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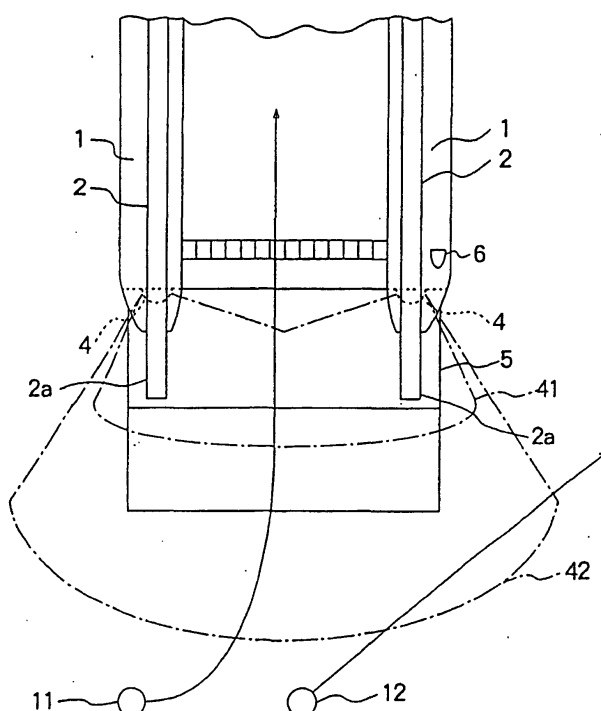
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(54) **PASSENGER CONVEYER CONTROLLER AND OPERATION CONTROL METHOD**

(57) In a control apparatus for a passenger conveyor, an operation mode is switched by means of a mode switching circuit, in accordance with information from a passenger detecting device. Status of the operation mode switching control performed by the mode switching circuit is selectably switched between a first switch-

ing control status and a second switching control status, by a control status switching unit. In the first switching control status, the operation mode is switched among a stop/standby mode, a low speed mode and a transportation mode. In the second switching control status, it is switched between the low speed mode and the transportation mode.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a passenger conveyor such as an escalator or a moving walk. More particularly, the invention relates to a control apparatus and an operation controlling method for a passenger conveyor in which operating modes are automatically switched over in accordance with the absence/presence of passengers.

BACKGROUND ART

[0002] Conventionally, in a stop type automatic operating system passenger conveyor, sensors are provided on poles provided at an entrance gate. The conveyor is in standby with the operation thereof stopped when no passengers are detected and the conveyor is operated at a rated speed when a passenger is detected by the sensors.

[0003] A so-called low speed automatic operating system can also be provided in contrast to the above-described stop type automatic operation system.

[0004] For example, Japanese Patent Application Laid-Open No. Sho 62-275990 shows a control method in which a passenger conveyor stands by at a low speed operation, is accelerated in accordance with a detection signal of a passenger detection device, and is again decelerated after a predetermined period of time.

[0005] Also, Japanese Patent Publication No. Hei 5-5572 discloses a method in which after a passenger conveyor has been accelerated from a low speed operation by a VVVF inverter, the drive source is switched over to a commercial power source to thereby perform a rated speed operation.

[0006] In such low speed automatic operating systems, since low speed operation is continued even during standby conditions, it is possible to omit or simplify the automatic operation display lamps or operating direction display lamps. Also, in the case where the passenger conveyor is gradually accelerated by the inverter, even if a passenger were to ride on the conveyor during the acceleration operation, it is very unlikely that the passenger would fall down. Accordingly, it is possible to place the passenger detection positions just before the passenger entrance and exit gates. It is therefore possible to dispense with the guide railings and easily incorporate the passenger detection device into the passenger conveyor.

[0007] However, the energy saving effect in the low speed automatic operating system is degraded compared with the stop type system because low speed operation is performed even during the standby condition.

[0008] In contrast, Japanese Patent Application Laid-Open No. Sho 57-72581 and Japanese Patent Application Laid-Open No. Sho 61-162485 disclose a control method in which if no passengers are detected for a pre-

determined period of time while the passenger conveyor is standing by at low speed operation, operation is stopped and the conveyor stands by. However, in this case, since the conveyor is stopped for the standby mode when it is not busy, as in the stop type automatic operating system, it is necessary to provide the automatic operation display lamps and the operating direction display lamps.

[0009] In addition, Japanese Patent Application Laid-Open No. Sho 55-161770, Japanese Patent Application Laid-Open No. Sho 64-14784 and Japanese Patent Application Laid-Open No. Hei 4-58582 disclose a control method in which the operating speed is changed in accordance with the absence/presence of passengers.

[0010] Also, Japanese Patent Application Laid-Open No. Sho 62-269882 discloses a control method in which, in accordance with an output from a device for detecting the number of passengers per unit time the low speed operation is performed when there is no-load and the rated speed operation is performed when passengers are detected.

[0011] Furthermore, Japanese Patent Application Laid-Open No. Hei 1-281288 discloses a method in which sensors are arranged at an end portion of the handrail and the ceiling, respectively, and when a passenger is detected by either one of the sensors, the operation is started.

[0012] Also, Japanese Patent Application Laid-Open No. Hei 3-243591 discloses a control method in which a first detecting device is provided at the entrance and exit gates and a second detecting device is provided in the vicinity of the comb portion so that the passenger conveyor is started by the first detecting device and a counting operation according to a timer is started with the second detecting device, the operation of the passenger conveyor being stopped after a predetermined period of time.

[0013] As described above, the conventional stop type automatic operation system needs additional equipment such as poles, automatic operation display lamps, operating direction display lamps and guide railings. Also, the energy saving effect of the conventional low speed automatic operating system is low compared to the stop type because the low speed operation is performed during standby.

[0014] Also, Japanese Patent Publication No. Sho 61-57274 discloses a passenger conveyor operating apparatus which comprises a transit passenger detecting device for detecting the absence/presence of a passenger before the entrance gate and a riding passenger detecting device for detecting advance of the passenger to a step board of the entrance gate portion. A drive device is switched over from suspended operation to low speed operation in accordance with a detection signal from the transit passenger detecting device, and the drive device is switched over from low speed operation to regular speed operation in accordance with the detection signal from the riding passenger detecting de-

vice.

[0015] It is to be noted here that actual usage conditions of the passenger conveyor by passengers change depending on installation environment and time period. Examples of conceivable usage conditions are 1) commuter rush in a station building (substantially constant usage), 2) normal time periods in a station building (light usage, every 10 - 50 seconds without interruption), 3) after midnight in a station building (usage 1 time every few minutes), 4) holidays in a shopping center (scattered usage every 10 - 50 seconds without interruption), and 5) weekdays in a shopping center (usage 1 time every few minutes).

[0016] Under usage conditions such as in 1 above, regardless of whether the low speed automatic operating system or the stop type automatic operating system is adopted, as long as passengers use the passenger conveyor without interruption the passenger conveyor continues to operate at a rated speed without a change in its operating mode. However, depending on the length of the time periods passengers do not use the passenger conveyor and depending on how frequently these periods occur, differences regarding their operating modes will be generated between the operating systems. As such, differences in passenger convenience and in an energy saving effect are generated depending on which operating system is adopted.

[0017] Further, with the low speed automatic operating system the passenger conveyor is operated at a low speed during standby. As a result, the energy saving effect is smaller than the stop type automatic operating system. Therefore, the low speed automatic operating system is suitable for avoiding deterioration of passenger service under usage conditions with relatively frequent usage, such as in 2 and 4 above, but the energy saving effect is insufficient for conditions with infrequent usage, such as in 3 and 5.

[0018] On the other hand, in the case of the stop type automatic operating system, the energy saving effect is greater than the low speed automatic operating system. However, even when information is displayed by means of automatic operation display lamps and operating direction display lamps, there are instances when passengers mistakenly think operation of the passenger conveyor has stopped. Further, depending on the frequency of use, starting and stopping are frequently repeated, reducing the convenience of the passenger conveyor. In other words, the stop type automatic operating system is suitable for increasing the energy saving effect under usage conditions such as in 3 and 5 above, but convenience deteriorates under conditions such as in 2 and 4 above.

DISCLOSURE OF THE INVENTION

[0019] The present invention has been made to solve the above-mentioned problems, and has as an object to obtain a control apparatus and an operation controlling

method for a passenger conveyor in which the most suitable operating mode can be selected in accordance with usage conditions.

[0020] To this end, according to one aspect of the present invention, there is provided a control apparatus for a passenger conveyor, comprising: a control apparatus main unit for controlling operation of the passenger conveyor by means of a plurality of operating modes including a stop/standby mode stopping operation to stand by, a transportation mode transporting passengers and a low speed mode operating at a lower speed than that of the transporting mode; a passenger detecting device for monitoring to distinguish absence/presence of passengers within a first zone including an area above a floor board of an entrance gate, from absence/presence of passengers within a second zone adjacent to the outside of the first zone so as to cover the first zone; a mode switching circuit for switching the operating mode in accordance with information from the passenger detecting device; and a control status switching unit for switching the operating mode switching control status performed by the mode switching circuit, between a first switching control status and a second switching control status, wherein in the first switching control status, the operating mode is in the stop/standby mode during standby, and when a passenger is detected within the second zone during the stop/standby mode the operating mode is switched over to the low speed mode, and when a passenger is detected within the first zone during the low speed mode the operating mode is switched to the transporting mode; and in the second switching control status, the operating mode is in the low speed mode during standby, and when a passenger is detected within the first zone during the low speed mode the operating mode is switched over to the transporting mode.

[0021] According to another aspect of the present invention, there is provided an operation controlling method for a passenger conveyor for monitoring to distinguish absence/presence of passengers within a first zone including an area above a floor board of an entrance gate, from absence/presence of passengers within a second zone adjacent to the outside of the first zone so as to cover the first zone, and for switching among a plurality of operation modes according to the absence/presence of passengers in the first and second zones, to control the operation of the passenger conveyor, wherein: the operating modes include a stop/standby mode stopping operation to stand by, a transportation mode transporting passengers, and a low speed mode operating at a lower speed than that of the transporting mode; status of the operating mode switching control can be switched between a first switching control status and a second switching control status; in the first switching control status, the operating mode is in the stop/standby mode during standby, and when a passenger is detected within the second zone during the stop/standby mode the operating mode is switched over

to the low speed mode, and when a passenger is detected within the first zone during the low speed mode the operating mode is switched over to the transporting mode; and in the second switching control status, the operating mode is in the low speed mode during stand-
by, and when a passenger is detected within the first zone during the low speed mode the operating mode is switched over to the transporting mode.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

Fig. 1 is a plan view showing an entrance gate of a passenger conveyor in accordance with Embodiment 1 of the present invention;

Fig. 2 is a side elevational view showing the entrance gate shown in Fig. 1;

Fig. 3 is a front view showing the entrance gate shown in Fig. 1;

Fig. 4 is an enlarged view showing a display device shown in Fig. 3;

Fig. 5 is a block diagram showing a control apparatus for the passenger conveyor shown in Fig. 1;

Fig. 6 is a plan view showing an exit gate of the passenger conveyor shown in Fig. 1;

Fig. 7 is a plan view showing the exit gate shown in Fig. 1 in a second switching control status;

Fig. 8 is an explanatory diagram showing an example of a control status switching unit shown in Fig. 5;

Fig. 9 is a block diagram showing a control apparatus for a passenger conveyor in accordance with Embodiment 2 of the present invention;

Fig. 10 is an explanatory diagram showing an example of a switching method for switching the switching control status as is performed by the control apparatus shown in Fig. 9; and

Fig. 11 is an explanatory diagram showing another example of a switching method for switching the switching control status performed by the control apparatus shown in Fig. 9.

BEST MODE FOR CARRYING OUT THE INVENTION

[0023] Preferred embodiments of the present invention will be described below with reference to the accompanying drawings.

Embodiment 1

[0024] Fig. 1 is a plan view showing an entrance gate of a passenger conveyor in accordance with Embodiment 1 of the present invention, Fig. 2 is a side elevational view showing the entrance gate shown in Fig. 1, and Fig. 3 is a front view showing the entrance gate shown in Fig. 1.

[0025] In the drawings, moving handrails 2 are provided on a pair of balustrades 1, respectively. A passen-

ger detecting device 4 for detecting absence/presence of a passenger is provided in a lower portion of a handrail return port 3 of each balustrade 1. For example, devices having reflective photo detection type sensors with light emitting portions and light receiving portions may be used as these passenger detecting devices 4. Also, for example, ultrasonic wave sensors or the like may be used.

[0026] Moreover, the passenger detecting devices 4 monitor to distinguish the presence/absence of a passenger within a first zone 41 at the entrance gate side, including an entrance floor board 5, from the presence/absence of a passenger within a second zone 42 at the entrance gate side and adjacent to the outside of the first zone 41 so as to cover the first zone 41. The first zone 41 is a range in which the passenger is about to ride on the passenger conveyor from a range slightly projecting from the handrail return portions 2 at both sides, for example.

[0027] The second zone 42 is wider than the first zone 41 in consideration of the approach path of passengers. The first zone 41 and the second zone 42 may partially overlap each other. For instance, the detection range of the passenger conveyor in the longitudinal direction is about 1.0 to 2.0 m from the handrail return portions 2a. Also, the first and second zones 41 and 42 include a region outside of the handrail return portion 2a on both sides of the passenger conveyor. Thus, it is possible to detect a passenger who detours around the entrance/exit gates from outside of the handrail return portions 2a.

[0028] A display device 6 for showing the automatic operation display, operating direction display and the like is provided on a balustrade 1. Fig. 4 is an enlarged view showing the display device 6 in Fig. 3. The operating mode such as, for example, "low speed operation" or the like is displayed in the display device 6.

[0029] Fig. 5 is a block diagram showing a control apparatus for the passenger conveyor shown in Fig. 1. A signal from the passenger detecting device 4 is outputted to a mode switching circuit 7. The mode switching circuit 7 switches over the operating mode of the control apparatus main unit 8 in accordance with information from the passenger detecting device 4. The control apparatus main unit 8 controls the operation of the passenger conveyor by means of a plurality of operating modes including a stop/standby mode in which the operation is stopped and the conveyor is standing by, a transportation mode transporting passengers, a low speed mode operating at a lower speed than that of the transporting mode and a warning mode for informing a passenger trying to enter through the exit gate that the operating direction is in the opposite direction.

[0030] In the operating mode switching control performed by the mode switching circuit 7, a switching control status (control method) is selectably switched between a first switching control status and a second switching control status. The display device 6 also displays whether the switching control status is in the first

switching control status or the second switching control status.

[0031] Connected to the control apparatus main unit 8 are the display device 6, a drive motor 10 for driving the passenger conveyor, and warning means 20 for emitting a warning to passengers near the exit gate.

[0032] Next, the control method performed by the control apparatus shown in Fig. 5 will be explained. In the first switching control status (the stop type automatic operating system) the operating mode is switched to the stop/standby mode during standby. When a passenger is detected within the second zone 42 during the stop/standby mode, the operating mode is switched to the low speed mode. When a passenger is detected within the first zone 41 during the low speed mode, the operating mode is switched to the transporting mode.

[0033] In the transporting mode, the passenger conveyor is operated at a rated speed for as long as the duration of time set in advance (duration of time produced by adding the duration of a leeway time to the time needed to transport the passenger). Further, sensors are provided to the exit gate side, and the passenger conveyor may be stopped after a given duration of time elapses once the last passenger exits.

[0034] Further, while in the low speed mode, when the duration of time during which no passengers are detected in either the first or the second zones 41, 42 exceeds a set duration of time (for example 0 - 10 seconds), the control apparatus main unit 8 operating mode is returned to the stop/standby mode.

[0035] On the other hand, in the second switching control status (the low speed automatic operating system), the operating mode is switched to the low speed mode during standby. When a passenger is detected within the first zone 41 during the low speed mode, the operating mode is switched to the transporting mode.

[0036] The exit gate of the passenger conveyor is provided with the passenger detecting device 4 and the display device 6 similarly to the entrance gate, as shown in Fig. 6. Then, the passenger detecting device 4 detects the absence/presence of passengers on the exit side as well, within the first and second zones 41, 42 on the exit side.

[0037] Further, in the first switching control status, when passengers are detected within the second zone 42 on the exit gate side during the stop/standby mode, the operating mode is switched to the low speed mode. When passengers are detected within the first zone 41 on the entrance gate side during the low speed mode, the operating mode is switched to the warning mode.

[0038] In the warning mode, in addition to the passenger conveyor operating in the normal direction, a warning is issued by the warning means 20 to a passenger trying to enter from the exit gate side, and the passenger is informed that the operating direction is in the opposite direction.

[0039] Next, operation on the entrance gate side in the first switching control status will be explained. In the

case where passengers are not riding the passenger conveyor and no passengers are detected in the vicinity of the entrance/exit gate, the operating mode of the control apparatus main unit 8 is the stop/standby mode, and the operation of the passenger conveyor is stopped. In this state, in the case where a passenger 11 shown in Fig. 1 enters the passenger conveyor along the path of the arrow, first, when the passenger 11 enters the second zone 42, the operating mode switches over to the low speed mode. Accordingly, the passenger conveyor begins low speed operation. Then, when the passenger 11 enters the first zone 41, the operating mode is switched to the transporting mode and the passenger 11 is transported by the passenger conveyor.

[0040] Further, in the case where a passenger 12, as shown in Fig. 1, cuts across the second zone 42 along the path of the arrow, when the passenger 12 enters the second zone 42, the operating mode is switched to the low speed mode and the passenger conveyor is operated at low speed. However, after the passenger 12 leaves the second zone 42, when a set duration of time elapses the operating mode is returned to the stop/standby mode, and the operation of the passenger conveyor is stopped.

[0041] Next, operation on the exit gate side in the first switching control status will be explained. In the stop/standby mode, in the case where a passenger 14, as shown in Fig. 6, enters the second zone 42 on the exit gate side, the operating mode is switched to the low speed mode. Accordingly, the passenger conveyor begins low speed operation in its normal direction. As a result, the passenger 14 notices that he/she was trying to enter from the opposite direction, and he/she backs off from the exit gate in the direction of the arrow.

[0042] However, when a passenger 15 having entered the second zone 42 on the exit gate side enters the first zone 41 on the exit gate side without noticing the low speed operation, the operating mode is switched to the warning mode, in which a warning is emitted by the warning means 20 and the passenger conveyor is operated at the rated speed. As a result, the passenger 14 notices that he/she was trying to enter from the opposite direction, and he/she backs off from the exit gate as indicated by the arrow.

[0043] Further, in the case where a passenger 16, as shown in Fig. 6, cuts across the second zone 42 on the exit gate side along the path of the arrow, when the passenger 16 enters the second zone 42, the operating mode is switched to the low speed mode and the passenger conveyor is operated at low speed. However, after the passenger 16 leaves the second zone 42, when a set duration of time elapses the operating mode is returned to the stop/standby mode, and the operation of the passenger conveyor is stopped.

[0044] Next, operation on the entrance gate side in the second switching control status will be explained. In the second switching control status, the absence/presence of passengers is detected only in the first zone 41.

The operating mode is in the low speed mode during standby. During operation in the low speed mode, when a passenger 17 enters the first zone 41 as shown in Fig. 7, the operating mode is switched to the transporting mode, and the passenger 17 is transported by the passenger conveyor.

[0045] Further, at the exit gate side in the second switching control status, when the operating mode is in standby in the low speed mode and a passenger enters the first zone 41 on the exit gate side without noticing the low speed operation, the operating mode is switched to the warning mode, in which a warning is emitted by the warning means 20 and the passenger conveyor is operated at the rated speed.

[0046] Next, Fig. 8 is an explanatory diagram showing an example of a control status switching unit 9 shown in Fig. 5, and shows an example of an escalator installed in a station. Arranged in the underfloor of the escalator's upper entrance/exit gate is an escalator control panel 21 for controlling the operation of the escalator. The escalator control panel 21 is provided with a control status switching circuit 22 for outputting the signal to a mode switching circuit 7. Connected to the control status switching circuit 22 is a time switch 23.

[0047] The usage conditions of the escalator are monitored by means of a plurality of ITV's (industrial television) 24. The images captured by the ITV's 24 are produced on an ITV monitor 26 inside a station staff room 25. The station staff room 25 is provided with a switching portion 27 which is connected to the control status switching circuit 22 and which operated manually. In this example, the control status switching unit 9 comprises the control status switching circuit 22, the time switch 23 and the switching portion 27.

[0048] In the above-mentioned control status switching unit 9, the switching control status is automatically switched according to the time duration set into the time switch 23 in advance. Further, the station staff in the station staff room can watch the ITV monitor 26 to judge the escalator usage conditions, and manually manipulate the switching portion 27. The switching control status may also be switched in this way.

[0049] Here, automatic switching and remote manual switching which are performed by means of the time switch 23 are shown, but it is also possible to manually manipulate a key switch (not shown) which is provided to the passenger conveyor, to manually switch the switching control status from where the key switch is installed. Further, the switching control status may also be automatically switched according to a program inputted into a microcomputer.

[0050] In the above-mentioned control apparatus for the passenger conveyor, the first and second switching control statuses are switched according to the usage conditions of the passenger conveyor, and stop type automatic operation and low speed automatic operation are used separately as appropriate. As a result, the most appropriate operating mode can be selected in accordance

with the usage conditions, and energy saving effects can be enhanced while improving passenger convenience.

[0051] Further, in the first switching control status, since low speed operation is begun when a passenger reaches a position slightly distanced from the entrance gate or the exit gate, passengers are prevented from mistakenly thinking that the passenger conveyor is stopped. Further, a passenger is able to visually confirm the operating direction when he/she has entered the second zone 42. Therefore, the display device 6, such as the automatic operation display lamps or the operating direction display lamps, can be relatively simple, and can be attached to designed parts such as a balustrade 1.

[0052] Moreover, in the case where a passenger cuts across the second zone 42 like passenger 12 shown in Fig. 1 and passenger 16 shown in Fig. 6, since the low speed operation is only performed temporarily, it is possible to suppress energy losses caused by starting up operations.

[0053] Further, since the first and second zones 41, 42 also include areas on the outside of both handrail return portions 2a, it is possible to detect passengers coming around to the entrance gate or to the exit gate from the outside of the handrail return portions 2a, and so guide railing becomes unnecessary.

[0054] Further, since the passenger detecting device 4 having reflected light detecting sensors is provided at the balustrade 1, it is not necessary to provide equipment such as poles to incorporate sensors.

[0055] Moreover, by making the ranges of the first and second zones 41, 42 on the entrance gate side and on the exit gate side the same, the construction of the passenger detecting device 4 at the entrance gate and at the exit gate can be made identical, whereby maintenance and adjusting operations and the like become easy.

[0056] Further, since the display device 6 displays whether the switching control status is the first or second switching control status, even during low speed operation and during operation at the rated speed, the manager of the passenger conveyor can easily grasp the switching control status.

[0057] Further, since the first switching control status and the second switching control status both use the first zone 41, costs for the passenger detecting device 4 can be reduced.

Embodiment 2

[0058] Next, Fig. 9 is a block diagram showing a control apparatus for an escalator in accordance with Embodiment 2 of the present invention. In the diagram, a passenger detection frequency comparator circuit 28 and a mode switching frequency comparator circuit 29 are connected to the control status switching unit 9, and the first and second switching control statuses are

switched by the control status switching unit 9 according to information from these circuits 28, 29.

[0059] Namely, the mode switching frequency comparator circuit 29 compares the frequency of the starting/stopping of the passenger conveyor to a preset frequency that has been set in advance. As shown in Fig. 10, in the first switching control status, when starting/stopping is performed at a higher frequency than the preset frequency, the control status switching unit 9 switches over the switching control status to the second switching control status at the point in time T1 shown in Fig. 10.

[0060] Further, the passenger detection frequency comparator circuit 28 compares the frequency at which passengers are detected by the passenger detecting device 4 to the preset frequency that has been set in advance. As shown in Fig. 11, in the second switching control status, when the passenger detection frequency of the first zone 41 at the entrance gate and at the exit gate falls below the preset frequency, the control status switching unit 9 switches the switching control status over to the first switching control status at the point in time T2 shown in Fig. 11.

[0061] Note that, when monitoring the frequency of passenger detection, both the first and the second zones 41, 42 may be monitored. However, since passengers by such as passenger 12 shown in Fig. 1 will also cause the switching control status to switch, it is desirable to monitor only the first zone 41.

[0062] In accordance with the control apparatus described above, the frequency of the starting/stopping of the passenger conveyor is monitored to automatically perform the switch from the first switching control status to the second switching control status, thereby improving convenience.

[0063] Further, the frequency of passenger detection is monitored to automatically perform the switch from the second switching control status to the first switching control status, whereby the energy saving effect can be enhanced.

Claims

1. A control apparatus for a passenger conveyor, comprising:

a control apparatus main unit for controlling operation of the passenger conveyor by means of a plurality of operating modes including a stop/standby mode stopping operation to stand by, a transportation mode transporting passengers and a low speed mode operating at a lower speed than that of the transporting mode;
a passenger detecting device for monitoring to distinguish absence/presence of passengers within a first zone including an area above a floor board of an entrance gate, from absence/

presence of passengers within a second zone adjacent to the outside of the first zone so as to cover the first zone;

a mode switching circuit for switching the operating mode in accordance with information from the passenger detecting device; and
a control status switching unit for switching the operating mode switching control status performed by the mode switching circuit, between a first switching control status and a second switching control status,

wherein in the first switching control status, the operating mode is in the stop/standby mode during standby, and when a passenger is detected within the second zone during the stop/standby mode the operating mode is switched over to the low speed mode, and when a passenger is detected within the first zone during the low speed mode the operating mode is switched to the transporting mode; and

the second switching control status, the operating mode is in the low speed mode during standby, and when a passenger is detected within the first zone during the low speed mode the operating mode is switched over to the transporting mode.

2. The control apparatus for a passenger conveyor according to claim 1, wherein the control status switching unit has a switching portion for manually manipulating the switching.
3. The control apparatus for a passenger conveyor according to claim 1, wherein the control status switching unit automatically switches the switching control status according to a duration of time based on information inputted in advance.
4. The control apparatus for a passenger conveyor according to claim 1, wherein: the operating mode includes a warning mode for informing a passenger trying to enter from an exit gate that the operating direction is the opposite direction; in addition to the first and the second zones at the entrance gate, the passenger detecting device monitors the absence/presence of passengers near the exit gate; and in the first switching control status, when the operating mode is in the stop/standby mode and a person is detected near the exit gate, the operating mode is switched over to the warning mode.
5. The control apparatus for a passenger conveyor according to claim 4, wherein operation in a normal direction is performed in the warning mode.
6. The control apparatus for a passenger conveyor according to claim 1, further comprising a mode switch frequency comparator circuit for comparing start-

ing/stopping frequency against a preset frequency, wherein when in the first switching control status the starting/stopping is performed at a higher frequency than the preset frequency, the switching control status is switched over to the second switching control status by the control status switching unit.

7. The control apparatus for a passenger conveyor according to claim 1, further comprising a passenger detection frequency comparator circuit for comparing frequency of passenger detection by the passenger detecting device against a preset frequency, wherein when the frequency of passenger detection drops below the preset frequency in the second switching control status, the switching control status is switched over to the first switching control status by the control status switching unit.
8. The control apparatus for a passenger conveyor according to claim 1, further comprising a display device arranged near at least one of the entrance gate and the exit gate, for displaying whether the switching control status is in the first or the second switching control status.
9. An operation controlling method for a passenger conveyor for monitoring to distinguish absence/presence of passengers within a first zone including an area above a floor board of an entrance gate, from absence/presence of passengers within a second zone adjacent to the outside of the first zone so as to cover the first zone, and for switching among a plurality of operation modes according to the absence/presence of passengers in the first and second zones, to control the operation of the passenger conveyor, wherein:

the operating modes include a stop/standby mode stopping operation to stand by, a transportation mode transporting passengers, and a low speed mode operating at a lower speed than that of the transporting mode; status of the operating mode switching control can be switched between a first switching control status and a second switching control status; in the first switching control status, the operating mode is in the stop/standby mode during standby, and when a passenger is detected within the second zone during the stop/standby mode the operating mode is switched over to the low speed mode, and when a passenger is detected within the first zone during the low speed mode the operating mode is switched over to the transporting mode; and in the second switching control status, the operating mode is in the low speed mode during standby, and when a passenger is detected

within the first zone during the low speed mode the operating mode is switched over to the transporting mode.

10. The operation controlling method for a passenger conveyor according to claim 9, wherein: starting/stopping frequency is compared against a preset frequency; and when in the first switching control status the starting/stopping is performed at a higher frequency than the preset frequency, the switching control status is switched over to the second switching control status.
11. The operation controlling method for a passenger conveyor according to claim 9, wherein: frequency of passenger detection is compared against a preset frequency; and when the frequency of passenger detection drops below the preset frequency in the second switching control status, the switching control status is switched over to the first switching control status.

FIG. 1

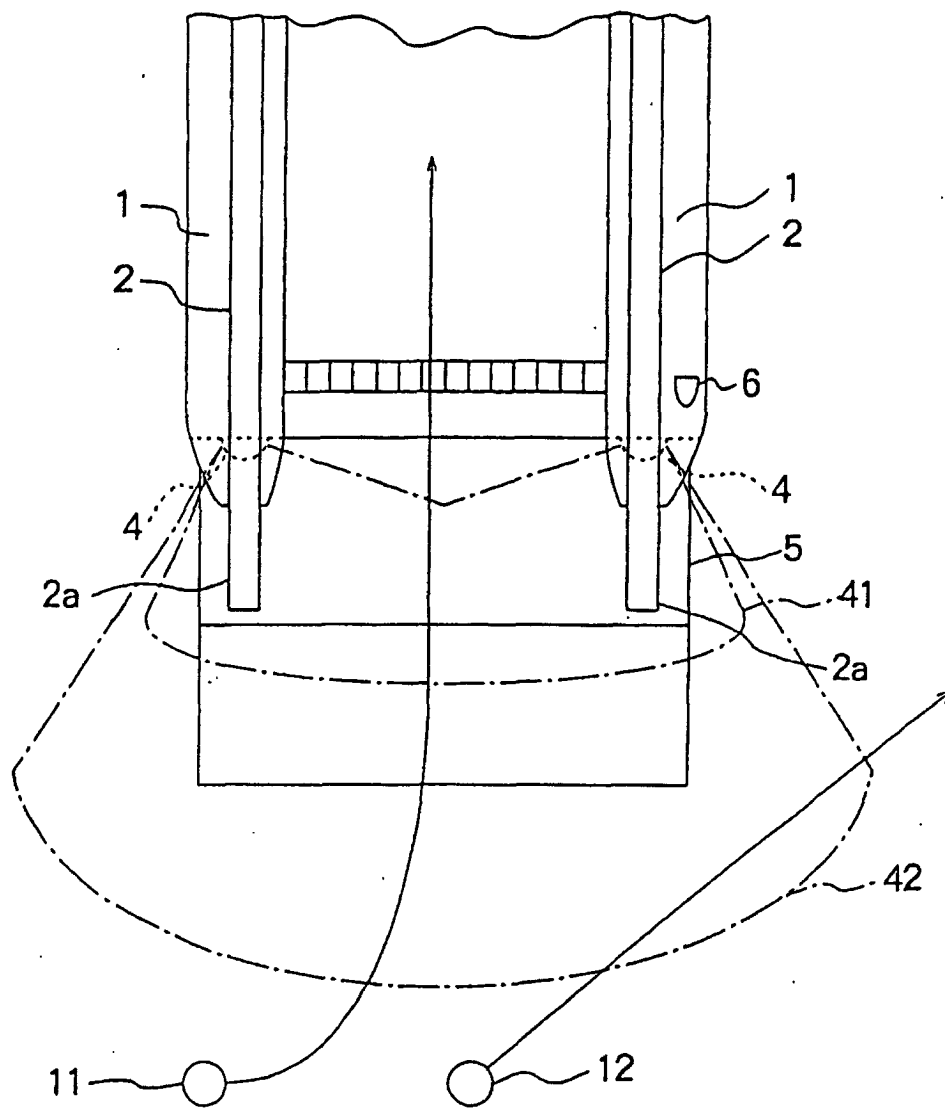


FIG. 2

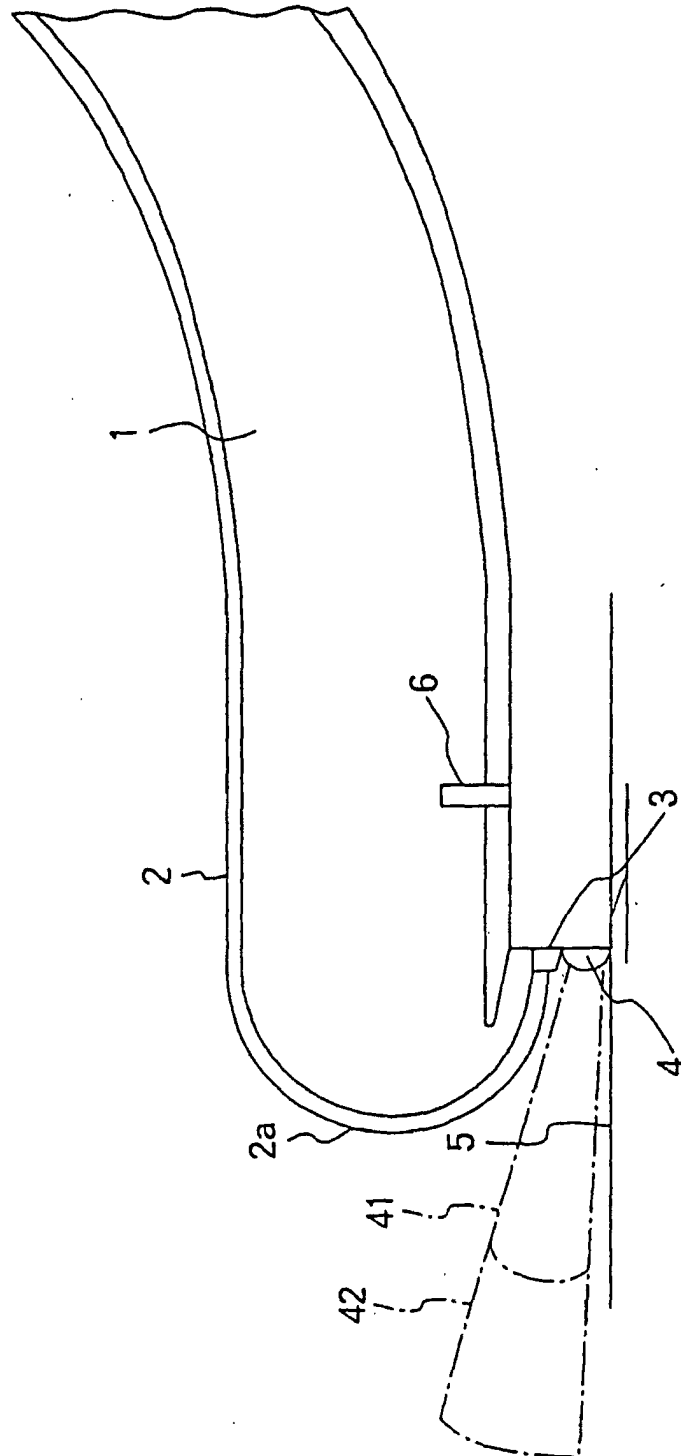


FIG. 3

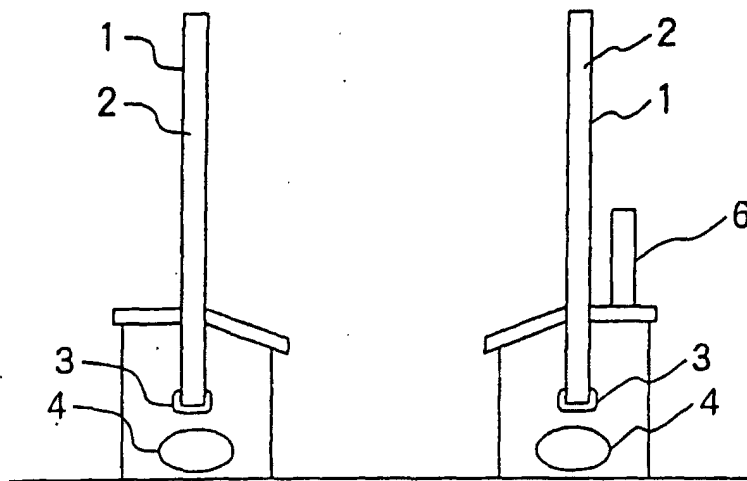


FIG. 4

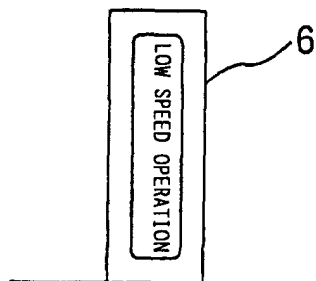


FIG. 5

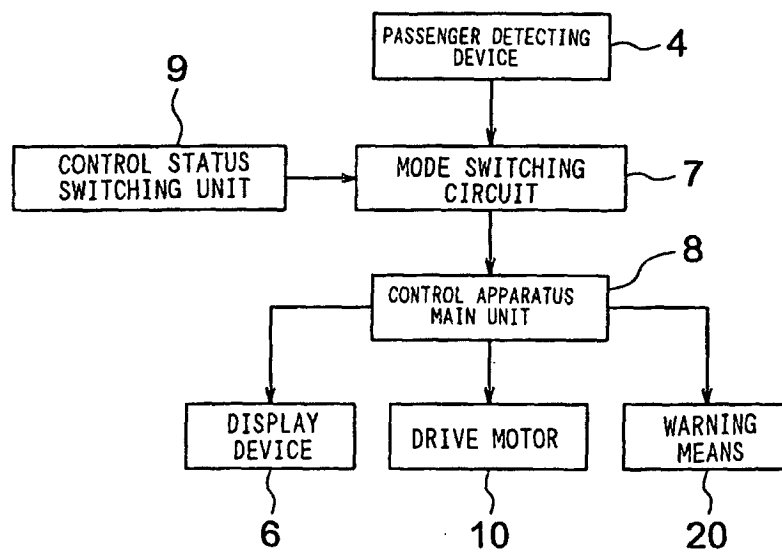


FIG. 6

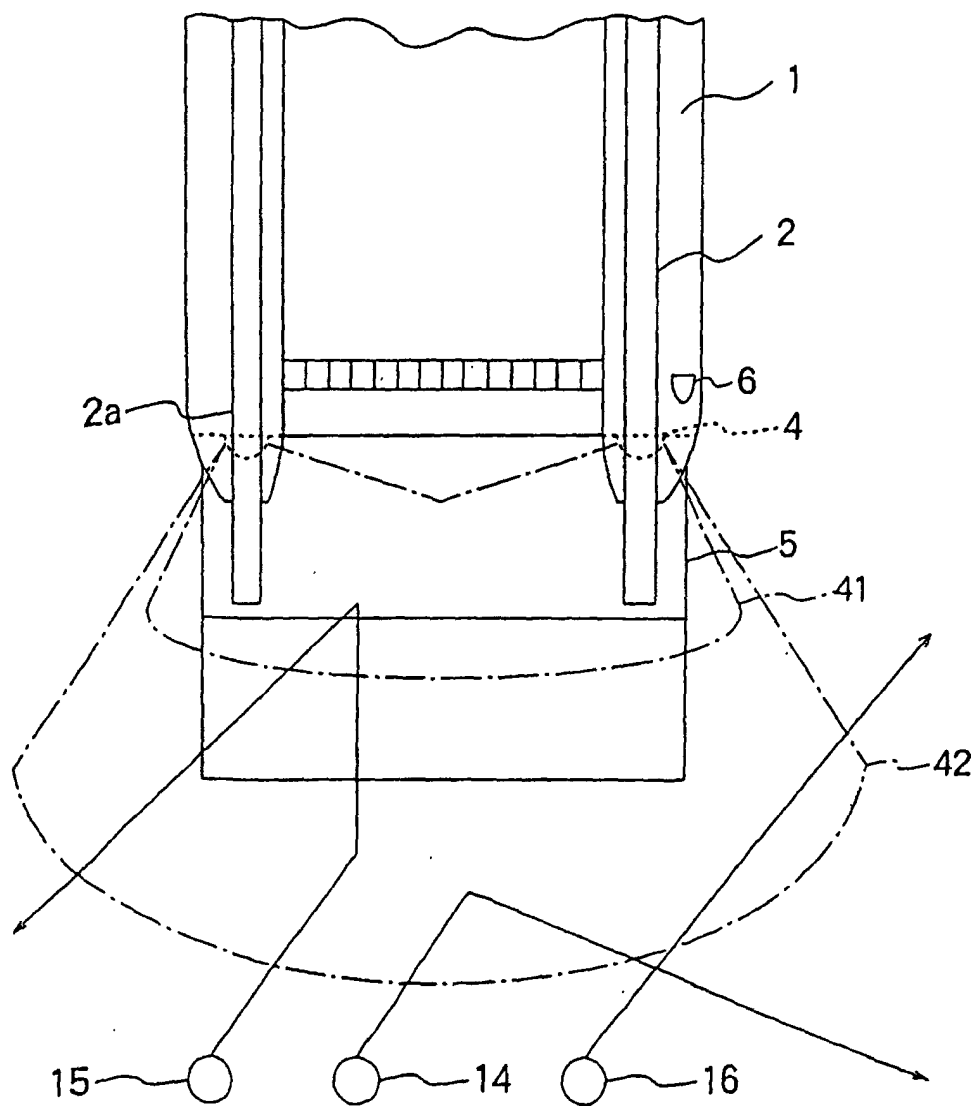


FIG. 7

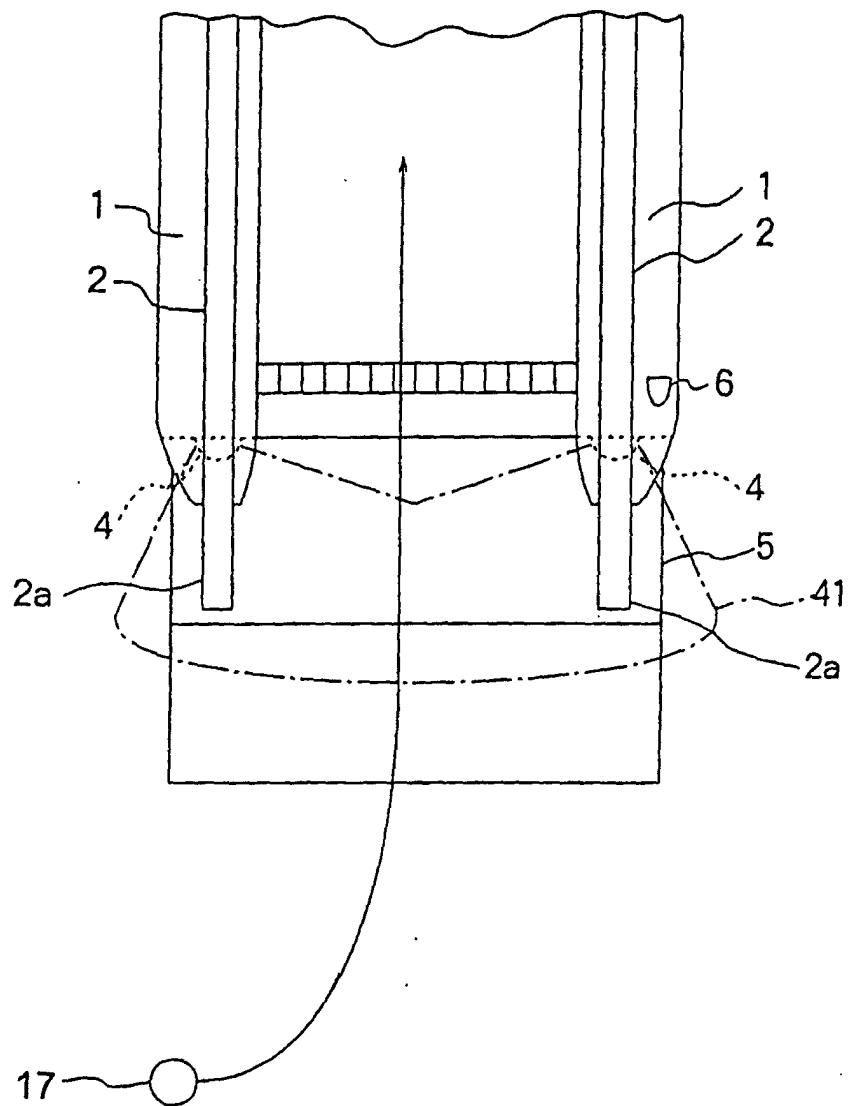


FIG. 8

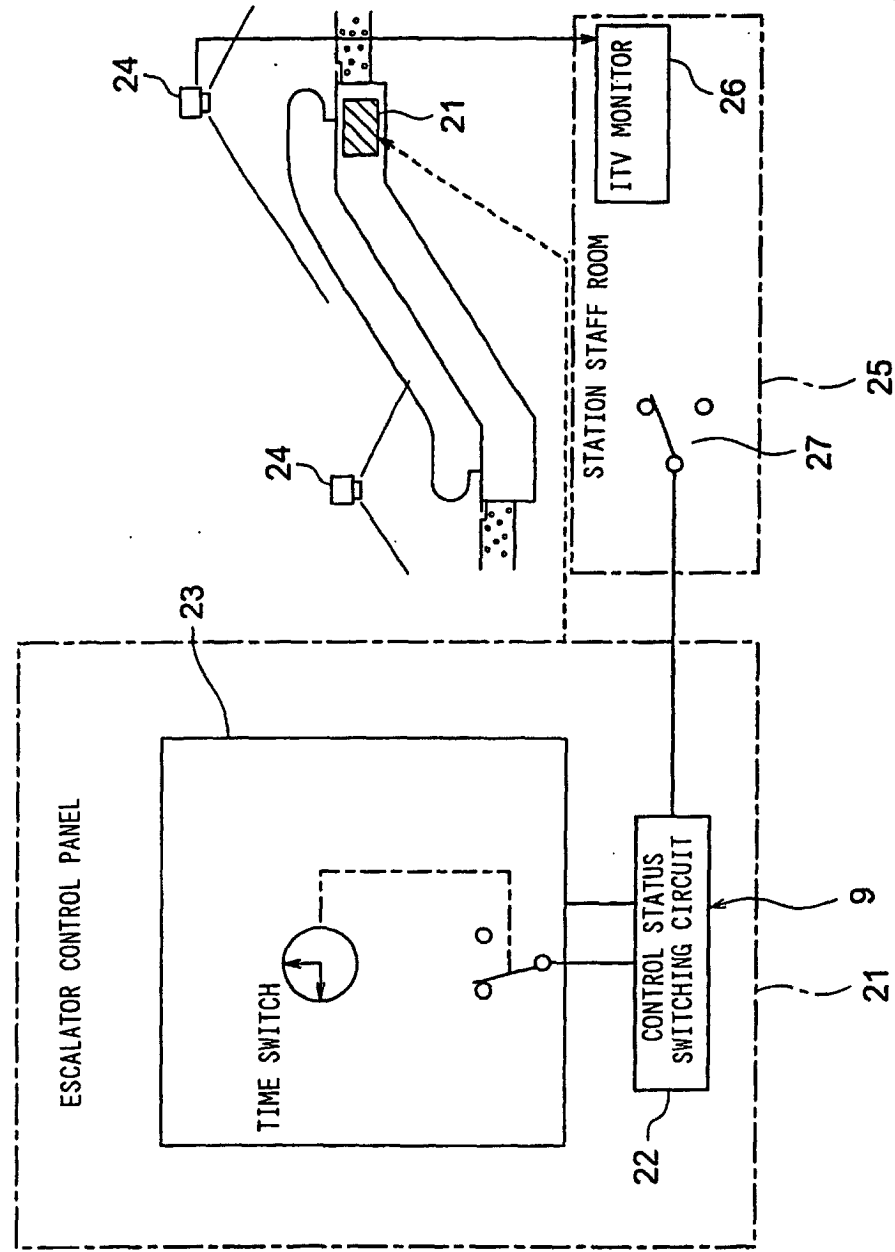


FIG. 9

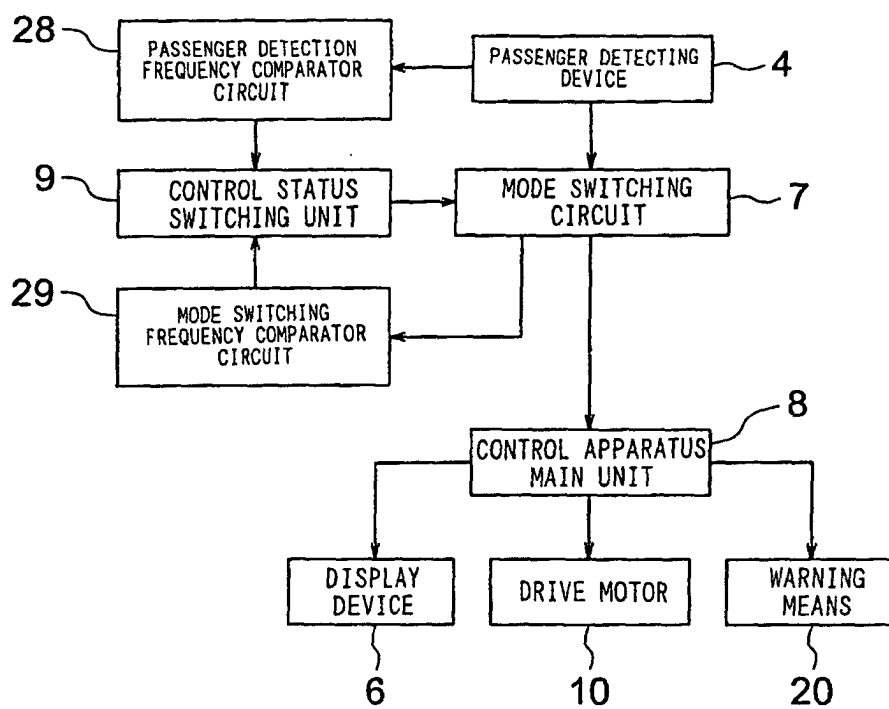


FIG. 10

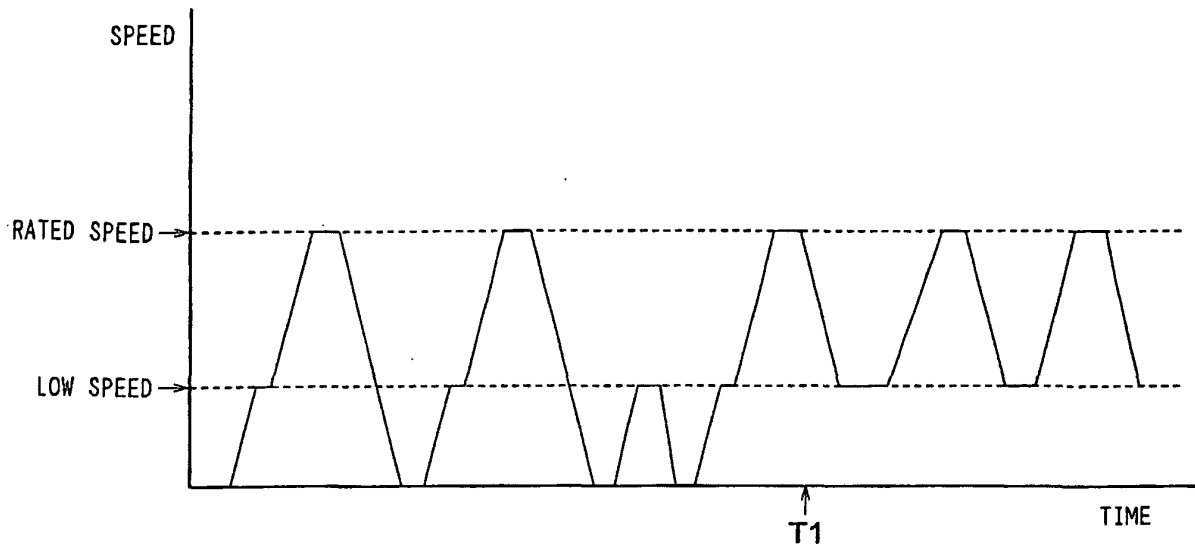
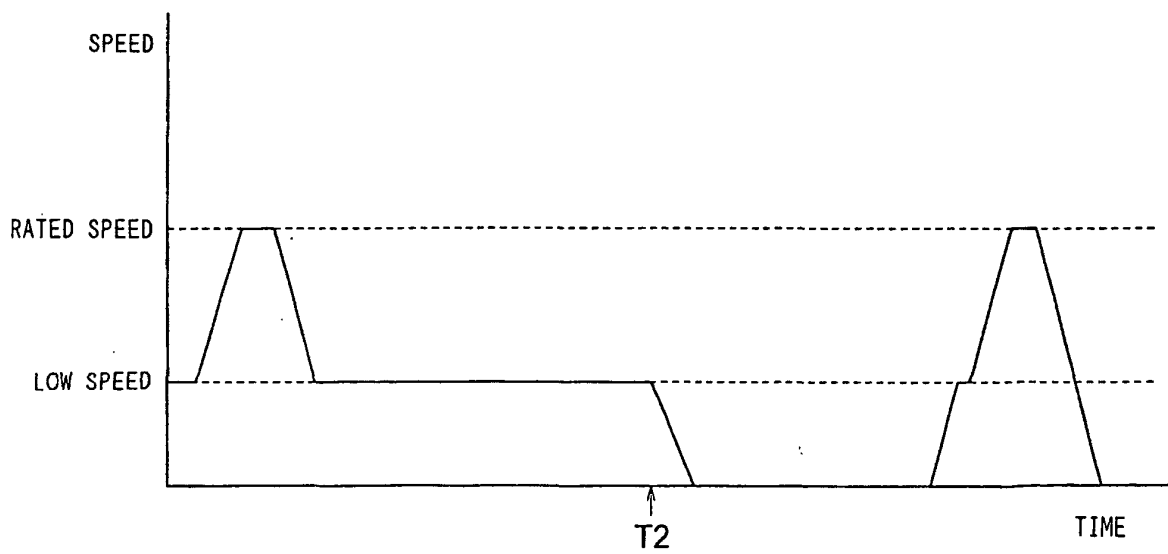


FIG. 11



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP00/08088

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 1996-2001 Kokai Jitsuyo Shinan Koho 1971-2001 Toroku Jitsuyo Shinan Koho 1994-2001		
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 A	Microfilm of Japanese Utility Model Application No. 61361/1987 (Laid-open No. 169584/1988), (Chuo Electronics Service K.K.), 04 November, 1988 (04.11.88), description; page 4, line 13 to page 5, line 9; page 6, lines 12 to 19; Figs. 4 to 5 (Family: none)	1-5, 8-9 6-7, 10-11
Y Y	JP 61-57274 B2 (Hitachi Ltd.), 05 December, 1986 (05.12.86), column 1, lines 2 to 15 column 1, lines 2 to 15; column 6, lines 28 to 38 & JP 57-67468 A	1-5, 9 8
Y Y	JP 1-26994 B2 (Hitachi Ltd.), 26 May, 1989 (26.05.89), column 1, lines 2 to 14 column 1, lines 2 to 14; column 8, lines 25 to 35 & JP 57-67486 A	1-5, 9 8
☒ 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 "I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 31 July, 2001 (31.07.01)		Date of mailing of the international search report 14 August, 2001 (14.08.01)
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/JP00/08088

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 62-16465 Y2 (Toshiba K.K.), 25 April, 1987 (25.04.87), column 1, line 16 to column 2, line 20 & JP 60-26485 U	2
Y	JP 9-30764 A (Takenaka Komuten Co., Ltd.), 04 February, 1997 (04.02.97), Claim 1 (Family: none)	4-5
A	JP 61-69683 A (Matsushita Electric Works, Ltd.), 10 April, 1986 (10.04.86), (Family: none)	4-5
A	JP 6-87592 A (Toshiba Corporation), 29 March, 1994 (29.03.94), (Family: none)	1-11
A	JP 10-182050 A (Invention AG), 07 July, 1998 (07.07.98), & CA 2224829 A1 & CN 1185412 A & EP 0847956 A1 & US 5923005 A	1-11

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