on-standby type of passenger conveyor, the steps are shifted to a continuous operation at a rated speed, and when the first detector (6) detects a passenger thereafter, the passenger conveyor returns to the automatic operation again.

Fig. 2



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Description

Technical Field

[0001] This invention relates to a device for automatically operating a passenger conveyor having a first detector for detecting approach of passengers and a second detector for detecting passage of the passengers, in accordance with detection conditions of the above-described detectors.

Background Art

[0002] It is conventionally known to actuate and automatically operate passenger conveyors such as escalators, and moving walks when detecting passengers approaching an entrance gate side and automatically stop the above-described operation when passengers no longer exist. Those using reflection type passenger detectors are disclosed, for example, in Japanese laid-open patent publication No. Hei 6-87592, and Japanese laid-open patent publication No. Hei 10-182050.

[0003] However, the reflection type passenger detector using reflection of an energy wave easily varies in its detection distance depending on the detection objects and the environmental conditions, and the following problems occur due to the occurrence of failures.

(1) In the case in which the detector fails at one of the gate sides and the detecting function is lost

[0004] In the type in which the steps stop during standby, it is possible that passengers get on from the gate side in the opposite direction when the detector which is at the gate side in the opposite direction to the conveying direction fails. In this case, when a passenger riding from the gate side in the normal direction is detected, the steps are actuated in the opposite direction while the passenger from the opposite direction is walking on the steps, and there is a possibility that the passenger falls down. When the passenger riding thereon from the normal direction cannot be detected due to the failure of the detector, there also arises the problem that while the passenger is walking on the steps, the passenger from the opposite direction is detected and the steps are suddenly actuated.

[0005] In a type in which the steps are operated at a low speed during standby, it is considered that ride of the passengers from the opposite direction does not occur, but as passengers cannot be detected at the gate side, the conveyor keeps operation at a low speed, thus causing the problem of reducing convenience. In addition, there exists the problem that when a person approaches the gate side in the opposite direction in this state, or when the passenger riding from the normal direction is detected at the exit gate side, acceleration is started with the passengers carried on the steps.

[0006] Especially, the reflection type passenger detector not only detects the users of the passenger conveyor, but also people and the like passing around it,

and therefore it is prone to cause the problems as described above.

(2) In the case in which the detection distance of the detector varies at one of the side gates and detection becomes unstable

[0007] As to the cause of the unstable detection, the clothing and movement of the passengers, the life of the detector and the like could be cited.

[0008] In this case, in the type in which the steps are stopping during standby, detection is delayed, and thereby sufficient acceleration cannot be made by the time the passenger gets on the steps, thus reducing convenience. When the detection is extremely delayed, the steps are actuated at the same time as the passenger gets on the step, and there is the fear of the passenger falling down.

[0009] In the type in which the steps are operated at a low speed during standby, if the detection is delayed, acceleration from the low speed is delayed, and there is also the problem of reducing convenience.

[0010] Meanwhile, Japanese laid-open patent publication No. Hei 11-292447 describes that as a first detector for detecting approach of a passenger, a reflection type passenger detector using reflection of an energy wave is used, and as a second detector for detecting a passenger passing a position just before a step of the passenger conveyor, a transmission type passenger detector for projecting a light beam is used. However, neither in this official gazette, the problems occurring when the reflection type passenger detector fails and when the detection becomes unstable are considered.

[0011] This invention is made to eliminate the above-described problems, and has its object to provide an automatic operation device for a passenger conveyor which does not cause trouble when a passenger rides thereon even when a failure occurs to the detector, and to make it possible to increase convenience and maintainability.

Disclosure of the Invention

[0012] An automatic operation device for a passenger conveyor of the present invention stops actuation of steps when a first detector does not detect a passenger and the second detector detects the passenger, while the passenger conveyor is on standby (is stopping).

[0013] Moreover, the automatic operation device for the passenger conveyor of the present invention operates the steps continuously at a rated speed when the first detector does not detect a passenger and the second detector detects the passenger while the passenger conveyor is on standby (is operating at a low speed).

[0014] Further, the automatic operation device for the passenger conveyor of the present invention uses such a type of detector as detects a passenger by a reflection wave of an energy wave as the first detector, and as the second detector, such a type of detector as detects a passenger by cutoff of an energy beam is used.

[0015] Moreover, the automatic operation device for the passenger conveyor of the present invention operates the steps continuously at a rated speed when a state in which the second detector detects a passenger before the moving speed of the steps actuated as a result of the first detector detecting the passenger reaches a specified speed occurs successively for the predetermined number of times or more.

[0016] Further, the automatic operation device for the passenger conveyor of the present invention returns to the automatic operation again when the first detector detects a passenger after the steps shift to the continuous operation.

[0017] Moreover, the automatic operation device for the passenger conveyor of the present invention outputs a malfunction signal outside and records the history of the malfunction judgment when the first detector does not detect a passenger and the second detector detects the passenger, or when a state in which the second detector detects a passenger before the steps reach a specified speed after the first detector detects the passenger occurs successively for the predetermined number of times or more.

Brief Description of the Drawings

[0018]

Figure 1 is a sectional side view of an upper riding section of a passenger conveyor with an automatic operation function;

Figure 2 is a plane view of the passenger conveyor in Figure 1;

Figure 3 is a function block diagram showing an embodiment of this invention;

Figure 4 is an operation flowchart of the passenger conveyor with a stop-on-standby type automatic operation function showing an embodiment of this invention; and

Figure 5 is an operation flowchart of the passenger conveyor with a low-speed-operation-on-standby type automatic operation function showing an embodiment of this invention.

Best Mode for Carrying Out the Invention

[0019] In order to explain this invention further in detail, this will be explained concerning an upper gate side in accordance with the attached drawings. (Since a lower gate side is the same, explanation will be omitted.)

First embodiment (Claims 1, 3, 4 and 6, Figures 1 to 4)

[0020] In Figure 1 and Figure 2, reference numeral 1 denotes a main body of a passenger conveyor such as an escalator, reference numeral 2 denotes a mobile handrail which moves synchronously with steps (not shown), reference numeral 3 denotes a floor plate laid

on a gate side of the escalator, reference numeral 4 denotes a control panel placed in a truss, reference numeral 5 denotes a floor surface of the gate side, reference numeral 6 denotes an upper first detector constituted of a reflection type passenger detector which is placed at a lower portion of the gate side, irradiates an energy beam such as a near infrared ray, a supersonic wave, etc., and has a detection area 6a where approach of a passenger is detected by its reflection wave, and reference numeral 7 denotes an upper second detector constituted of a transmission type passenger detector which projects a light beam 7a to a lower part of the gate side across a passage of the passenger to detect the passing of the passenger as a result of the passenger cutting it off.

[0021] In Figure 3, reference numeral 8 denotes a lower first detector which is placed at a lower gate side and has the same function as the upper first detector 6, reference numeral 9 is a lower second detector which is placed at the lower gate side and has the same function as the second detector 7, reference numeral 10 denotes actuation judging means for instructing the passenger conveyor to actuate or stop in accordance with the detection of presence or absence of a passenger from each of the above-described detectors 6 to 9, reference numeral 11 denotes a drive means for controlling the operation and stoppage of the passenger conveyor in accordance with the command from the actuation judging means 10, reference numeral 12 is a passenger detection failure judging means for judging a failure of each of the detectors 6 to 9, reference numeral 13 denotes an alarm for indicating the failures of the detectors 6 to 9, reference numeral 14 denotes a historic memory for storing history of the failures of the detectors 6 to 9, reference numeral 15 denotes a speed detector for detecting the speed of a driving machine (not shown) of the passenger conveyor, namely the moving speed of the steps, reference numeral 16 denotes a ride time speed judging means for judging whether the moving speed of the steps when a passenger passes the second detectors 7 and 9 is lower than a predetermined value, and reference numeral 17 denotes a low-speed ride counter for counting the number of times of the passengers riding when the moving speed of the steps is low.

[0022] Next, an operation of this embodiment will be explained with reference to Figure 4.

[0023] This passenger conveyor has a stop-on-standby type automatic operating function. Namely, when there are no passengers, the conveyor stops the steps and is on standby, and when the conveyor detects a passenger, it starts operation, whereby silence and energy conservation are realized.

[0024] In step S1, a count time N of the low speed ride counter 17 is set at zero. In step S2, the passenger conveyor is in a standby (stopping) state. In step S3, the passenger detection failure judging means 12 judges whether the upper first detector 6 detects a passenger, and when it does not detect the passenger, a command

is given to proceed to step S4, and the passenger detection failure judging means 12 judges whether the upper second detector 7 detects a passenger. When the upper second detector 7 does not detect the passenger, the passenger detection failure judging means 12 judges that there is no passenger, and a command is given to return to step 2. When the upper second detector 7 detects a passenger, a command is given to proceed to step S5, and the actuation judging means 10 outputs an actuation stopping command to stop actuation of the steps via the driving means 11. In step S6, the passenger detector failure judging means 12 outputs a malfunction signal to a monitor panel, a remote monitoring center, and an alarm 13 such as a failure indicator, and records the malfunction judgment into the historic memory 14. Here, steps S2 to S5 define the actuation judging means 10.

[0025] In this manner, actuation of the passenger conveyor is stopped when the first detector 6 does not detect a passenger and the second detector 7 detects the passenger while the passenger conveyor is stopping, and therefore when the first detector 6 is incapable of detecting a passenger due to failure or the like, the passenger conveyor can be prevented from being actuated after the passenger gets on the passenger conveyor which is stopping.

[0026] Next, when it is judged that the first detector 6 detects a passenger in step S3, a timer (not shown) is started in step S7, and a standby releasing command for the passenger conveyor is outputted in step S8. In step S9, it is determined that the second detector 7 detects the passenger. When the second detector 7 does not detect the passenger, a command is given to wait until a set time elapses in step S10, and after the set time elapses, a stop command for the passenger conveyor is outputted in step S11 and a command is given to return to step S2.

[0027] Next, when the second detector 7 detects a passenger in step S9, a command is given to proceed to step S12, and the ride time speed judging means 16 judges whether the speed of the steps is a specified speed or higher from the output of the speed detector 15. When the speed is lower than the specified speed, a command is given to proceed to step S13, and it is judged whether the count time N of the low speed ride counter 17 is 5 or more. When it is less than 5 times, one is added to the time N, then a command is given to shift to an automatic operation in step S16, and to return to step S2. When the count time N is 5 or more, the passenger conveyor is continuously operated at a rated speed in step S17, then the malfunction signal is outputted to indicate the malfunction from the alarm 13 and record the malfunction judgment in the historic memory 14 in step S18. Here, steps S3, S7 to S9, S12 and S13 define the passenger detector failure judging means 12, and step S17 defines the actuation judging means 10.

[0028] In this manner, as the passenger conveyor is continuously operated at the rated speed when the state

in which the second detector 7 detects passengers before the moving speed of the steps actuated in step S8 reaches the specified speed or higher occurs successively for the predetermined number of times or more, the passengers can be prevented from getting on the step in the state in which the steps are not sufficiently accelerated due to reduction of the detection distance of the first detector 6 or the like.

[0029] As when the first detector 6 does not detect a passenger but the second detector 7 detects a passenger, or when a state in which the second detector 7 detects a passenger before the steps reach the specified speed after the first detector 6 detects a passenger occurs successively for the predetermined number of times or more, the malfunction signal is outputted to, for example, the warning panel, the remote warning center or the failure display device and the like, and the history of the malfunction judgment is stored, it possible to notice a failure and reduction in the detecting ability of the first detector as soon as possible and enhance maintainability, and to confirm the above-described history at the time of maintenance or the like after the passenger conveyor returns to automatic operation.

[0030] When it is judged that the speed of the steps is the specified speed or higher in step S12, the count number N of the counter 17 is returned to zero in step S15, and the automatic operation is carried out in step S16.

[0031] Here, it is the condition that the speed of the steps when the second detector 7 detects a passenger is the specified speed or higher, but the condition may be the elapsed time from the time at which the first detector 6 detects a passenger until the time at which the second detector 7 detects the passenger.

Second embodiment (Claims 2 to 6, Figures 1 to 3, Figure 5)

[0032] The passenger conveyor of a second embodiment has a low speed operation-on-standby type automatic operation function. Namely, the passenger conveyor is on standby with the steps moving at a low speed when there is no passenger, and when it detects a passenger, it starts an automatic operation, whereby silence and energy conservation are realized.

[0033] Next, an operation of this embodiment will be explained with reference to Figure 5. A basic operation is the same as in Figure 4, and therefore the points different from Figure 4 will be mainly explained.

[0034] The count time N of the low speed ride counter 17 is set at zero in step S1. In step S21, the passenger conveyor is brought into a standby (low speed) state. In step S3, it is judged whether the first detector 6 detects a passenger, and when it does not detect the passenger, a command is given to proceed to step S4, and it is judged whether the second detector 7 detects the passenger. When the passenger is detected, a command is given to proceed to step S22, the passenger conveyor

is continuously operated at the rated speed, the malfunction signal is outputted in step S23, the malfunction is indicated from the alarm 13 and the malfunction judgment is recorded in the historic memory. Then, a command is given to wait until the first detector 6 detects a passenger in step S24, and when the first detector 6 detects a passenger, a command is given to return to automatic operation in step S25 and to return to step S21. Here, steps S22, S24, and S25 define the automatic operation returning means. In step S26, a standby command for the passenger conveyor is outputted.

[0035] In this manner, as the passenger conveyor is returned to the automatic operation again when the first detector 6 detects a passenger after the steps shift to continuous operation, even if temporary reduction of the detection ability of the first detector 6 occurs due to the environment, the clothing of passengers and the like, it is possible to return to automatic operation, thus making it possible to enhance convenience.

[0036] Further, when the first detector 6 does not detect a passenger and the second detector 7 detects the passenger, the malfunction signal is outputted to indicate this and the history of the malfunction judgment is stored, therefore making it possible to notice a failure and reduction in the detection ability of the first detector 6 as soon as possible and to increase maintainability, and alsomaking it possible to confirm the history of the shift to the continuous operation during maintenance and the like even after returning to the automatic operation.

[0037] In each of the above-described embodiments, the first detector 6 is one using a reflection type passenger detector, and this is because the reflection type passenger detector can detect approach of a passenger from a position away from the gate side. However, the first detector 6 is not limited to the reflection type passenger detector, and other types of detectors are sufficiently useful as long as they can detect a passenger approaching the gate side.

Industrial Applicability

[0038] As explained thus far, the automatic operation device for the passenger conveyor according to this invention is useful as the countermeasure against the case in which a failure occurs to the detection of the first detector when the first detector for detecting a passenger approaching the gate side of the passenger conveyor, and the second detector for detecting a passenger passing just before the steps are provided. This is especially suitable for the case using the reflection type passenger detector in which the first detector is considered to vary in the detection distance due to the condition of the environment and the detected object.

Claims

1. An automatic operation device for a passenger conveyor having a first detector having a detection area in which a passenger approaching a gate side of the passenger conveyor is detected, and a second detector provided at a position closer to said gate side than said detection area to detect passing of said passenger, and switching steps to an automatic operation when said first detector is operated while said passenger conveyor is on standby with steps of said passenger conveyor being stopped, **characterized by** further comprising:

actuation judging means for outputting a command to stop actuation of said steps when said first detector does not detect said passenger and said second detector detects said passenger.

2. An automatic operation device for a passenger conveyor having a first detector having a detection area in which a passenger approaching a gate side of the passenger conveyor is detected, and a second detector provided at a position closer to said gate side than said detection area to detect passing of said passenger, and switching steps to an automatic operation when said first detector is operated while said passenger conveyor is on standby with steps of said passenger conveyor operating at a low speed, **characterized by** further comprising:

actuation judging means for outputting a command to operate said steps continuously at a rated speed when said first detector does not detect said passenger and said second detector detects said passenger.

3. The automatic operation device for the passenger conveyor according to claim 1 or 2, **characterized in that:**

the first detector is a reflection type detector for irradiating an energy wave and detecting approach of the passenger by a reflection wave thereof, and the second detector is a transmission type detector for projecting an energy beam across the gate side and detecting passing of said passenger when the energy beam is cut off.

4. The automatic operation device for the passenger conveyor according to any one of claims 1 to 3, **characterized by** further comprising:

a speed detector for detecting a moving speed of the steps;
passenger detector failure judging means for

judging whether or not a state in which the second detector detects a passenger before the moving speed of said steps actuated as a result that the first detector detects the passenger reaches a specified speed occurs successively for the predetermined number of times or more; and
 actuation judging means for outputting a command to operate said steps continuously at a rated speed when said passenger detector failure judging means judges that the state in which the second detector detects said passenger occurs successively for the predetermined number of times or more.

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5. The automatic operation device for the passenger conveyor according to claim 2, **characterized by** further comprising:

automatic operation returning means for returning to the automatic operation again when the first detector detects a passenger after the steps shift to the continuous operation.

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6. The automatic operation device for the passenger conveyor according to any one of claims 1 to 3, **characterized by** further comprising:

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a history memory; and
 passenger detector failure judging means for outputting a malfunction signal outside and recording a history of the malfunction judgment to said history memory when the first detector does not detect a passenger and the second detector detects the passenger, or when a state in which said second detector detects said passenger before the steps reach a specified speed after said first detector detects said passenger occurs successively for the predetermined number of times or more.

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Fig. 1

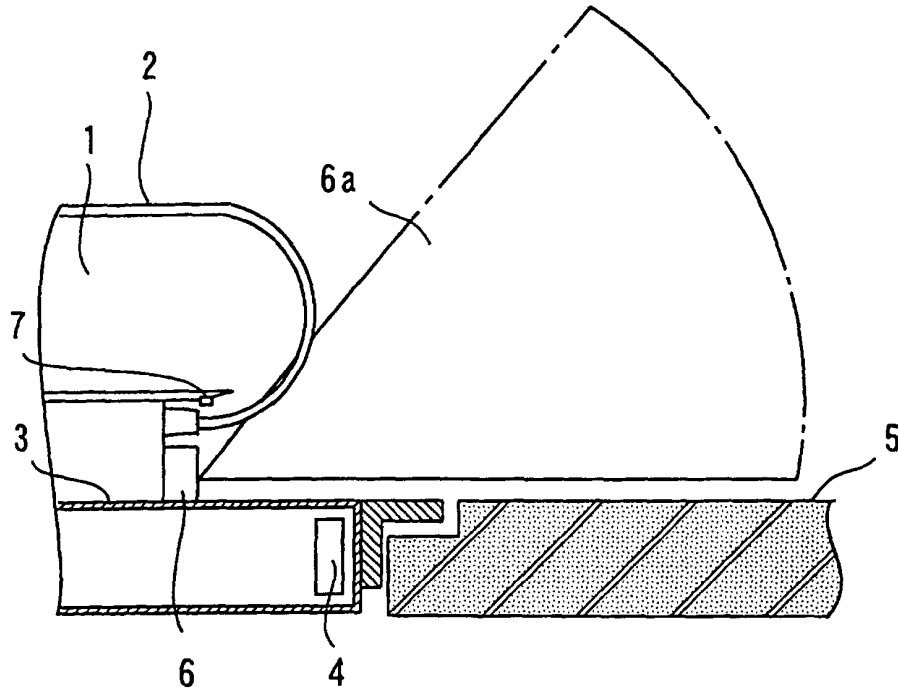


Fig. 2

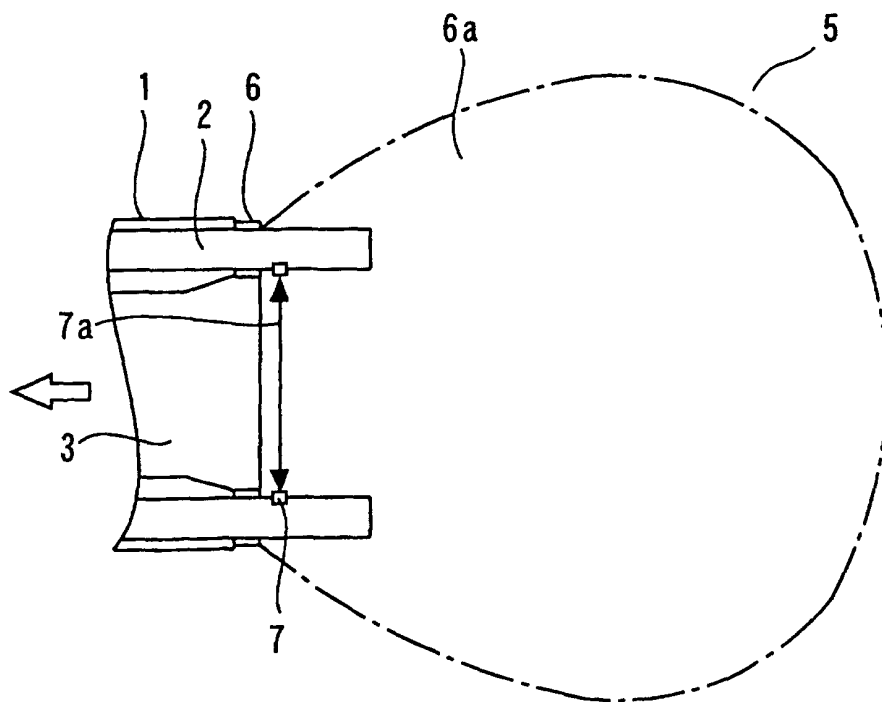


Fig. 3

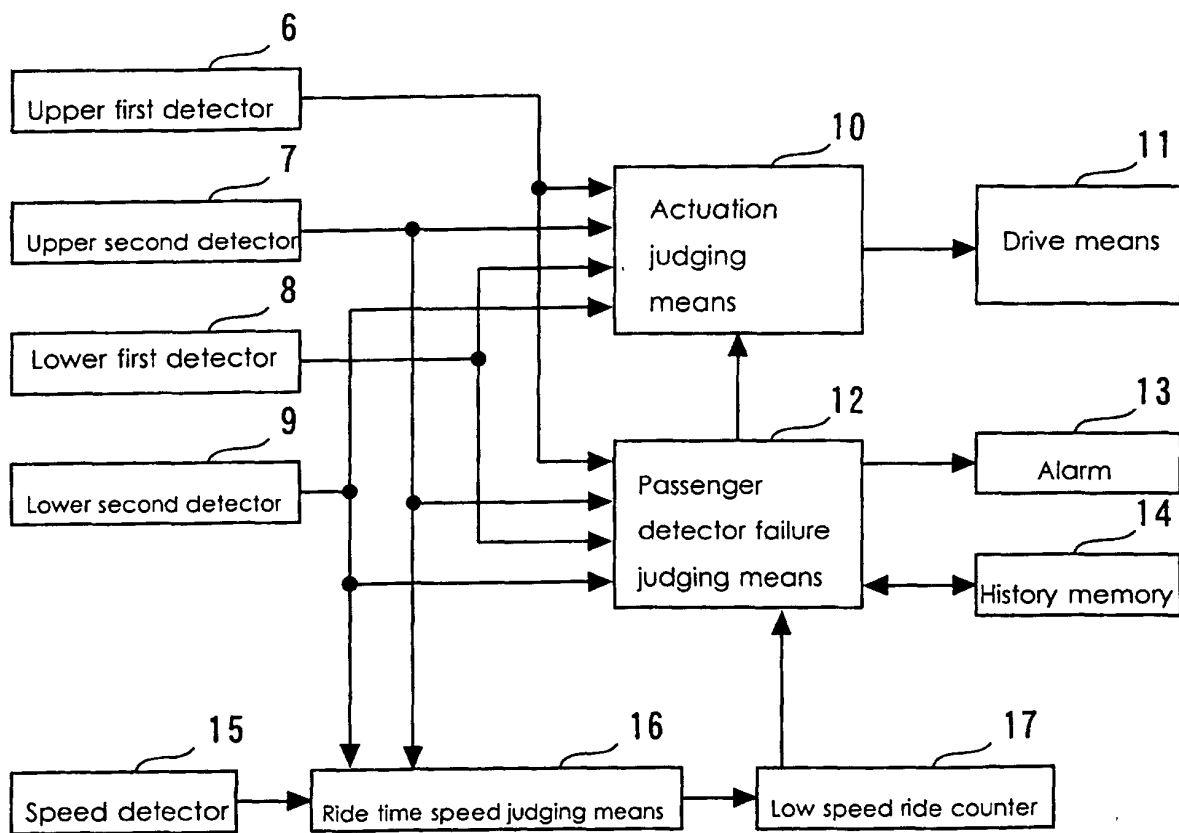


Fig. 4

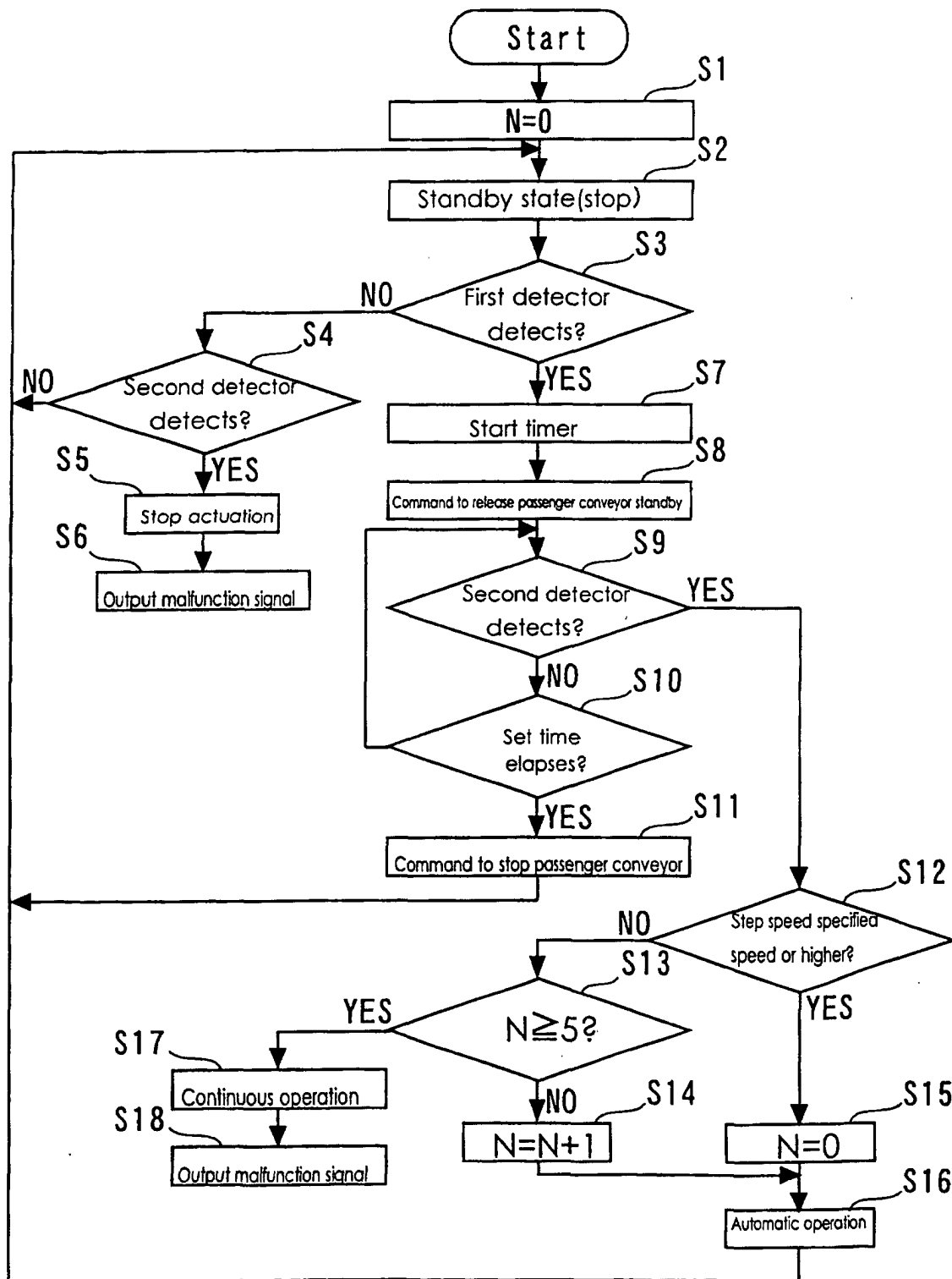
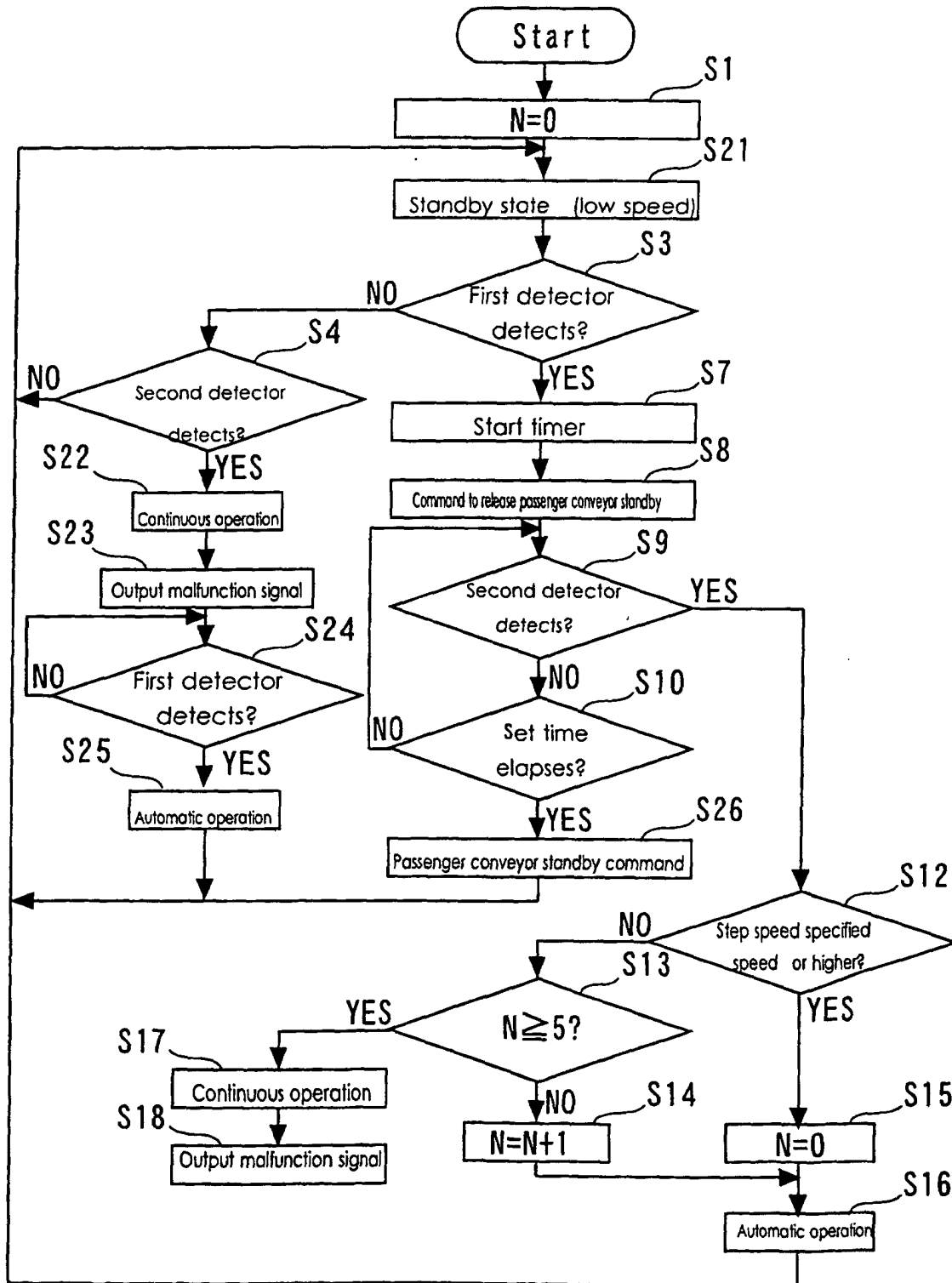


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/04781

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ B66B25/00		
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) Int.Cl. ⁷ B66B21/00-B66B31/02		
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 1996-2003 Kokai Jitsuyo Shinan Koho 1971-2003 Toroku Jitsuyo Shinan Koho 1994-2003		
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.
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Y	JP 1-281288 A (Mitsubishi Electric Corp.), 13 November, 1989 (13.11.89), (Family: none)	1, 3
Y	WO 00/69766 A1 (Mitsubishi Electric Corp.), 23 November, 2000 (23.11.00), Abstract; page 14; Figs. 10 to 11 & EP 1097898 A1 & US 2001/0002644 A1	1, 3
A	JP 48-37881 A (Tokyo Shibaura Electric Co., Ltd.), 04 June, 1973 (04.06.73), (Family: none)	1
☒ 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 document 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		"T" 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 05 February, 2003 (05.02.03)		Date of mailing of the international search report 18 February, 2003 (18.02.03)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/04781

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP 61-57274 B2 (Hitachi, Ltd.), 05 December, 1986 (05.12.86), & JP 57-67468 A	2
A	JP 59-114284 A (Mitsubishi Electric Corp.), 02 July, 1984 (02.07.84), (Family: none)	2, 4, 5
A	JP 11-349269 A (Hitachi, Ltd.), 21 December, 1999 (21.12.99), (Family: none)	6

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