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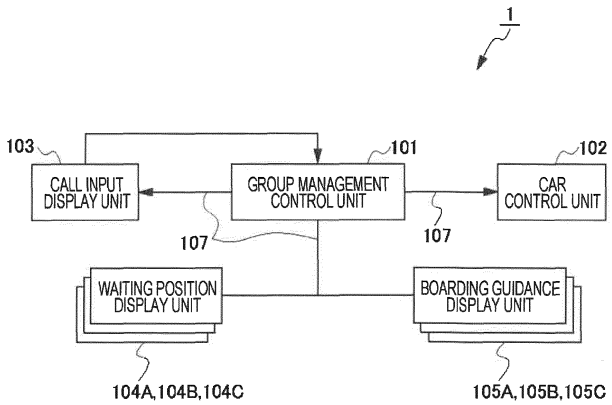
(54) MULTI-CAR ELEVATOR SYSTEM

(57) The group management control unit assigns a specific boarding group from among a plurality of boarding groups to passengers. In addition, the group management control unit calculates boarding guidance information, which is information regarding a car to be boarded by passengers, for each of a plurality of boarding groups based on the movement information, and outputs the boarding guidance information to the outside.

FIG. 1



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Description

Technical Field

[0001] The present invention relates to a multi-car elevator system that controls a multi-car elevator in which a plurality of cars move in a moving path.

Background Art

[0002] In recent years, a multi-car elevator has been proposed in which a plurality of cars move in one moving path. In the multi-car elevator, the plurality of cars with different destinations stop at the same platform. Therefore, every time the car stops at the platform, the passenger needs to decide whether to get on the car.

[0003] Further, as a technique for guiding the boarding, for example, there is one disclosed in PTL 1. In PTL 1, a car is assigned according to the destination floor input by the passenger, and when the assigned car is approaching the departure floor, an identification code is displayed in one of signs adjacent to the hoist way where the assigned car travels.

Citation List

Patent Literature

[0004] PTL 1: JP 2009-519876 T

Summary of Invention

Technical Problem

[0005] However, in the technique described in PTL 1, every time the car arrives at the platform, the passenger needs to confirm whether the passenger should get on the arrived car by looking at the sign. As a result, when a plurality of cars arrive at the platform at the same time, the passenger must check the signs provided at each platform and make a decision in a short period of time, which increases the burden on the passenger's boarding decision.

[0006] An object of the invention is to provide a multi-car elevator system that can reduce the burden of passengers' boarding decisions in consideration of the above problems.

Solution to Problem

[0007] In order to solve the above problems and achieve the purpose, the multi-car elevator system is a multi-car elevator system that controls a multi-car elevator in which a plurality of cars move in the same moving path.

[0008] The multi-car elevator system includes a call input display unit, a group management control unit, and a car control unit. The call input display unit is provided in the platform hall where the car stops, and the destination is input by the passenger. The group management control unit receives destination information regarding the passenger's destination transmitted from the call input display unit, and assigns a specific boarding group to the passenger from among a plurality of boarding groups based on the destination information. The car control unit controls the movement of the car, and transmits the movement information regarding the movement of the car to the group management control unit. In addition, the group management control unit calculates boarding guidance information, which is information regarding the car to be boarded by the passenger, for each of the plurality of boarding groups based on the movement information received from the car control unit, and outputs the information to the outside.

Advantageous Effects of Invention

[0009] According to the multi-car elevator system having the above configuration, it is possible to reduce the burden of passengers' decision on boarding.

Brief Description of Drawings

[0010]

[FIG. 1] FIG. 1 is a block diagram illustrating a schematic configuration of a multi-car elevator system according to a first embodiment.

[FIG. 2] FIG. 2 is a schematic configuration diagram illustrating an example of a multi-car elevator controlled in the multi-car elevator system according to the first embodiment.
[FIG. 3] FIG. 3 is an explanatory diagram illustrating a first configuration example of a platform hall of the multi-car elevator system according to the first embodiment.
[FIG. 4] FIG. 4 is an explanatory diagram illustrating a first boarding guidance example of the multi-car elevator system according to the first embodiment.
[FIG. 5] FIG. 5 is an explanatory diagram illustrating a second configuration example of the platform hall of the multi-car elevator system according to the first embodiment.
[FIG. 6] FIG. 6 is an explanatory diagram illustrating a third configuration example of the platform hall of the multi-car elevator system according to the first embodiment.
[FIG. 7] FIG. 7 is an explanatory diagram illustrating a fourth configuration example of the platform hall of the multi-car elevator system according to the first embodiment.
[FIG. 8] FIG. 8 is an explanatory diagram illustrating a fifth configuration example of the platform hall of the multi-car elevator system according to the first embodiment.
[FIG. 9] FIG. 9 is an explanatory diagram illustrating a sixth configuration example of the platform hall of the multi-car elevator system according to the first embodiment.
[FIG. 10] FIG. 10 is an explanatory diagram illustrating the sixth configuration example of the platform hall of the multi-car elevator system according to the first embodiment.
[FIG. 11] FIG. 11 is a sequence diagram illustrating a notification process of a boarding group in the multi-car elevator system according to the first embodiment.
[FIG. 12] FIG. 12 is a flowchart illustrating a boarding group allocation process in the multi-car elevator system according to the first embodiment.
[FIG. 13] FIG. 13 is a sequence diagram illustrating a boarding guidance display process in the multi-car elevator system according to the first embodiment.
[FIG. 14] FIG. 14 is a flowchart illustrating a departure group list output process in the multi-car elevator system according to the first embodiment.
[FIG. 15] FIG. 15 is an explanatory diagram illustrating a state in which boarding taxiways intersect in the platform hall in the second configuration example.
[FIG. 16] FIG. 16 is a block diagram illustrating a schematic configuration of a multi-car elevator system according to a second embodiment.
[FIG. 17] FIG. 17 is a diagram illustrating an example of boarding allocation availability condition data in the multi-car elevator system according to the second embodiment.
[FIG. 18] FIG. 18 is a diagram illustrating an example of the boarding allocation availability condition data on a first platform in the multi-car elevator system according to a third embodiment.
[FIG. 19] FIG. 19 is a diagram illustrating an example of the boarding allocation availability condition data on a second platform in the multi-car elevator system according to the third embodiment.
[FIG. 20] FIG. 20 is a flowchart illustrating a departure group list output process in the multi-car elevator system according to the third embodiment.
[FIG. 21] FIG. 21 is an explanatory diagram illustrating a configuration of a platform hall in a multi-car elevator system according to a modification.

Description of Embodiments

[0011] Hereinafter, a multi-car elevator system according to embodiments will be described with reference to FIGS. 1 to 21. The common members in each drawing are designated by the same reference numerals.

1. First Embodiment

1-1. Configuration example of multi-car elevator system

[0012] First, the configuration of the multi-car elevator system according to a first embodiment (hereinafter, referred to as "this example") will be described with reference to FIG. 1.
[0013] FIG. 1 is a block diagram illustrating a schematic configuration of the multi-car elevator system of this example.
[0014] A multi-car elevator system 1 illustrated in FIG. 1 is a system that controls and guides boarding on the multi-car elevator 10 (see FIG. 2) in which a plurality of cars 11A to 11G move in one moving path 5 formed in a building structure. As illustrated in FIG. 1, the multi-car elevator system 1 includes a group management control unit 101, a car control unit 102, a call input display unit 103, a plurality of waiting position display units 104A, 104B, and 104C, and a plurality of boarding guidance display units 105A, 105B, and 105C.

[0015] The group management control unit 101, the car control unit 102, the call input display unit 103, and the plurality of boarding guidance display units 105A, 105B, and 105C are connected to each other via a system bus 107 so that information can be transmitted and received. Then, the group management control unit 101 controls the entire system. The group management control unit 101 has, for example, a CPU (Central Processing Unit), a RAM (Random Access Memory), and a ROM (Read Only Memory) . The RAM is used as the work area of the CPU, and the ROM stores programs executed by the CPU.

[0016] In addition, the group management control unit 101 receives movement information of a car, opening/closing information of an opening/closing door from the car control unit 102, and receives destination information of a passenger from the call input display unit 103. The group management control unit 101 performs a boarding group allocation process on passengers to assign a specific boarding group from among a plurality of boarding groups based on the destination information received from the call input display unit 103.

[0017] In addition, the group management control unit 101 calculates a departure group list based on the movement information of the car from the car control unit 102 and the boarding group information, and outputs boarding guidance information to each of the boarding guidance display units 105A, 105B, and 105C. The boarding group allocation process and the departure group list calculation process in the group management control unit 101 will be described later.

[0018] The car control unit 102 controls the movement of the plurality of cars 11A to 11G (see FIG. 2) moving along the moving path, and controls the opening and closing of the opening/closing doors provided in the cars 11A to 11G. Further, the car control unit 102 transmits the movement information of the cars 11A to 11G and the opening/closing information of the opening/closing door to the group management control unit 101.

[0019] The call input display unit 103, the waiting position display units 104A, 104B, and 104C, and the boarding guidance display units 105A, 105B, and 105C are provided in a platform hall 50 (see FIG. 3 etc.) which is provided on each floor of the building structure for a passenger to board or alight. The call input display unit 103 includes an input unit through which the passenger inputs a destination, and a display unit 103a (see FIG. 3) that displays the assigned boarding group.

[0020] When the destination is input by the passenger, the call input display unit 103 transmits the destination information and the call information for calling a car to the input platform hall to the group management control unit 101. Further, the call input display unit 103 receives the boarding group information calculated by the group management control unit 101. This boarding group information is boarding group information for a passenger who has entered the destination. Then, the call input display unit 103 displays an identifier for identifying the boarding group in the display unit based on the received boarding group information, and notifies the passenger who has input the destination of the boarding group.

[0021] The identifier for identifying the boarding group is indicated by, for example, any one or a plurality of combinations of a mechanism, characters, colors, patterns, and the like.

[0022] The call input display unit 103 is configured by, for example, a touch panel, a key input unit, a reading unit for reading tags and cards possessed by passengers, and the like.

[0023] Here, the boarding group is an individual, a group heading to the same floor, a group heading to the same zone by grouping multiple floors as one zone, a group determined by the multi-car elevator system 1, and the like.

[0024] The waiting position display units 104A, 104B, and 104C and the boarding guidance display units 105A, 105B, and 105C are provided for each boarding group. The detailed configurations of the waiting position display units 104A, 104B, and 104C and the boarding guidance display units 105A, 105B, and 105C will be described later.

1-2. Configuration example of multi-car elevator

[0025] Next, an example of a multi-car elevator to which the above-mentioned multi-car elevator system 1 is applied will be described with reference to FIG. 2.

[0026] FIG. 2 is a schematic configuration diagram illustrating an example of a multi-car elevator controlled by the multi-car elevator system 1 of this example.

[0027] As illustrated in FIG. 2, a multi-car elevator 10 includes a plurality of cars 11A, 11B, 11C, 11D, 11E, and 11F for carrying people and luggage, and a drive unit (not illustrated). The plurality of cars 11A to 11F circulate in the moving path 5 provided in the building structure.

[0028] Further, the moving path 5 is provided with an ascending path 6 indicating a first moving path in which the cars 11A to 11F move upward and a descending path 7 indicating a second moving path in which the cars 11A to 11G move downward. Further, at the upper ends of the ascending path 6 and the descending path 7 in the vertical direction in the moving path 5, a first reversing path 8 is provided in which the movement of the cars 11A to 11F is reversed from ascending to descending. Further, at the lower ends of the ascending path 6 and the descending path 7 in the vertical direction in the moving path 5, a second reversing path 9 is provided in which the movement of the cars 11A to 11F is reversed from descending to ascending.

[0029] Then, the plurality of cars 11A to 11F are driven by the drive unit and circulate in the ascending path 6, the

descending path 7, the first reversing path 8, and the second reversing path 9 in the moving path 5.

[0030] As the multi-car elevator 10, the multi-car elevator in which the plurality of cars 11A to 11F circulate and move has been described, but the invention is not limited to this. For example, it can be applied to a multi-car elevator in which a plurality of cars can move up and down the moving path in both directions.

[0031] As a driving method for the cars 11A to 11F of the multi-car elevator 10, there may be used a driving method provided with a hoisting machine and a driving method in which a linear drive unit is provided and an induced current flows to the main rope connected to the cars 11A to 11F to generate a driving force (thrust) in the main rope itself. It can also be applied to self-propelled multi-car elevators with drive units on the cars 11A to 11F.

[0032] Further, the number of cars provided in the multi-car elevator 10 is not limited to 6, and the number of cars may be 5 or less, or 7 or more.

[0033] In addition, on the stop floor where cars 11A to 11F stop in the building structure, there is a platform hall 50 where a passenger 21 gets on and off.

1-3. Example of boarding guidance

[0034] Next, an example of boarding guidance in the multi-car elevator system 1 of this example will be described with reference to FIGS. 3 to 9. The dotted lines illustrated in FIGS. 3 to 9 indicate a state in which the boarding guidance display unit is turned off.

[0035] First, with reference to FIG. 3, a first configuration example of the platform hall will be described with reference to FIGS. 3 and 4.

[0036] FIG. 3 is an explanatory diagram illustrating a first configuration example of the platform hall.

[0037] In the platform hall 50 illustrated in FIG. 3, there are provided two platforms 51A and 51B where the passenger 21 gets on and off the cars 11A to 11G. The first platform 51A and the second platform 51B are located opposite each other in the platform hall 50. The first platform 51A and the second platform 51B each are provided with entrances for the passenger 21 to get on and off the cars 11A to 11G. Further, at this entrance, a platform door 15 is installed so that it can be opened and closed.

[0038] In addition, the passenger 21 comes in and out the platform hall 50 from the side of the first platform 51A and the second platform 51B, which are orthogonal to the direction in which the first platform 51A and the second platform 51B face each other. Therefore, the entrances of the platform hall 50 are arranged on the sides of the first platform 51A and the second platform 51B.

[0039] Further, in the platform hall 50, the call input display unit 103, the plurality of waiting position display units 104A, 104B, and 104C, and the boarding guidance display units 105A, 105B, and 105C are installed. The call input display unit 103 is installed at the entrance of the platform hall 50. The waiting position display units 104A, 104B, and 104C and the boarding guidance display units 105A, 105B, and 105C are installed between the call input display unit 103 and the first platform 51A and the second platform 51B.

[0040] When the destination is input by the passenger 21, the call input display unit 103 transmits the destination information and the call information to the group management control unit 101. Then, the call input display unit 103 receives the boarding group information calculated by the group management control unit 101, and displays the identifier on the display unit based on the boarding group information. As a result, the passenger 21 comes to know that it is better to stand at which of the waiting position display units 104A, 104B, and 104C among the plurality of waiting position display units 104A, 104B, and 104C by the identifier displayed in the call input display unit 103.

[0041] The waiting position display units 104A, 104B, and 104C are at standby positions for the passenger 21 who has input the destination to the call input display unit 103 to wait for the cars 11A to 11G. The waiting position display units 104A, 104B, and 104C are formed on the floor surface of the platform hall 50 for each of the assigned boarding groups 21A, 21B, and 21C. The first waiting position display unit 104A corresponds to the first boarding group 21A, the second waiting position display unit 104B corresponds to the second boarding group 21B, and the third waiting position display unit 104C corresponds to the third boarding group 21C.

[0042] The waiting position display units 104A, 104B, and 104C are formed substantially parallel to the direction orthogonal to the direction in which the first platform 51A and the second platform 51B face each other. The waiting position display units 104A, 104B, and 104C may be formed by embedding an LED, a phosphorescent member, or the like in the floor surface, or may be drawn on the floor surface with paint. Further, the waiting position display units 104A, 104B, and 104C may be formed by attaching a sticker to the floor surface, or may be formed by various other guidance methods.

[0043] Although an example in which the waiting position display units 104A, 104B, and 104C are formed for each of the boarding groups 21A, 21B, and 21C has been described, the invention is not limited to this. As the waiting position display units 104A, 104B, and 104C, for example, the display screen of one display device may be divided into the waiting position display units 104A, 104B, and 104C.

[0044] The boarding guidance display units 105A, 105B, and 105C are formed on the floor surface of the platform hall

50. The boarding guidance display units 105A, 105B, and 105C are arranged at the head of the standby position in the corresponding waiting position display units 104A, 104B, and 104C. The first boarding guidance display unit 105A is visibly arranged with respect to the first boarding group 21A on standby in the first waiting position display unit 104A. The second boarding guidance display unit 105B is visibly arranged with respect to the second boarding group 21B on standby in the second waiting position display unit 104B, and the third boarding guidance display unit 105C is visibly arranged with respect to the third boarding group 21C on standby in the third waiting position display unit 104C.

[0045] The boarding guidance display units 105A, 105B, and 105C are, for example, light emitting display devices such as LEDs and liquid crystal panels embedded in the floor surface of the platform hall 50. The boarding guidance display units 105A, 105B, and 105C are turned off, turned on, and blinked based on the boarding guidance information output from the group management control unit 101. Then, the boarding guidance display units 105A, 105B, and 105C guide the corresponding boarding groups 21A, 21B, and 21C to the platforms 51A and 51B for the boarding by turning on or blinking.

[First boarding guidance example]

[0046] Next, a first boarding guidance example will be described with reference to FIG. 4.

[0047] FIG. 4 is an explanatory diagram illustrating a first boarding guidance example.

[0048] As illustrated in FIG. 4, when the car stops or approaches the first platform 51A and the second platform 51B, the group management control unit 101 transmits the boarding guidance information to the boarding guidance display units 105A, 105B, and 105C. The boarding guidance display units 105A, 105B, and 105C is turned on or blink based on the boarding guidance information received from the group management control unit 101, and guide the corresponding boarding groups 21A, 21B, and 21C to the platforms 51A and 51B to be boarded.

[0049] In the example illustrated in FIG. 4, the first boarding group 21A is assigned to the first platform 51A, and the second boarding group 21B and the third boarding group 21C are assigned to the second platform 51B. As illustrated in FIG. 4, the first boarding guidance display unit 105A is turned on or blinks from the head of the first waiting position display unit 104A to the first platform 51A. The second boarding guidance display unit 105B is turned on or blinks from the head of the second waiting position display unit 104B to the second platform 51B, and the third boarding guidance display unit 105C is turned on or blinks from the head of the third waiting position display unit 104C to the second platform 51B.

[0050] Therefore, the passenger of the first boarding group 21A comes to know that it is better to get on the car stopped at the first platform 51A by the first boarding guidance display unit 105A. In addition, the passengers of the second boarding group 21B and the passengers of the third boarding group 21C may come to know that it is better to get on the car stopped at the second platform 51B by the second boarding guidance display unit 105B and the third boarding guidance display unit 105C.

[0051] As described above, according to the multi-car elevator system 1 of this example, the passenger 21 can easily determine a car to get on based on the display contents of the boarding guidance display units 105A, 105B, and 105C arranged at the head of each of the waiting position display units 104A, 104B, and 104C. As a result, the burden of the passenger 21 on boarding decision can be reduced.

[Second boarding guidance example]

[0052] Next, a second boarding guidance example will be described with reference to FIG. 5.

[0053] FIG. 5 is an explanatory diagram illustrating a second configuration example of the platform hall. FIG. 5 illustrates a state in which the cars are stopped at the platforms 51A and 51B. The portions common to the platform hall 50 according to the first configuration example are designated by the same reference numerals, and duplicate description will be omitted.

[0054] In the platform hall 60 according to the second configuration example illustrated in FIG. 5, two platforms 51A and 51B are provided as in the platform hall 50 of the first configuration example. The first platform 51A and the second platform 51B are arranged side by side.

[0055] Further, in the platform hall 60, a call input display unit 203, a plurality of waiting position display units 204A, 204B, and 204C, and boarding guidance display units 205A, 205B, and 205C are installed. The boarding guidance display units 205A, 205B, and 205C are arranged from the head of the standby position in the corresponding waiting position display units 204A, 204B, and 204C to the first platform 51A and the second platform 51B.

[0056] Further, in the example illustrated in FIG. 5, the first boarding group 21A is assigned to the first platform 51A, and the third boarding group 21C is assigned to the second platform 51B. The second boarding group 21B is in a standby state without getting on the car arriving at the first platform 51A and the second platform 51B this time.

[0057] The first boarding guidance display unit 205A is turned on or blinks from the first waiting position display unit 204A to the first platform 51A, and the third boarding guidance display unit 205C is turned on or blinks from the third

waiting position display unit 204C to the second platform 51B. Then, the second boarding guidance display unit 205B is turned off.

[0058] As a result, since the second boarding guidance display unit 205B is turned off, the second boarding group 21B can know that it is better not to get on the car arriving at the first platform 51A and the second platform 51B this time. On the other hand, the first boarding group 21A can know that it is better to get on the car stopped at the first platform 51A based on the display contents of the first boarding guidance display unit 205A, and the third boarding group 21C can know that it is better to get on the car stopped at the second platform 51B based on the display contents of the third boarding guidance display unit 205C.

[0059] In this way, the passenger can easily determine a car to be boarded based on the display contents of the boarding guidance display units 205A to 205B.

[Third boarding guidance example]

[0060] Next, a third boarding guidance example will be described with reference to FIG. 6.

[0061] FIG. 6 is an explanatory diagram illustrating a third configuration example of the platform hall. FIG. 6 illustrates a state in which the car is stopped at the platforms 51A and 51B. The portions common to the platform hall 50 according to the first configuration example are designated by the same reference numerals, and duplicate description will be omitted.

[0062] In a platform hall 70 according to the third configuration example illustrated in FIG. 6, two platforms 51A and 51B are provided as in the platform hall 50 according to the first configuration example. The first platform 51A and the second platform 51B are arranged side by side in the same manner as the platform hall 60 in the second configuration example.

[0063] In addition, the passenger 21 enters and exits the platform hall 70 from the direction facing the first platform 51A and the second platform 51B. Therefore, the entrance of the platform hall 70 is located in front of the first platform 51A and the second platform 51B.

[0064] Further, in the platform hall 70, a call input display unit 303, waiting position display units 304A, 304B, and 304C, and boarding guidance display units 305A, 305B, and 305C are installed. The call input display unit 303 is arranged at a position facing the first platform 51A and the second platform 51B, which are the entrances and exits of the platform hall 70.

[0065] The waiting position display units 304A, 304B, and 304C are formed in front of the first platform 51A and the second platform 51B in parallel with the direction facing the first platform 51A and the second platform 51B. Further, the waiting position display units 304A, 304B, and 304C are arranged at intermediate positions in the direction in which the first platform 51A and the second platform 51B are aligned. The boarding guidance display units 305A, 305B, and 305C are arranged between the waiting position display units 304A, 304B, and 304C and the first platform 51A and the second platform 51B.

[0066] In the example illustrated in FIG. 6, the first boarding group 21A and the second boarding group 21B are assigned to the first platform 51A, and the third boarding group 21C is assigned to the second platform 51B. Therefore, the first boarding guidance display unit 305A is turned on or blinks from the first waiting position display unit 304A to the first platform 51A, and the second boarding guidance display unit 305B is turned on or blinks from the second waiting position display unit 304B to the first platform 51A. The third boarding guidance display unit 305C is turned on or blinking from the third waiting position display unit 304C to the second platform 51B.

[0067] As a result, the passenger can easily determine the car to be boarded based on the display contents of the boarding guidance display units 305A to 305C.

[Fourth boarding guidance example]

[0068] Next, a fourth boarding guidance example will be described with reference to FIG. 7.

[0069] FIG. 7 is an explanatory diagram illustrating a fourth configuration example of the platform hall. FIG. 7 illustrates a state in which the car is stopped at a platform 51. The portions common to the platform hall 50 according to the first configuration example are designated by the same reference numerals, and duplicate description will be omitted.

[0070] In a platform hall 80 according to the fourth configuration example illustrated in FIG. 7, only one platform 51 is provided. Further, the entrance of the platform hall 80 is arranged in front of the platform 51 as in the platform hall 70 according to the third configuration example.

[0071] In the platform hall 80 a call input display unit 403, waiting position display units 404A, 404B, and 404C, and boarding guidance display units 405A, 405B, and 405C are installed. The call input display unit 403 is arranged at a position facing the platform 51, which is the entrance of the platform hall 80. The waiting position display units 404A, 404B, and 404C are formed in front of the platform 51 in parallel with the direction facing the platform 51.

[0072] The boarding guidance display units 405A, 405B, and 405C are arranged between the waiting position display

units 404A, 404B, and 404C and the platform 51. The boarding guidance display units 405A, 405B, and 405C extend from the head of the corresponding waiting position display units 404A, 404B, and 404C to the platform 51.

[0073] In the example illustrated in FIG. 7, the first boarding group 21A and the third boarding group 21C are assigned to get on the car arriving at the platform 51 this time. Then, the second boarding group 21B is in a standby state without boarding the car that has arrived at the platform 51 this time.

[0074] Therefore, the first boarding guidance display unit 405 and the third boarding guidance display unit 405C are turned on or blinking, and the second boarding guidance display unit 405B is turned off. As a result, the passengers of the first boarding group 21A and the third boarding group 21C know that it is better to get on the arrived car based on the display contents of the first boarding guidance display unit 405A and the third boarding guidance display unit 405C. Then, the passenger of the second boarding group 21B knows that it is not better to get on the arrived car this time based on the display contents of the second boarding guidance display unit 405B.

[0075] As a result, the passenger can easily determine the car to be boarded based on the display contents of the boarding guidance display units 405A to 405C.

[Fifth boarding guidance example]

[0076] Next, a fifth boarding guidance example will be described with reference to FIG. 8.

[0077] FIG. 8 is an explanatory diagram illustrating a fifth configuration example of the platform hall. FIG. 8 illustrates a state in which the cars are stopped at the platforms 51A and 51B. The portions common to the platform hall 50 according to the first configuration example are designated by the same reference numerals, and duplicate description will be omitted.

[0078] As illustrated in FIG. 8, in a platform hall 90 according to the fifth configuration example, the first platform 51A and the second platform 51B are arranged side by side in the same manner as the platform halls 60 and 70 according to the second configuration example and the third configuration example. The entrance of the platform hall 90 is arranged in front of the first platform 51A and the second platform 51B, as in the platform hall 70 according to the third configuration example.

[0079] In the platform hall 80, a call input display unit 503, waiting position display units 504A, 504B, 504C, 504D, 504E, and 504F, and boarding guidance display units 505A, 505B, 505C, 505D, 505E, and 505F are installed.

[0080] The first waiting position display unit 504A, the second waiting position display unit 504B, and the third waiting position display unit 504C are formed in front of the first platform 51A. The fourth waiting position display unit 504D, the fifth waiting position display unit 504E, and the sixth waiting position display unit 504F are formed in front of the second platform 51B.

[0081] The first boarding guidance display unit 505A extends from the head of the first waiting position display unit 504A to the first platform 51A, the second boarding guidance display unit 505B extends from the head of the second waiting position display unit 504B to the first platform 51A, and the third boarding guidance display unit 505C extends from the head of the third waiting position display unit 504C to the first platform 51A.

[0082] In addition, the fourth boarding guidance display unit 505D extends from the head of the fourth waiting position display unit 504D to the second platform 51B, the fifth boarding guidance display unit 505E extends from the head of the fifth waiting position display unit 504E to the second platform 51B, and the sixth boarding guidance display unit 505F extends from the head of the sixth waiting position display unit 504F to the second platform 51B.

[0083] As described above, in the platform hall 90 according to the fifth configuration example, the waiting position display units 504A to 504F and the boarding guidance display units 505A to 505F are provided for each of the platforms 51A and 51B.

[0084] Further, when the destination is input by the passenger 21, the call input display unit 503 displays an identifier based on the boarding group. In the fifth configuration example, when the group management control unit 101 determines the boarding group, the platform for getting on the car is also determined at the same time. That is, when the passengers 21 are assigned to the first boarding group 21A, the second boarding group 21B, and the third boarding group 21C, the group management control unit 101 assigns the passengers to board from the first platform 51A at the same time. Then, when the passengers 21 are assigned to the fourth boarding group 21D, the fifth boarding group 21E, and the sixth boarding group 21F, the group management control unit 101 assigns the passengers to board from the second platform 51B at the same time.

[0085] In the example illustrated in FIG. 8, the first boarding group and the third boarding group 21C assigned to the first platform 51A are assigned to get on the car that has arrived at the first platform 51A this time. Then, the second boarding group 21B assigned to the first platform 51A is in a standby state without getting on the car that has arrived at the first platform 51A this time.

[0086] In addition, the fifth boarding group 21E assigned to the second platform 51B is assigned to get on the car that has arrived at the second platform 51B this time. Then, the fourth boarding group 21D and the sixth boarding group 21F assigned to the second platform 51B are in a standby state without getting on the car that has arrived at the second

platform 51B this time.

[0087] Therefore, among the boarding guidance display units 505A to 505C arranged at the first platform 51A, the first boarding guidance display unit 505A and the third boarding guidance display unit 505C are turned on or blink, and the second boarding guidance display unit 505B is turned off. In addition, among the boarding guidance display units 505D to 505F arranged at the second platform 51B, the fifth boarding guidance display unit 505E is turned on or blinks, and the fourth boarding guidance display unit 505D and the sixth boarding guidance display unit 505F are turned on.

[0088] As a result, the passenger can easily determine the car to be boarded based on the display contents of the boarding guidance display units 505A to 505F.

[Sixth boarding guidance example]

[0089] Next, a sixth boarding guidance example of the platform hall will be described with reference to FIGS. 9 and 10. FIGS. 9 and 10 are explanatory diagram illustrating a sixth configuration example of the platform hall. Further, FIG. 9 illustrates a state in which the car has stopped at the platform 51, and FIG. 10 illustrates a state in which the car stopped at the platform 51 has departed in FIG. 9.

[0090] As illustrated in FIG. 9, in a platform hall 80A according to the sixth configuration example, only one platform 51 is provided as in the platform hall 80 according to the fourth configuration example. Further, the entrance of the platform hall 80A is arranged in front of the platform 51 as in the platform hall 80 according to the fourth configuration example.

[0091] In the platform hall 80A the call input display unit 403 and waiting position display units 604A, 604B, and 604C are installed.

[0092] The waiting position display units 604A, 604B, and 604C are formed in front of the platform 51. The waiting position display units 604A, 604B, and 604C are arranged at intervals in the direction away from the front of the platform 51. The first waiting position display unit 604A is arranged at the position closest to the platform 51 among the waiting position display units 604A, 604B, and 604C. The third waiting position display unit 604C is arranged at the position farthest from the platform 51 among the waiting position display units 604A, 604B, and 604C. The second waiting position display unit 604B is arranged between the first waiting position display unit 604A and the third waiting position display unit 604C.

[0093] The boarding group 21A on standby in the first waiting position display unit 604A gets on firstly among the boarding groups 21A, 21B, and 21C on standby in the waiting position display units 604A, 604B, and 604C. The boarding group 21B on standby in the second waiting position display unit 604B gets on secondly among the boarding groups 21A, 21B, and 21C on standby in the waiting position display units 604A, 604B, and 604C. Then, the boarding group 21C on standby in the third waiting position display unit 604C gets on thirdly among the boarding groups 21A, 21B, and 21C on standby in the waiting position display units 604A, 604B, and 604C.

[0094] The waiting position display units 604A, 604B, and 604C also serve as a boarding guidance display unit. Then, the waiting position display units 604A, 604B, and 604C change the displayed contents and blink or turn on the display based on the boarding guidance information from the group management control unit 101, so that the boarding groups 21A, 21B, and 21C are guided.

[0095] When the destination is input by the passenger 21, the call input display unit 403 displays an identifier on a display unit 403a based on the boarding groups 21A, 21B, and 21C. In the fifth configuration example, when the group management control unit 101 determines the boarding groups 21A, 21B, and 21C, the order of getting on the car is also determined at the same time. For example, the boarding groups 21A, 21B, and 21C guided by the call input display unit 403 may include not only those assigned to the third waiting position display unit 604C to be boarded last, but also the boarding groups 21A, 21B, and 21C on standby in the first waiting position display unit 604A and the second waiting position display unit 604B to be boarded first or second. That is, instead of having the passengers 21 board in the order which is input to the call input display unit 403, it is also allowed that passengers 21 input later to the call input display unit 403 to board first.

[0096] In addition, when the car approaches or stops at the platform 51, the first waiting position display unit 604A closest to the platform 51 changes the displaying to board the first boarding group 21A on standby in the first waiting position display unit 604A, and guides the first boarding group 21A. Then, at the timing when the first boarding group 21A on standby in the first waiting position display unit 604A gets on the car and the platform door 15 is started to close, the displaying of the second waiting position display unit 604B and the third waiting position display unit 604C changes. That is, the second waiting position display unit 604B and the third waiting position display unit 604C guide the second boarding group B and the third boarding group 21C on standby in the waiting position display units 604B and 604C to the waiting position display unit closest to the next previous platform 51.

[0097] As a result, as illustrated in FIG. 10, the first boarding group 21A, which has stood by in the first waiting position display unit 604A in FIG. 9, gets on the car. Then, the second boarding group 21B on standby in the second waiting position display unit 604B in FIG. 9 moves to the first waiting position display unit 604A, and the third boarding group

21C on standby in the third waiting position display unit 604C moves to the second waiting position display unit 604B.

[0098] As a result, the passengers can easily determine the order of boarding based on the display contents of the waiting position display units 604A, 604B, and 604C, which also serve as the boarding guidance display unit. As a result, it is possible to prevent passengers from getting on the wrong car.

[0099] The configuration example of the platform hall is not limited to the above-mentioned example, and for example, three or more platforms may be provided, and various other platform halls can be applied.

1-4. Operation example of multi-car elevator system

[0100] Next, an example of processing operation at the time of boarding guidance in the multi-car elevator system 1 having the above-described configuration will be described with reference to FIGS. 3, 4, 11 to 14. In the following description, the platform hall 50 according to the first configuration example described above will be used, but the platform halls 60, 70, 80, 80A, and 90 according to the second to sixth configuration examples, and a platform hall 80B according to a modification described below may be applied.

[0101] FIG. 11 is a sequence diagram illustrating a notification process of the boarding group in the multi-car elevator system 1.

[Boarding group notification process]

[0102] First, the notification process of the boarding group will be described with reference to FIGS. 3 and 11.

[0103] The passenger 21 inputs a destination using the call input display unit 103 (Step S11). The destination input in Step S11 may be the stop floor where the car is stopped, or may be any place, purpose, or other various information in the building structure in which the multi-car elevator is installed.

[0104] Next, the call input display unit 103 outputs the destination information regarding the destination input by the passenger 21 to the group management control unit 101 (Step S12). Further, in the process of Step S12, the call input display unit 103 also outputs the call information for calling the car to the input platform hall to the group management control unit 101.

[0105] Next, the group management control unit 101 performs a boarding group allocation process based on the destination information, and determines the boarding groups 21A, 21B, and 21C (Step S13). That is, the group management control unit 101 assigns an appropriate boarding group from a plurality of boarding groups 21A, 21B, and 21C to the passenger. The boarding group allocation process in Step S13 will be described later. Then, the group management control unit 101 notifies the boarding groups 21A, 21B, and 21C determined in the boarding group allocation process to the call input display unit 103 (Step S14) .

[0106] Next, the call input display unit 103 starts displaying the boarding groups 21A, 21B, and 21C notified from the group management control unit 101 on the display unit (Step S15). As described above, the information displayed by the call input display unit 103 is, for example, an identifier for identifying a boarding group.

[0107] Next, when a certain period of time has elapsed since the call input display unit 103 started displaying the boarding groups 21A, 21B, and 21C in the process of Step S15, the call input display unit 103 ends displaying the boarding groups 21A, 21B, and 21C (Step S16). As a result, the notification process of the boarding groups 21A, 21B, and 21C for the passenger 21 whose destination is input to the call input display unit 103 is completed.

[Boarding group allocation process]

[0108] Next, a boarding group allocation process performed in the process of Step 13 will be described with reference to FIG. 12.

[0109] FIG. 12 is a flowchart illustrating the boarding group allocation process.

[0110] As illustrated in FIG. 12, the group management control unit 101 calculates a group allocation score for each boarding group based on the destination information received from the call input display unit 103 (Step S21). Next, the group management control unit 101 determines whether there is a boarding group whose group allocation score calculated in Step S21 is equal to or greater than a threshold (Step S22).

[0111] In the process of Step S22, when the group management control unit 101 determines that there is a boarding group whose group allocation score is equal to or higher than the threshold (YES determination in Step S22), the group management control unit 101 assigns the boarding group having the maximum group allocation score as a boarding group for the input destination information (Step S23). Further, in the process of Step S23, when the group management control unit 101 determines that there is no boarding group whose group allocation score is equal to or higher than the threshold (NO determination in Step S22), the group management control unit 101 does not allocate the boarding group (Step S24). As a result, the boarding group allocation process is completed.

[0112] Next, an example of the calculation method of the group allocation score Si performed in the process of Step

S21 will be described.

[0113] The description will be given about the group allocation score Si for each group in a case where the car capacity is C, the number of assigned passengers assigned to the boarding group is ci, the number of destination types of the assigned passengers is fi, and the threshold used in Step S22 is 1. When ci < C, that is, when the number of assigned passengers ci has not reached the car capacity C, the group allocation score Si is calculated by the following Expression 1.

[Expression 1]

$$Si = C - fi + 1$$

[0114] Further, when ci ≥ C, that is, when the number of assigned passengers ci has reached the car capacity C, the group allocation score Si is set to 0.

[0115] According to the group allocation score Si calculated by the above method, the group allocation score Si of the boarding group in which the number ci of assigned passengers is equal to or more than the car capacity C becomes 0, and does not exceed the threshold "1" in the process of Step S22. Therefore, a boarding group having a group allocation score Si of 0 is not assigned to the destination information.

[0116] On the other hand, as illustrated in Expression 1 above, the group allocation score Si of the boarding group in which the number ci of assigned passengers is less than the car capacity C is set to be larger as the number fi of destination types of passengers assigned to the passenger group becomes smaller. As a result, in the process of Step S23, it is possible to preferentially assign a boarding group having a small number of destination types of assigned passengers.

[0117] The calculation method of the group allocation score is not limited to the above-mentioned example. For example, the number of thresholds may be changed, or various coefficients such as boarding time and stop area may be used as the coefficients used in the calculation formula. Therefore, various other calculation methods can be applied as the calculation method of the group allocation score.

[Boarding guidance display process]

[0118] Next, a boarding guidance display process will be described with reference to FIGS. 4 and 13.

[0119] FIG. 13 is a sequence diagram illustrating the boarding guidance display process.

[0120] First, the car control unit 102 controls the drive unit and starts decelerating the car to stop (Step S31). In the process of Step S31, the car control unit 102 transmits the movement information of the car to the group management control unit 101.

[0121] Next, the group management control unit 101 detects the deceleration of the car by receiving the movement information of the car from the car control unit 102 (Step S32). Then, the group management control unit 101 performs a departure group list output process (Step S33). The details of the departure group list output process will be described later. By the departure group list output process in the process of Step S33, the group management control unit 101 determines an appropriate boarding group to be boarded in the stopped car.

[0122] Next, based on the departure group list output in the process of Step S33, the group management control unit 101 transmits the boarding guidance information for the platform, where the car to be boarded stops, to each of the boarding guidance display units 105A, 105B, and 105C. That is, the group management control unit 101 instructs each boarding guidance display units 105A, 105B, and 105C to start boarding guidance (Step S34).

[0123] Next, the boarding guidance display units 105A, 105B, and 105C start displaying the boarding guidance based on the boarding guidance information output from the group management control unit 101 (Step S35). As a result, for example, as illustrated in FIG. 4, the boarding guidance to the platforms 51A and 51B determined from the waiting position display units 104A, 104B, and 104C is displayed on the boarding guidance display units 105A, 105B, and 105C.

[0124] Next, when the car arrives at the stop floor, the car control unit 102 stops the car (Step S36). Then, the car control unit 102 controls the opening/closing of the opening/closing door provided in the car, and opens the opening/closing door of the car (Step S37). The boarding group boarding this car moves to the platforms 51A and 51B according to the display contents of the boarding guidance display units 105A, 105B, and 105C, and gets on the car. Then, when the boarding group completes boarding the car, the car control unit 102 controls the opening/closing of the opening/closing door and starts the door closing operation of the opening/closing door of the car (Step S38). Further, in the process of Step S38, the car control unit 102 transmits door closing start information to the group management control unit 101.

[0125] Next, the group management control unit 101 detects the door closing of the opening/closing door by receiving the door closing start information from the car control unit 102 (Step S39). Then, the group management control unit 101 transmits the boarding guidance information to each of the boarding guidance display units 105A, 105B, and 105C, and instructs the end of the boarding guidance (Step S40). When each of the boarding guidance display units 105A,

105B, and 105C receives the boarding guidance information regarding the end of the boarding guidance from the group management control unit 101, the boarding guidance display ends the displaying of the boarding guidance (Step S41). As a result, the boarding guidance process is completed.

[Departure group list output process]

[0126] Next, a departure group list output process performed in the process of Step S33 will be described with reference to FIG. 14.

[0127] FIG. 14 is a flowchart illustrating the departure group list output process.

[0128] First, the group management control unit 101 initializes the departure group list created and stored in the previous departure group list output process as an empty list (Step S51). This departure group list is a list for managing the boarding groups to be boarded in the car.

[0129] Next, the group management control unit 101 creates a departure group candidate list that is a candidate for the departure group list (Step S52). In the multi-car elevator system 1 according to the first embodiment, all boarding groups 21A, 21B, and 21C, that is, combinations of all waiting position display units and all platforms are created as a departure group candidate list.

[0130] Next, the group management control unit 101 calculates a departure allocation score for each of the boarding groups 21A, 21B, and 21C for the arriving car (arrival car) from the departure group candidate list (Step S53). In the process of Step S53, for example, the value of the departure allocation score of the boarding group for more appropriate boarding on the arrival car is calculated to be higher than the departure allocation score of the other boarding groups. An example of the calculation method of the departure allocation score will be described later.

[0131] Next, the group management control unit 101 determines whether there is a boarding group whose departure allocation score calculated in Step S53 is equal to or greater than a threshold (Step S54). In the process of Step S54, when the group management control unit 101 determines that there is a boarding group whose departure allocation score is equal to or higher than the threshold (YES determination in Step S54), the group management control unit 101 adds the boarding group having the maximum departure allocation score to the departure group list. Further, the group management control unit 101 deletes the boarding group added to the departure group list from the departure group candidate list (Step S55). Then, when the process of Step S55 is completed, the group management control unit 101 returns to the process of Step S53 again.

[0132] Further, in the process of Step S54, when the group management control unit 101 determines that there is no boarding group whose departure allocation score is equal to or higher than the threshold (NO determination in Step S54), the group management control unit 101 outputs the departure group list created by the above process (Step S56). As a result, the departure group list output process is completed.

[0133] Next, an example of the calculation method of a departure allocation score Mi of the boarding group performed in the process of Step S53 will be described.

[0134] The description will be given about a departure allocation score Mi in a case where the waiting time of the boarding group is ti, the car capacity is C, the number of people who are assigned to the boarding group and standing by in the corresponding waiting position display unit is gi, the total number of people assigned to the arrival car is cj, and the threshold used in Step S54 is set to 1. First, when $cj + gi < C$, the departure allocation score Mi is calculated by the following Expression 2.

[Expression 2]

$$Mi = ti + 1$$

[0135] Also, when $cj + gi \geq C$, the departure allocation score Mi is set to 0. The waiting time ti of the boarding group is, for example, the waiting time of the passenger who is standing by first among the passengers of the boarding group.

[0136] According to the departure allocation score Mi calculated by the above method, the departure allocation score Mi of the boarding group to which the number of people who cannot get on the arriving car is allocated is 0 and does not exceed the threshold of 1. Therefore, a boarding group with the departure allocation score Mi of 0 is not added to the departure group list.

[0137] On the other hand, if the passengers get on the arriving car but still fit within the car capacity C, the value of the departure allocation score Mi becomes larger as the boarding group has a longer waiting time ti, as illustrated in Expression 2 above. As a result, in the process of Step S55, the boarding group having a long waiting time ti can be preferentially added to the departure group list.

[0138] The calculation method of the departure allocation score is not limited to the above-mentioned example. For example, the number of thresholds may be changed, or various coefficients such as the destination information of the

boarding group and the stop area may be used as the coefficients used in the calculation formula. Therefore, various other calculation methods can be applied as the calculation method of the departure allocation score.

[0139] In this way, according to the multi-car elevator system 1 of this example, the passengers can easily determine a platform for getting on the car based on the display contents of the boarding guidance display units 105A, 105B, and 105C installed in each of the boarding groups 21A, 21B, and 21C. As a result, the burden of the passenger 21 on boarding decision can be reduced.

2. Second embodiment

[0140] Next, the multi-car elevator system according to the second embodiment will be described with reference to FIGS. 15 to 17.

[0141] FIG. 15 is an explanatory diagram illustrating a state in which the boarding taxiways intersect in a platform hall 60 in the second configuration example. FIG. 16 is a block diagram illustrating a schematic configuration of the multi-car elevator system according to the second embodiment.

[0142] In the example illustrated in FIG. 15, the platform hall 60 in which a plurality of platforms 51A and 51B are arranged in the second configuration example described above will be described. As illustrated in FIG. 15, the third boarding guidance display unit 205C is already displayed to guide the passenger from the third waiting position display unit 204C to the first platform 51A. At this time, when the first boarding group 21A and the second boarding group 21B are assigned to the second platform 51B, the display contents of the first boarding guidance display unit 205A and the second boarding guidance display unit 205B intersect with the already displayed third boarding guidance display unit 205C.

[0143] In this way, when the boarding guidance display units 205A, 205B, and 205C intersect, the moving lines when passengers get on the car also intersect, and one of the boarding groups whose moving lines intersect needs to wait for the boarding. As a result, it may hinder a smooth boarding.

[0144] A multi-car elevator system 1A according to the second embodiment is a system provided with a boarding allocation availability determination unit 110 in order to prevent the intersection of the boarding guidance display units described above. Therefore, the same reference numerals are given to the parts common to the multi-car elevator system 1 according to the first embodiment, and duplicate description will be omitted.

[0145] As illustrated in FIG. 16, the multi-car elevator system 1A includes the group management control unit 101, the car control unit 102, the call input display unit 103, the plurality of waiting position display units 104A, 104B, and 104C, and the plurality of boarding guidance display units 105A, 105B, and 105C. Further, the multi-car elevator system 1A is provided with the boarding allocation availability determination unit 110.

[0146] The boarding allocation availability determination unit 110 is connected to the group management control unit 101 via the system bus 107. The boarding allocation availability determination unit 110 has boarding allocation availability condition data 1000 (see FIG. 17). The boarding allocation availability condition data 1000 is data in which the display contents of the boarding guidance display units 105A, 105B, and 105C and the availability condition for preventing the moving lines from intersecting are stored in the departure group list output process.

[0147] FIG. 17 is a diagram illustrating an example of the boarding allocation availability condition data.

[0148] In the example illustrated in FIG. 17, the boarding allocation availability condition data 1000 corresponding to the platform hall 60 illustrated in FIGS. 5 and 15 is obtained. That is, an example is illustrated in which the boarding group is divided into three waiting positions and two platforms are installed.

[0149] As illustrated in FIG. 17, column 1001 in the boarding allocation availability condition data 1000 indicates a waiting position corresponding to each column, and row 1002 indicates a platform corresponding to each row. Then, in the cell where column 1001 and row 1002 intersect, whether the allocation is available is indicated based on the intersection of the moving lines. "○" in each cell indicates that allocation is available, and "x" indicates that allocation is not available.

[0150] Specifically, since cell 1011 is "o", the first platform 51A can be assigned to the first waiting position, which is the waiting position of the first boarding group 21A. Further, since cell 1022 is "x", the second platform 51B cannot be assigned to the first waiting position. Since cell 1013 and cell 1014 are both "○", both the first platform 51A and the second platform 51B can be assigned to the second waiting position, which is the waiting position of the second boarding group 21B.

[0151] Further, since cell 1015 is "x", the first platform 51A cannot be assigned to a third waiting position, which is the waiting position of the third boarding group 21C. Since cell 1016 is "o", the second platform 51B can be assigned to the third waiting position.

[0152] In the multi-car elevator system 1A according to the second embodiment, in a departure group candidate list creation process of Step S52 illustrated in FIG. 14, the group management control unit 101 creates a departure group candidate list based on the boarding allocation availability condition data 1000. That is, the boarding allocation availability determination unit 110 extracts the cell of the boarding allocation availability condition data 1000 as "o", that is, the

combinations of the boarding group and all the platforms that can be assigned. Then, the boarding allocation availability determination unit 110 creates the extracted combinations as a departure group candidate list. In addition, the boarding allocation availability determination unit 110 outputs the created departure group candidate list to the group management control unit 101.

[0153] As a result, a departure group candidate list consisting of combinations in which the moving lines do not intersect can be created, and a departure group list in which the moving lines do not intersect can be output. As a result, according to the multi-car elevator system 1A of the second embodiment, the contents displayed on the boarding guidance display units 105A, 105B, and 105C do not intersect, so that each of the boarding groups 21A, 21B, and 21C can be smoothly guided.

3. Third embodiment

[0154] Next, the multi-car elevator system according to a third embodiment will be described with reference to FIGS. 18 to 20.

[0155] The multi-car elevator system according to the third embodiment is provided with the boarding allocation availability determination unit 110, similarly to the multi-car elevator system 1A according to the second embodiment. Further, the difference between the multi-car elevator system according to the third embodiment and the multi-car elevator system 1A according to the second embodiment is the contents of the boarding allocation availability condition data possessed by the boarding allocation availability determination unit 110. Therefore, here, the contents of the boarding allocation availability condition data will be described.

[0156] In the multi-car elevator system according to the third embodiment, the boarding allocation availability condition data is set so that the combinations that can be assigned to the boarding are not reduced while preventing the occurrence of intersecting the moving lines of the boarding guidance.

[0157] Next, an example of the boarding allocation availability condition data will be described with reference to FIGS. 18 and 19.

[0158] Boarding allocation availability condition data 2000 illustrated in FIG. 18 is data indicating whether boarding allocation is possible for the first platform. As illustrated in FIG. 18, column 2001 in the boarding allocation availability condition data 2000 illustrates the waiting position corresponding to each row and the state of boarding guidance from the waiting position to the first platform, and row 2002 indicates the waiting position corresponding to each column and the availability of boarding guidance from the waiting position to the platform. Then, each intersecting cell indicates whether boarding guidance is possible. "o" in each cell indicates that allocation is available, and "x" indicates that allocation is not available.

[0159] A specific example will be described with reference to row 2005. Row 2005 illustrates a case where the second waiting position, which is the waiting position of the second boarding group 21B, is assigned to the first platform 51A. Since cell 2011 is "o", it is possible to assign from the first waiting position to the first platform 51A without intersecting the moving lines. Since the second waiting position has already been assigned to the first platform 51A, cell 2012 is "x". And since cell 2013 is "o", it is possible to assign from the third waiting position to the first platform 51A without intersecting the moving lines.

[0160] In the boarding allocation availability condition data 2000 illustrated in FIG. 18, the availability of allocation at other waiting positions is indicated with respect to the allocation to the first platform 51A at one waiting position. However, in the boarding allocation availability condition data 2000, it is possible to easily determine whether to allocate other waiting positions even for the allocation of platforms at a plurality of waiting positions.

[0161] For example, if the first waiting position, which is the waiting position of the first boarding group 21A, is assigned to the second platform 51B, whether each waiting position can be assigned to the first platform 51A is illustrated in row 2004. As described above, when the second waiting position is assigned to the first platform 51A, whether each waiting position can be assigned to the first platform 51A is illustrated in row 2005.

[0162] Here, when the first waiting position is assigned to the second platform 51B and the second waiting position is assigned to the first platform 51A, whether the other waiting position (third waiting position) is assigned is determined by the result that satisfies both row 2004 and row 2005. That is, the product of availability sets of the respective rows 2004 and 2005 may be taken. In this case, since "o" is not illustrated in any of the cells, the result that there is no other waiting position that can be assigned is obtained.

[0163] Boarding allocation availability condition data 3000 illustrated in FIG. 19 is data indicating whether boarding allocation is possible for the second platform. As illustrated in FIG. 19, column 3001 in the boarding allocation availability condition data 3000 indicates the waiting position corresponding to each row and the state of boarding guidance from the waiting position to the second platform, and row 3002 indicates the waiting position corresponding to each row and whether boarding guidance from the waiting position to the platform is possible. Then, each intersecting cell indicates whether boarding guidance is possible. "○" in each cell indicates that allocation is available, and "x" indicates that allocation is not available.

[0164] A specific example will be described with reference to row 3005. Row 3005 indicates the case where the second waiting position, which is the waiting position of the second boarding group 21B, is assigned to the first platform 51A. Since cell 3011 is "x", it is not possible to assign from the first waiting position to the second platform 51B without intersecting the moving lines. Since the second waiting position has already been assigned to the first platform 51A, cell 3012 is "x". Then, since cell 3013 is "o", it is possible to assign from the third waiting position to the second platform 51B without intersecting the moving lines.

[0165] Further, the boarding allocation availability condition data 3000 in FIG. 19 indicates whether allocation to the second platform 51B at one waiting position can be assigned at another waiting position. However, in the boarding allocation availability condition data 3000, as in the case of the boarding allocation availability condition data 2000 illustrated in FIG. 18 described above, whether other waiting positions can be assigned to the allocation of the platform at a plurality of waiting positions can be easily obtained.

[0166] For example, if the first waiting position, which is the waiting position of the first boarding group 21A, is assigned to the second platform 51B, whether each waiting position can be assigned to the second platform 51B is illustrated in line 3004. As described above, when the second waiting position is assigned to the first platform 51A, whether each waiting position can be assigned to the second platform 51B is illustrated in row 3005.

[0167] Here, when the first waiting position is assigned to the second platform 51B and the second waiting position is assigned to the first platform 51A, whether the other waiting position (third waiting position) is assigned is determined by the result that satisfies both rows 3004 and 3005. That is, the product of sets of allocation availabilities of rows 3004 and 3005 may be taken respectively. In this case, since "○" is indicated in the third waiting position, the result is obtained that the other waiting position that can be assigned is the third waiting position.

[0168] Next, the departure group list output process in the multi-car elevator system according to the third embodiment having the above-described configuration will be described with reference to FIG. 20.

[0169] FIG. 20 is a flowchart illustrating a departure group list output process according to the third embodiment.

[0170] First, the group management control unit 101 initializes the departure group list created and stored in the previous departure group list output process as an empty list (Step S71). Next, the boarding allocation availability determination unit 110 creates a departure group candidate list based on the state of the boarding group allocation for each waiting position and the boarding allocation availability condition data 2000 and 3000 for each platform illustrated in FIGS. 18 and 19. (Step S72). Then, the boarding allocation availability determination unit 110 outputs the created departure group candidate list to the group management control unit 101.

[0171] Next, the group management control unit 101 calculates the departure allocation score for each of the boarding groups 21A, 21B, and 21C for the arriving car (arrival car) from the departure group candidate list (Step S73). In the process of Step S73, for example, the value of the departure allocation score of the boarding group for which it is more appropriate to board the arrival car is calculated to be higher than the departure allocation score of the other boarding groups. For example, as illustrated in Expression 2 above, by giving a positive correlation to the waiting time ti, it is possible to increase the hit of the departure allocation score for the boarding group having a longer waiting time ti.

[0172] Next, the group management control unit 101 determines whether there is a boarding group whose departure allocation score calculated in Step S73 is equal to or higher than a threshold (Step S74). In the process of Step S74, when the group management control unit 101 determines that there is a boarding group whose departure allocation score is equal to or higher than the threshold (YES determination in Step S74), the group management control unit 101 adds the boarding group having the maximum departure allocation score to the departure group list (Step S75). Then, when the process of Step S75 is completed, the group management control unit 101 returns to the process of Step S73 again, and the boarding allocation availability determination unit 110 creates a departure group candidate list.

[0173] Further, in the process of Step S74, when the group management control unit 101 determines that there is no boarding group whose departure allocation score is equal to or higher than the threshold (NO determination in Step S74), the group management control unit 101 outputs the departure group list created in the above process (Step S76). As a result, the departure group list output process is completed.

[0174] As described above, according to the multi-car elevator system according to the third embodiment, the boarding allocation availability determination unit 110 determines whether the allocation is possible using the boarding allocation availability condition data 2000 and 3000 illustrated in FIGS. 18 and 19. As a result, even when the boarding guidance is performed for a plurality of waiting positions at the same time, it is possible to prevent the moving lines of passengers moving from each waiting position to the respective platforms 51A and 51B from intersecting. As a result, it is possible to reduce the possibility of smooth boarding and the possibility that passengers get in a wrong car.

4. Modification

[0175] Next, a modification of the multi-car elevator system will be described with reference to FIG. 21.

[0176] FIG. 21 is an explanatory diagram illustrating the configuration of the platform hall in the multi-car elevator system according to the modification.

[0177] The difference between the multi-car elevator system according to this modification and the multi-car elevator system 1 according to the first embodiment is the configuration of the boarding guidance display unit. Therefore, the boarding guidance display unit will be described here, and the same reference numerals will be given to the parts common to the multi-car elevator system 1 according to the first embodiment, and duplicate description will be omitted.

[0178] In the platform hall 80B illustrated in FIG. 21, only one platform 51 is provided as in the platform hall 80 according to the fourth configuration example described above. As illustrated in FIG. 21, the platform hall 80B is provided with the call input display unit 403, the waiting position display units 404A, 404B, and 404C, and boarding guidance display units 805A, 805B, and 805C. Since the configurations of the call input display unit 403 and the waiting position display units 404A, 404B, and 404C are the same as those of the platform hall 80 according to the fourth configuration example, the description thereof will be omitted.

[0179] The boarding guidance display units 805A, 805B, and 805C are arranged on the wall surface provided with the platform door 15. The first boarding guidance display unit 805A is installed in front of the first waiting position display unit 404A. Therefore, the first boarding guidance display unit 805A is visibly installed from the first boarding group on standby in the first waiting position display unit 404A. The second boarding guidance display unit 805B is installed in front of the second waiting position display unit 404B so as to be visible from the second boarding group on standby in the second waiting position display unit 404B. The third boarding guidance display unit 805C is installed in front of the third waiting position display unit 404C so as to be visible from the third boarding group on standby in the third waiting position display unit 404C.

[0180] The guidance information for the corresponding boarding group is displayed on the boarding guidance display units 805A, 805B, and 805C, respectively. Further, as the boarding guidance display units 805A, 805B, and 805C, various other display devices such as a liquid crystal display device and an organic EL display device are applied. Further, as the boarding guidance display units 805A, 805B, and 805C, the display screen of one display device may be divided into the boarding guidance display units 805A, 805B, and 805C. Alternatively, independent display devices may be provided as the boarding guidance display units 805A, 805B, and 805C.

[0181] Since other configurations are the same as those of the boarding guidance display units 105A, 105B, and 105C of the multi-car elevator system according to the first embodiment described above, the description thereof will be omitted here. Even in the multi-car elevator system provided with the boarding guidance display units 805A, 805B, and 805C having such a configuration, the same operation and effect as the multi-car elevator system 1 according to the above-described first embodiment can be obtained.

[0182] The invention is not limited to the embodiments described above and illustrated in the drawings, and various modifications can be made without departing from the gist of the invention described in the claims.

[0183] In the above-described embodiment, an example in which the car ascends and descends in the vertical direction as a multi-car elevator has been described, but the invention is not limited to this, and the car may move in a slope direction inclined from the horizontal direction and the vertical direction.

[0184] Further, in the above-described embodiment, an example in which a boarding guidance display unit for displaying boarding guidance is provided in the platform hall as a multi-car elevator system has been described, but the invention is not limited to this. For example, when the car arrives or approaches, the group management control unit may output the boarding guidance information, which indicates a platform where the car to be boarded stops, to a mobile terminal owned by the passenger who has input a destination in the call input display unit. Then, the passenger moves to the car or the platform to be boarded according to the boarding guidance information output to the mobile terminal. According to this configuration, it is not necessary to install a waiting position display unit or a boarding guidance display unit on which passengers stand by in the platform hall.

[0185] Although words such as "parallel" and "orthogonal" have been used in the present specification, these do not mean only strict "parallel" and "orthogonal", but include "parallel" and "orthogonal". Further, it may be in a "substantially parallel" or "substantially orthogonal" state within a range in which the function can be exhibited. Reference Signs List

[0186]

1, 1A	multi-car elevator system
5	moving path
10	multi-car elevator
11A, 11B, 11C, 11D, 11E, 11F	car
15	platform door
21	passenger
21A	first boarding group
21B	second boarding group
21C	third boarding group
50	platform hall
51A	first platform

51B	second platform
101	group management control unit
102	car control unit
103	call input display unit
104A	first waiting position display unit
104B.	second waiting position display unit
104C	third waiting position display unit
105A	first boarding guidance display unit
105B	second boarding guidance display unit
105C	third boarding guidance display unit
107	system bus
110	boarding allocation availability determination unit

Claims

1. A multi-car elevator system for controlling a multi-car elevator in which a plurality of cars move in the same moving path, comprising:

   a call input display unit that is provided in a platform hall where the car stops and receives a destination from a passenger;
   a group management control unit that receives destination information, which is transmitted from the call input display unit, regarding the destination of the passenger, and assigns the passenger to a specific boarding group from among a plurality of boarding groups based on the destination information; and
   a car control unit that controls moving of the car and transmits movement information regarding the moving of the car to the group management control unit,
   wherein the group management control unit calculates boarding guidance information, which is information regarding the car to be boarded by the passenger, for each of the plurality of boarding groups based on the movement information received from the car control unit, and outputs the boarding guidance information to an outside.

2. The multi-car elevator system according to claim 1, comprising:

   a boarding guidance display unit that receives the boarding guidance information output by the group management control unit, and displays boarding guidance to guide the passenger,
   wherein the boarding guidance display unit is provided for each of the plurality of boarding groups, and installed to be visible from a corresponding boarding group.

3. The multi-car elevator system according to claim 1,
   wherein the platform hall is provided with a plurality of platforms where the car stops, and
   wherein the boarding guidance information output by the group management control unit also includes information regarding a platform where the car to be boarded stops among the plurality of platforms.

4. The multi-car elevator system according to claim 3,
   wherein the platform hall is provided with a plurality of waiting position display units, where the passenger stands by, for each of the plurality of boarding groups,
   the multi-car elevator system comprising:
   a boarding allocation availability determination unit that determines whether to board from the platform based on moving lines of movement from the plurality of waiting position display units to the plurality of platforms,
   wherein the group management control unit calculates the boarding guidance information based on information determined by the boarding allocation availability determination unit.

5. The multi-car elevator system according to claim 4,
   wherein the boarding allocation availability determination unit outputs combinations of the plurality of waiting position display units and the plurality of platforms, where the moving lines of movement from the plurality of waiting position display units and the platform of platforms do not intersect, as a departure group candidate list to the group management control unit, and
   wherein the group management control unit calculates the boarding guidance information from the departure group

candidate list.

6. The multi-car elevator system according to claim 1,
wherein the group management control unit calculates the boarding guidance information based on the movement information when the car stops or approaches the platform, and outputs the boarding guidance information.

FIG. 1

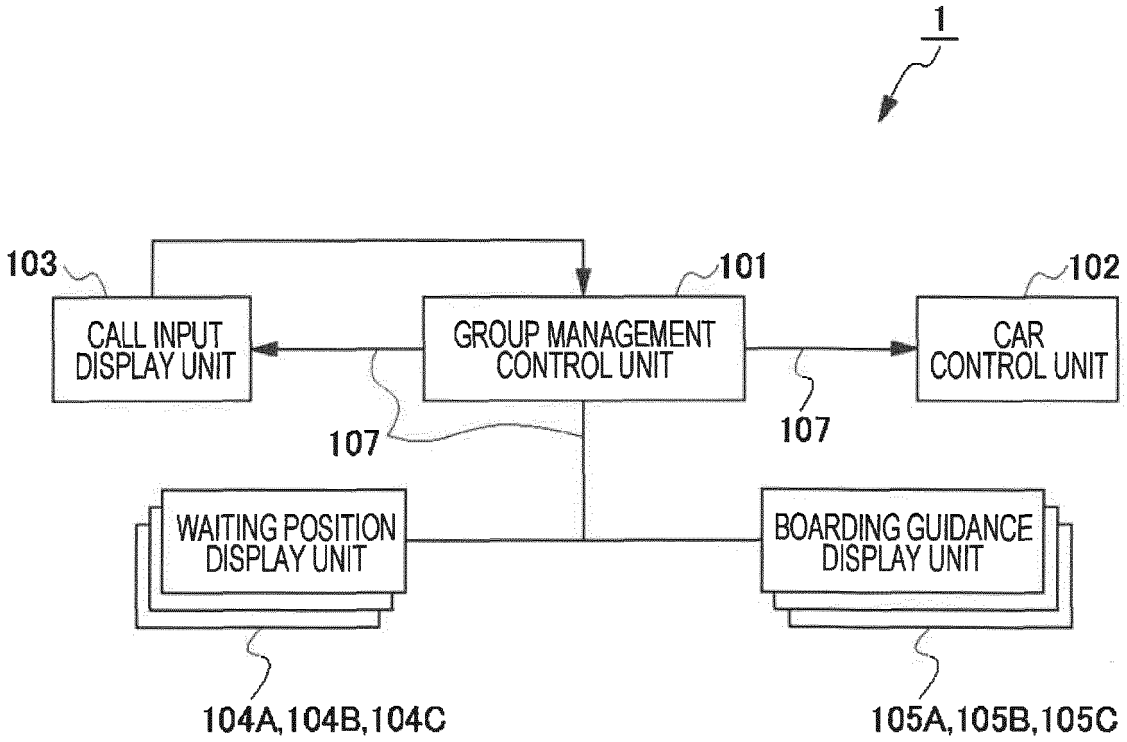

1
103
101
102
CALL INPUT DISPLAY UNIT
GROUP MANAGEMENT CONTROL UNIT
CAR CONTROL UNIT
107
107
WAITING POSITION DISPLAY UNIT
BOARDING GUIDANCE DISPLAY UNIT
104A,104B,104C
105A,105B,105C

FIG. 2

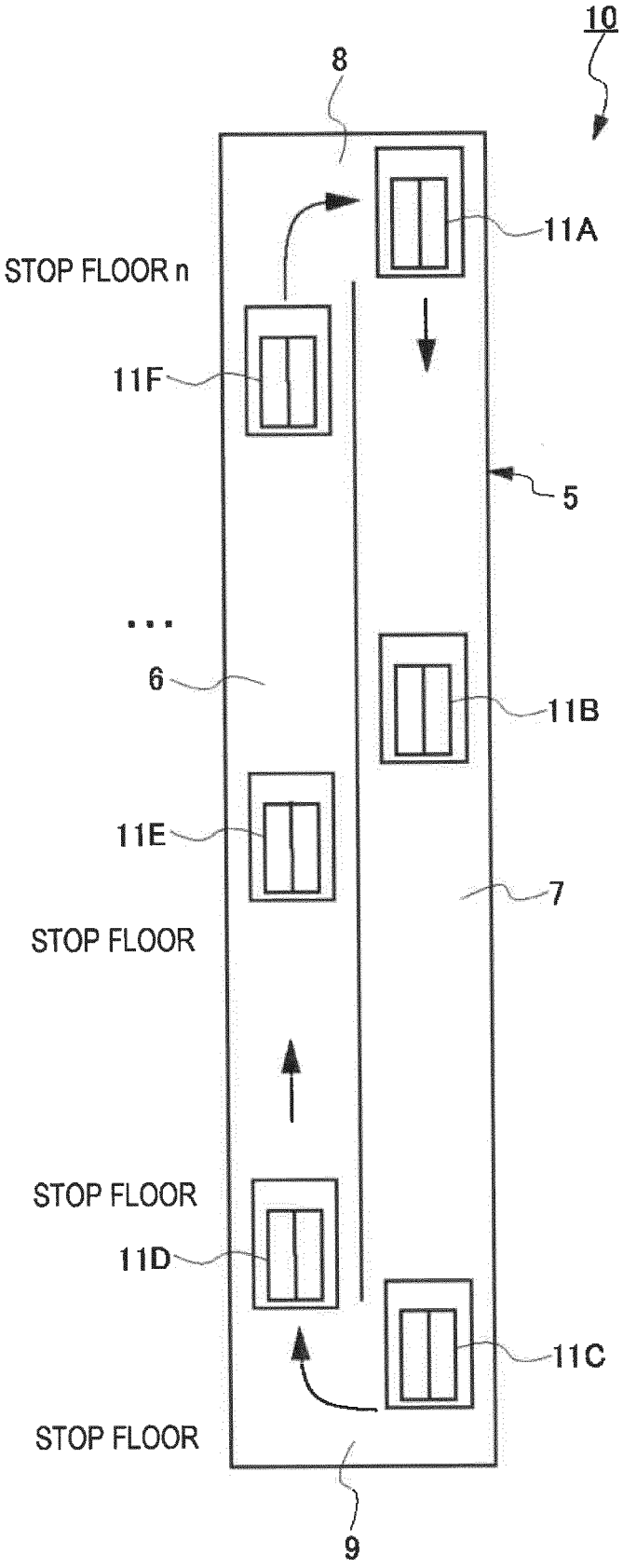

10
8
11A
STOP FLOOR n
11F
5
6
11B
11E
7
STOP FLOOR
STOP FLOOR
11D
11C
STOP FLOOR
9

FIG. 3

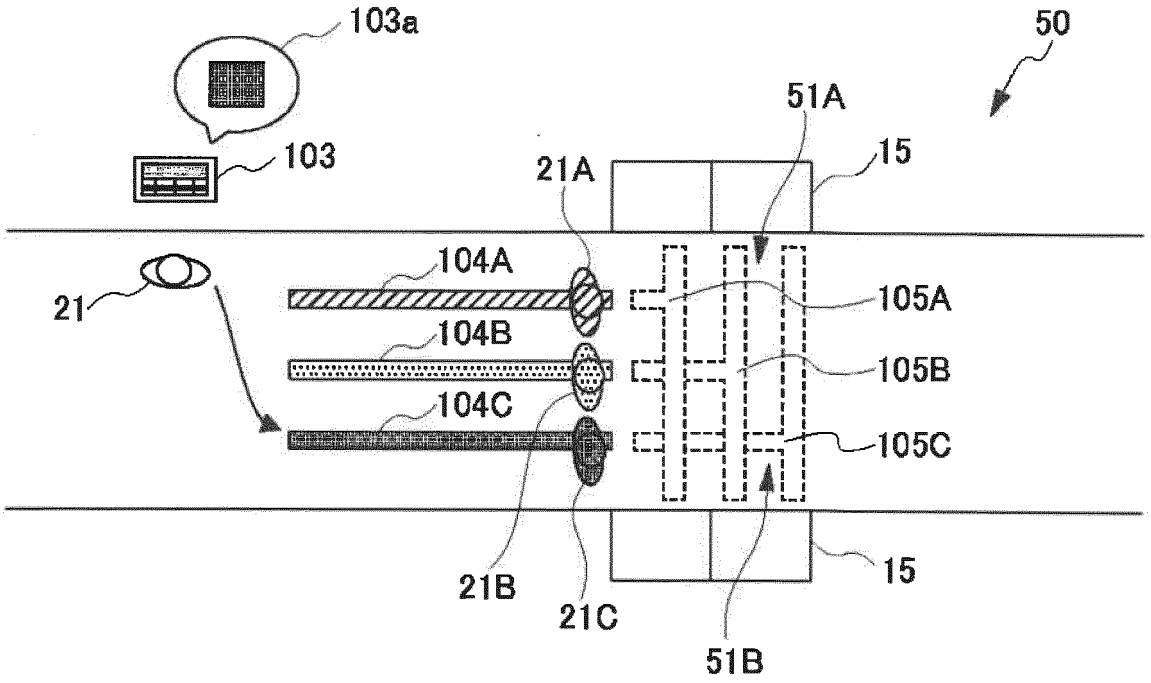

103a
103
50
51A
15
21A
104A
21
105A
104B
105B
104C
105C
21B
21C
15
51B

FIG. 4

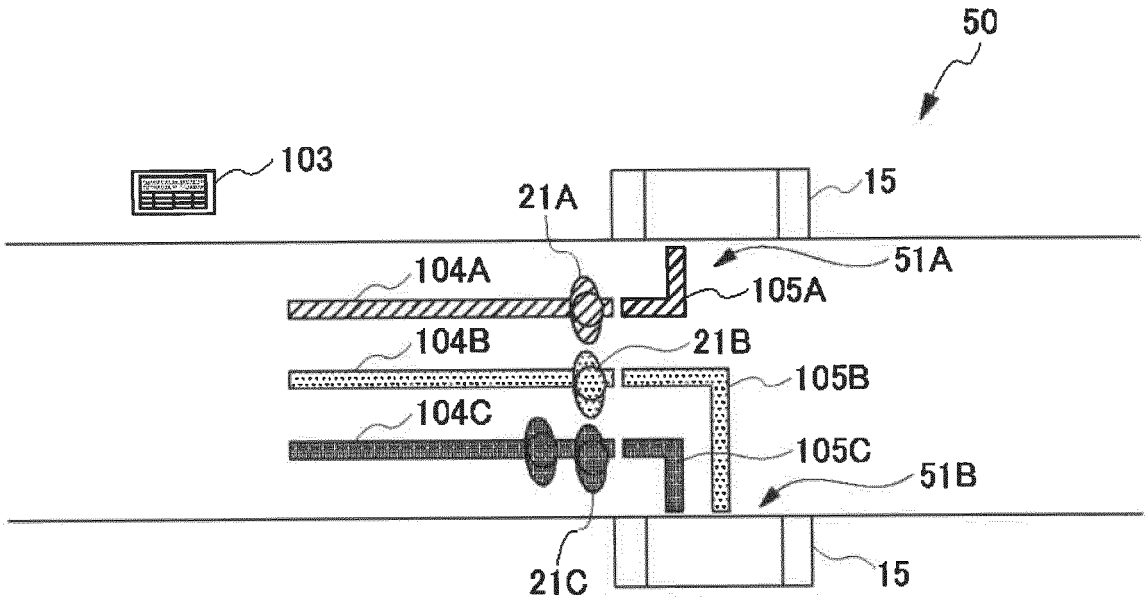


FIG. 5

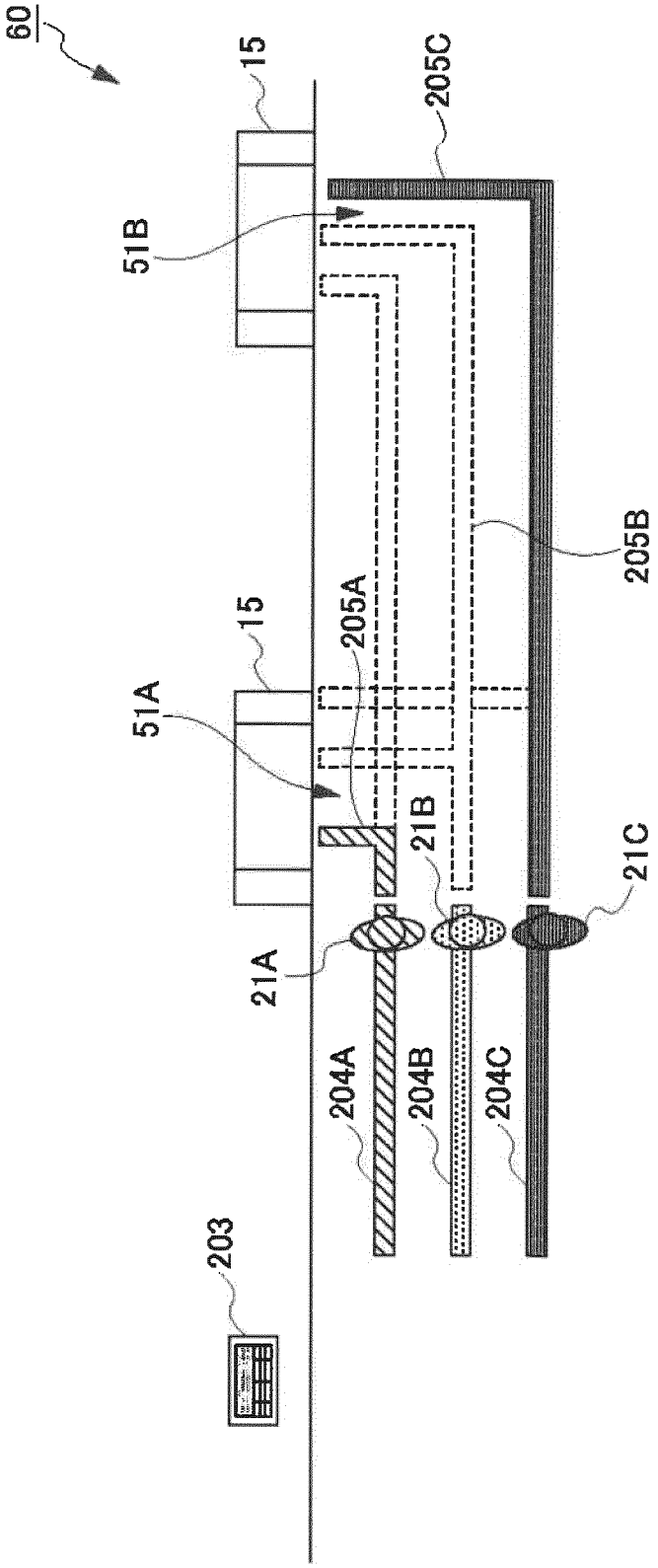


FIG. 6

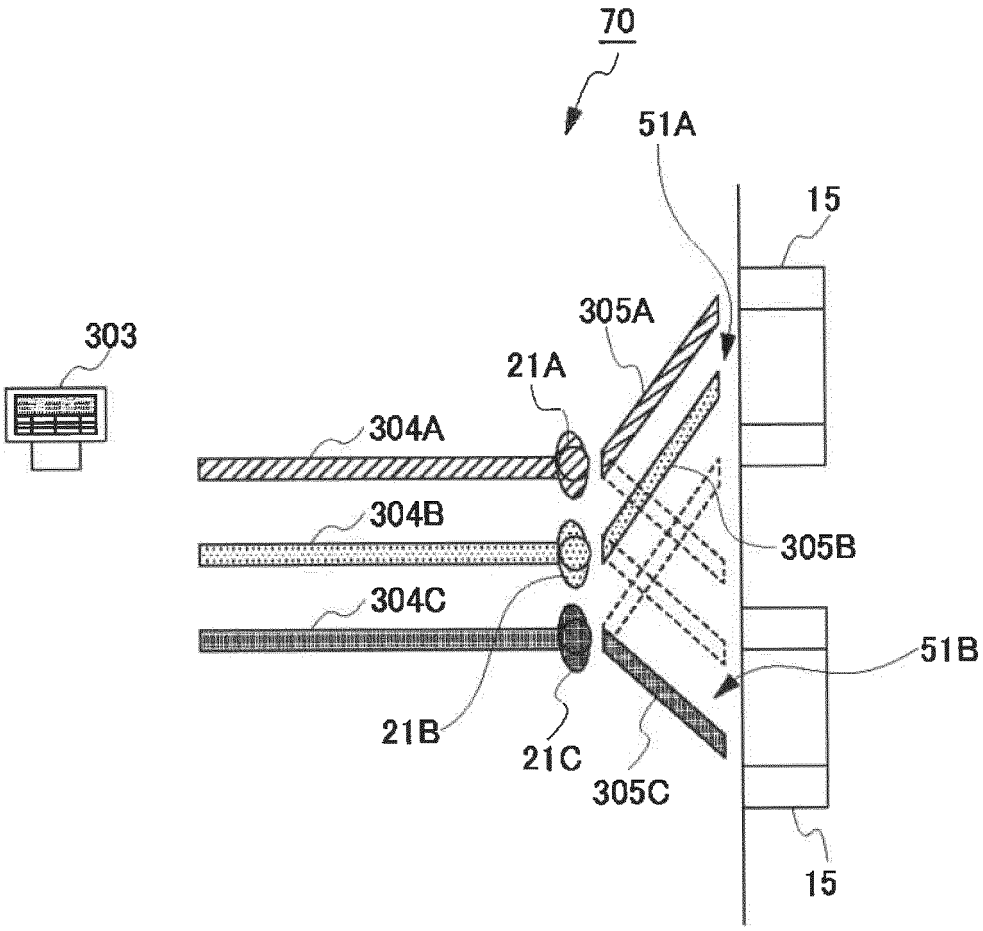


FIG. 7

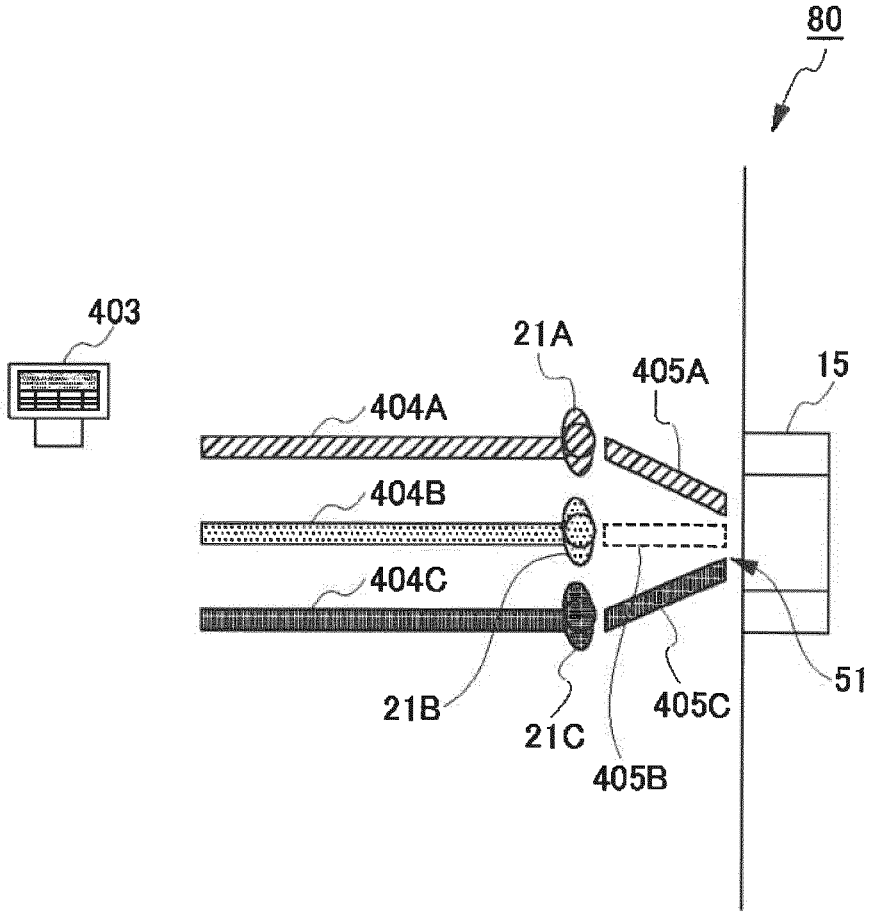


FIG. 8

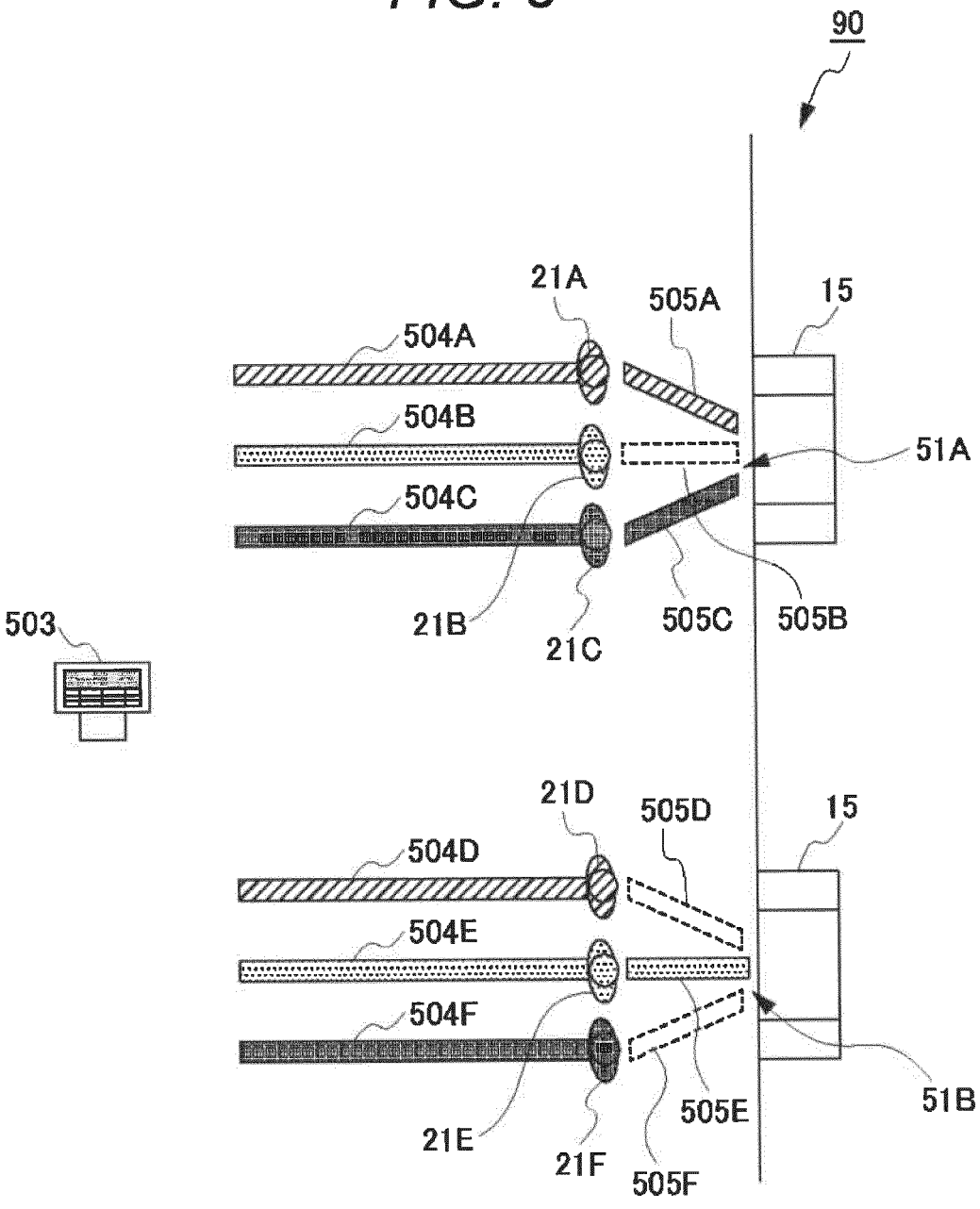

90
21A
505A
15
504A
504B
51A
504C
503
21B
21C
505C
505B
21D
505D
15
504D
504E
504F
51B
21E
21F
505E
505F

FIG. 9

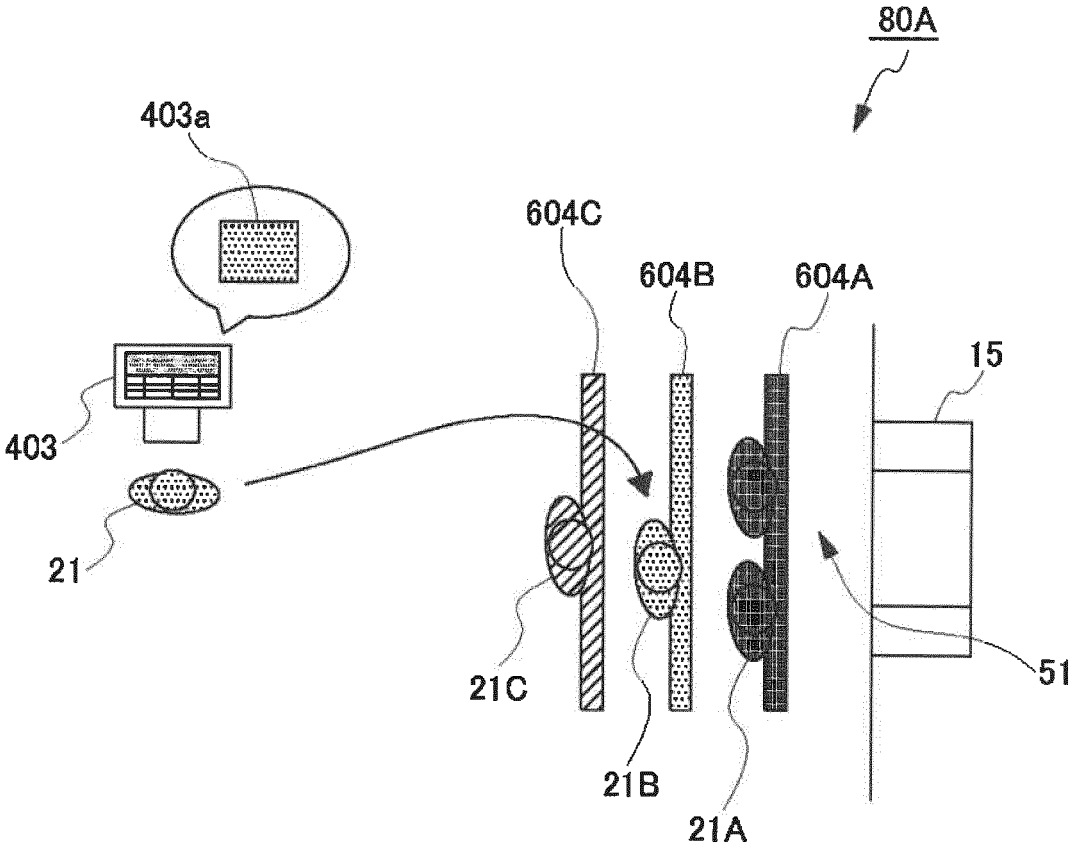


FIG. 10

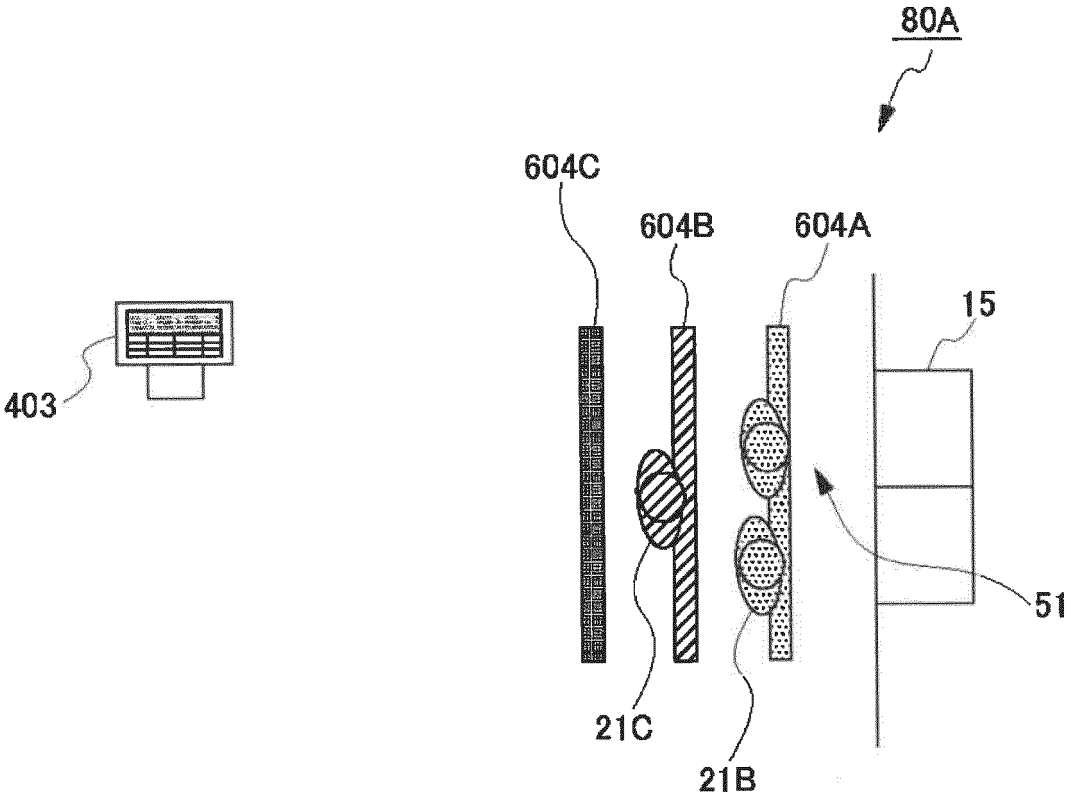


FIG. 11

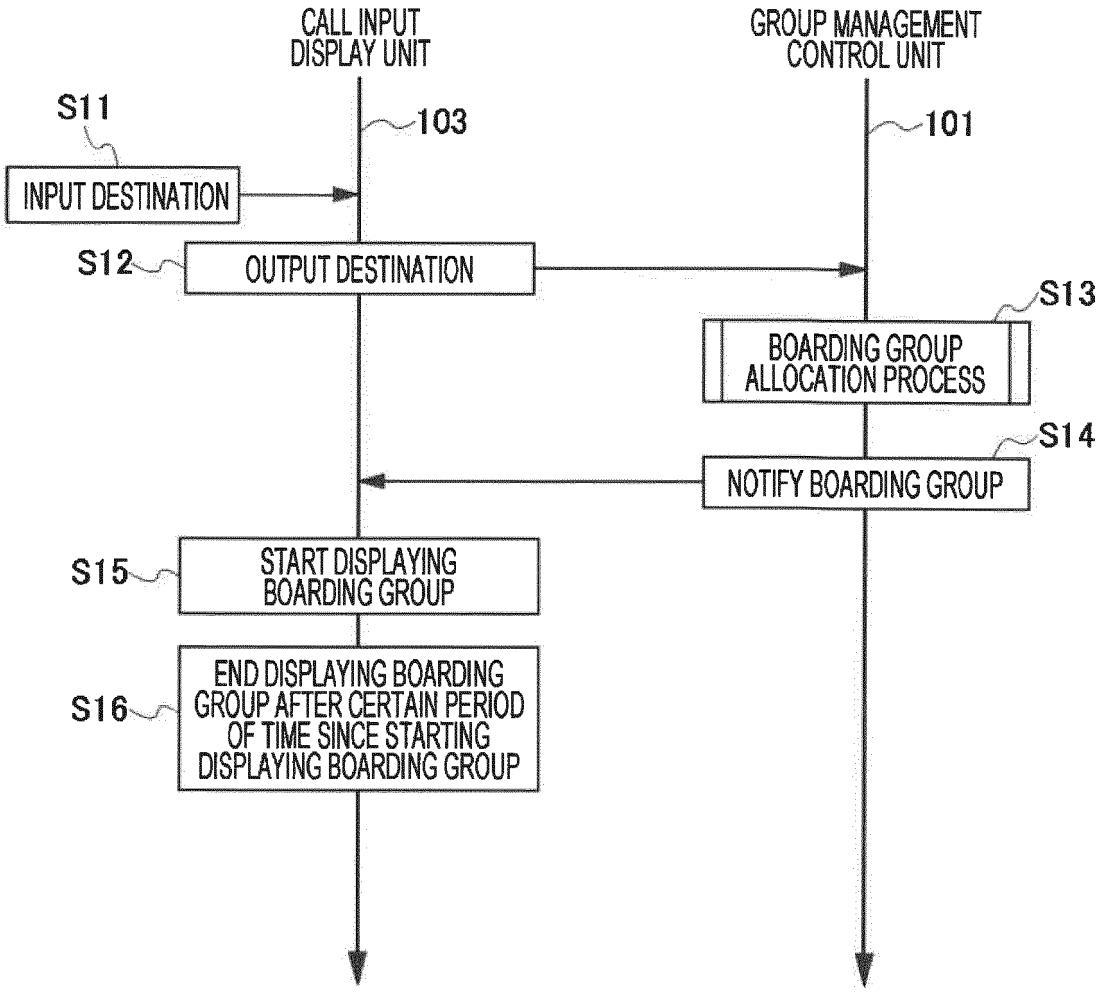

CALL INPUT DISPLAY UNIT
GROUP MANAGEMENT CONTROL UNIT
S11
103
101
INPUT DESTINATION
S12
OUTPUT DESTINATION
S13
BOARDING GROUP ALLOCATION PROCESS
S14
NOTIFY BOARDING GROUP
S15
START DISPLAYING BOARDING GROUP
S16
END DISPLAYING BOARDING GROUP AFTER CERTAIN PERIOD OF TIME SINCE STARTING DISPLAYING BOARDING GROUP

FIG. 12

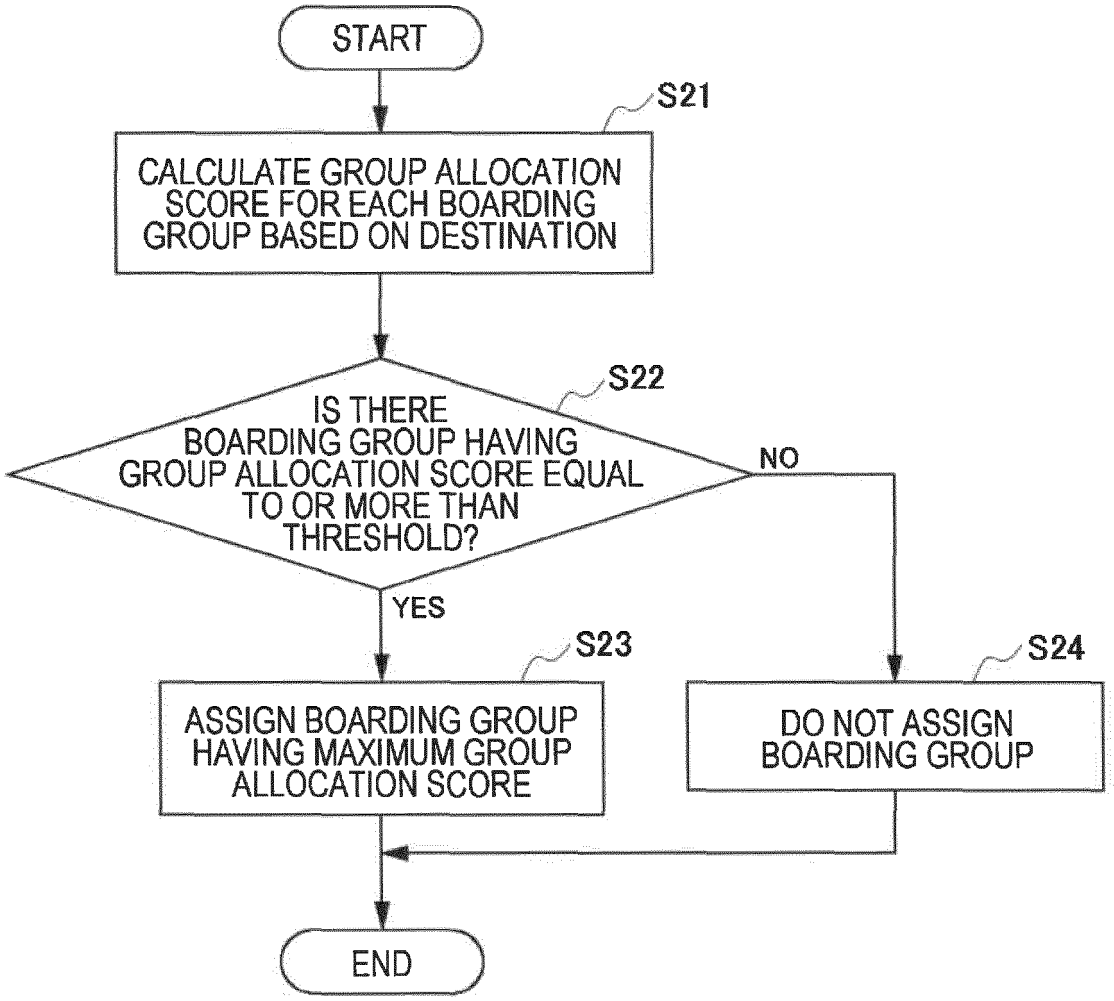

START
S21
CALCULATE GROUP ALLOCATION SCORE FOR EACH BOARDING GROUP BASED ON DESTINATION
S22
IS THERE BOARDING GROUP HAVING GROUP ALLOCATION SCORE EQUAL TO OR MORE THAN THRESHOLD?
NO
YES
S23
ASSIGN BOARDING GROUP HAVING MAXIMUM GROUP ALLOCATION SCORE
S24
DO NOT ASSIGN BOARDING GROUP
END

FIG. 13

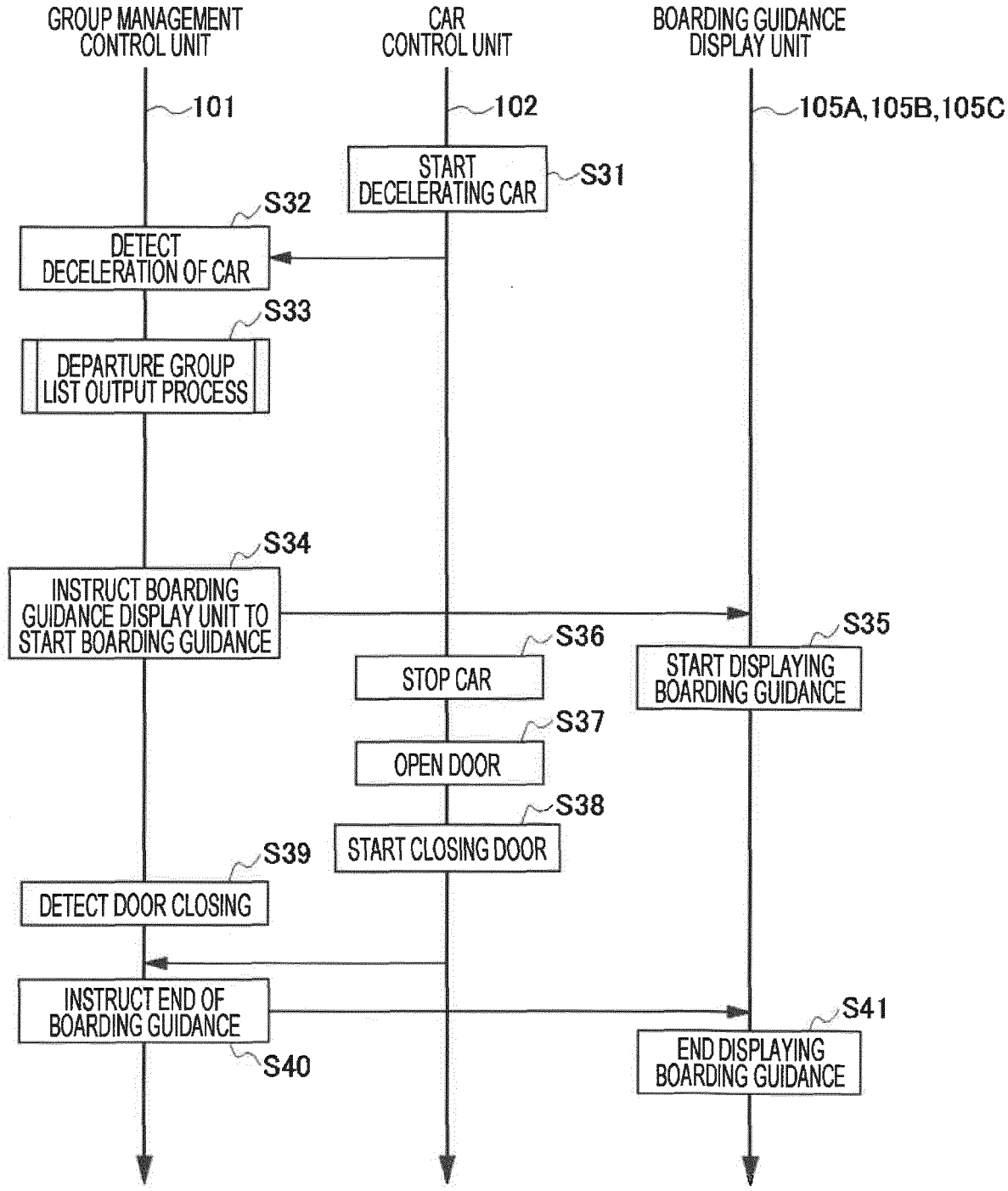

GROUP MANAGEMENT CONTROL UNIT
CAR CONTROL UNIT
BOARDING GUIDANCE DISPLAY UNIT
101
102
105A,105B,105C
START DECELERATING CAR
S31
S32
DETECT DECELERATION OF CAR
S33
DEPARTURE GROUP LIST OUTPUT PROCESS
S34
INSTRUCT BOARDING GUIDANCE DISPLAY UNIT TO START BOARDING GUIDANCE
S35
START DISPLAYING BOARDING GUIDANCE
S36
STOP CAR
S37
OPEN DOOR
S38
START CLOSING DOOR
S39
DETECT DOOR CLOSING
INSTRUCT END OF BOARDING GUIDANCE
S40
S41
END DISPLAYING BOARDING GUIDANCE

FIG. 14

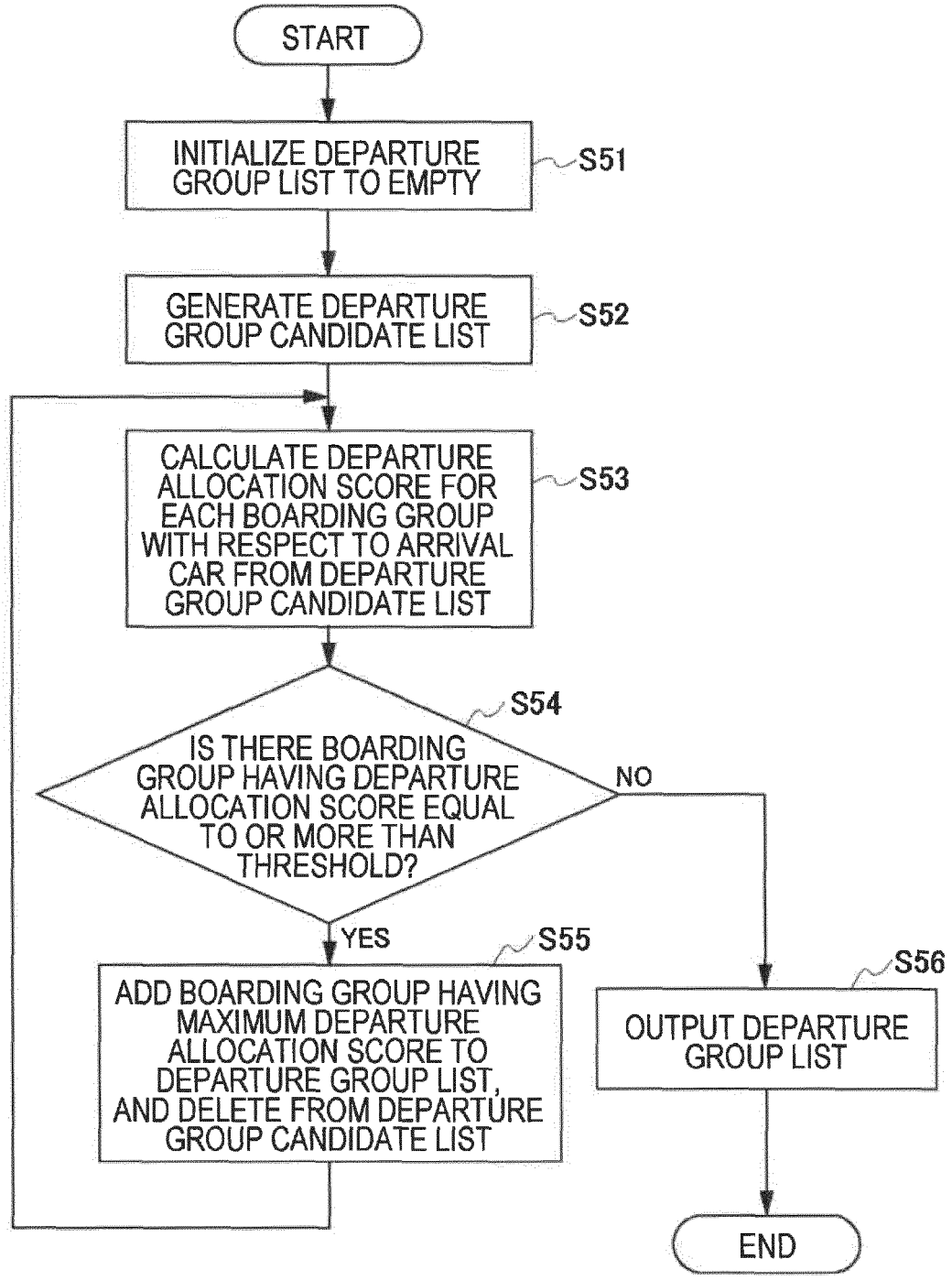

START
INITIALIZE DEPARTURE GROUP LIST TO EMPTY
S51
GENERATE DEPARTURE GROUP CANDIDATE LIST
S52
CALCULATE DEPARTURE ALLOCATION SCORE FOR EACH BOARDING GROUP WITH RESPECT TO ARRIVAL CAR FROM DEPARTURE GROUP CANDIDATE LIST
S53
S54
IS THERE BOARDING GROUP HAVING DEPARTURE ALLOCATION SCORE EQUAL TO OR MORE THAN THRESHOLD?
NO
YES
S55
ADD BOARDING GROUP HAVING MAXIMUM DEPARTURE ALLOCATION SCORE TO DEPARTURE GROUP LIST, AND DELETE FROM DEPARTURE GROUP CANDIDATE LIST
S56
OUTPUT DEPARTURE GROUP LIST
END

FIG. 15

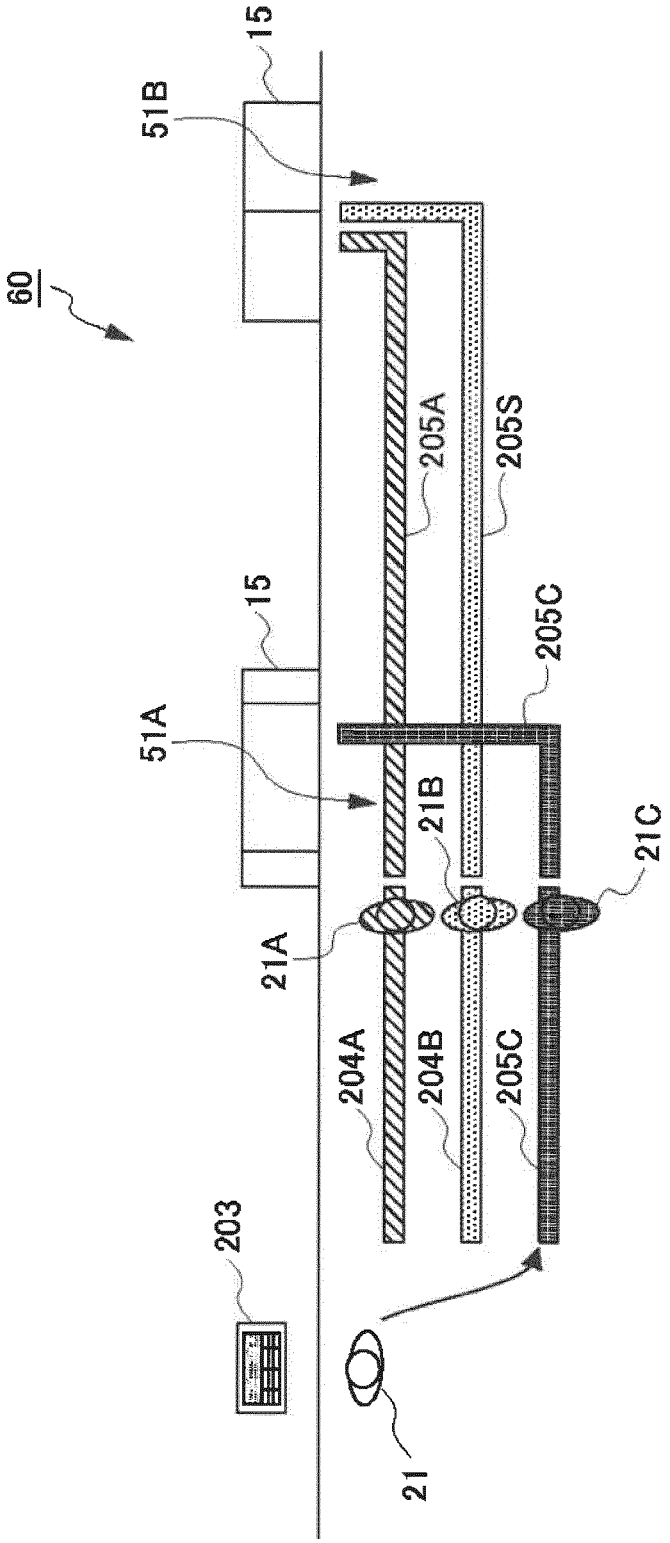

60
15
51B
205A
205S
15
205C
51A
21B
21C
21A
204A
204B
205C
203
21

FIG. 16

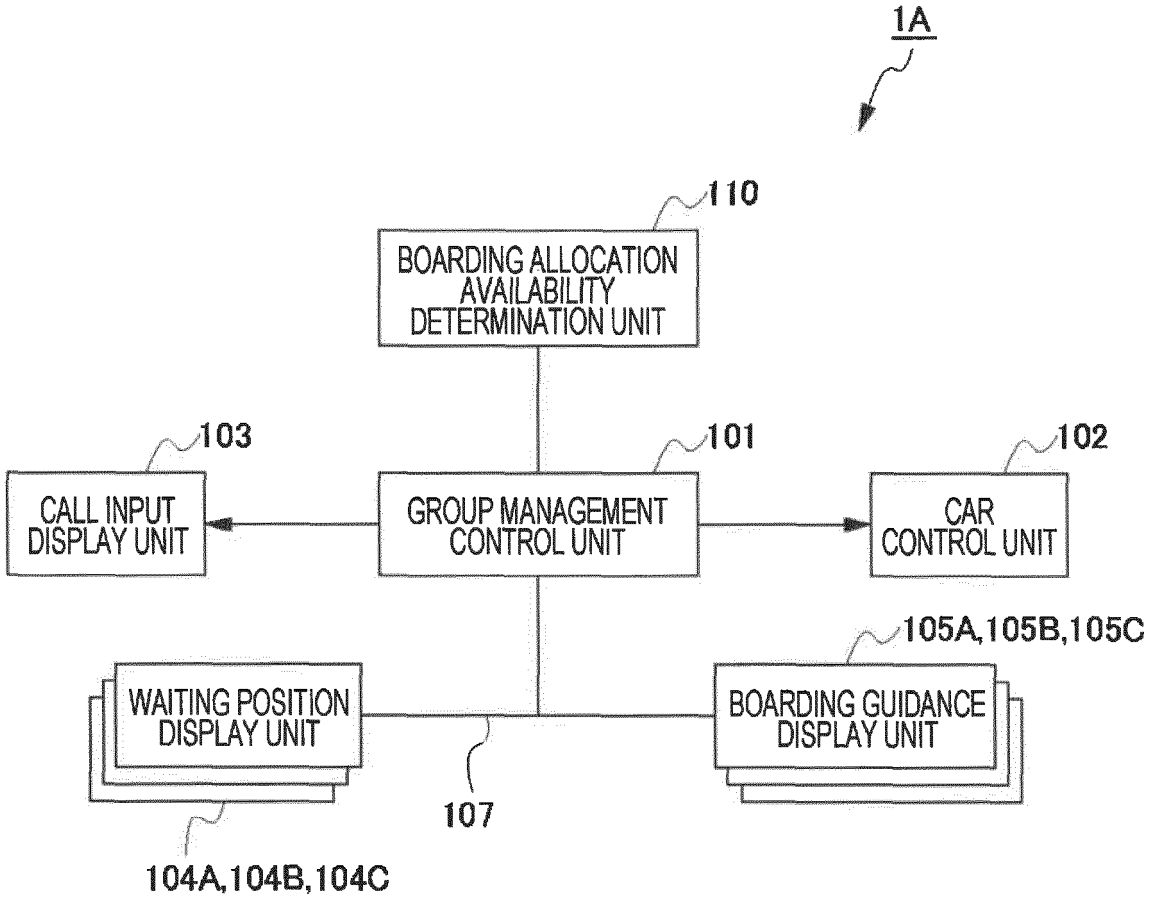

1A
110
BOARDING ALLOCATION AVAILABILITY DETERMINATION UNIT
103
101
102
CALL INPUT DISPLAY UNIT
GROUP MANAGEMENT CONTROL UNIT
CAR CONTROL UNIT
105A,105B,105C
WAITING POSITION DISPLAY UNIT
BOARDING GUIDANCE DISPLAY UNIT
107
104A,104B,104C

FIG. 17

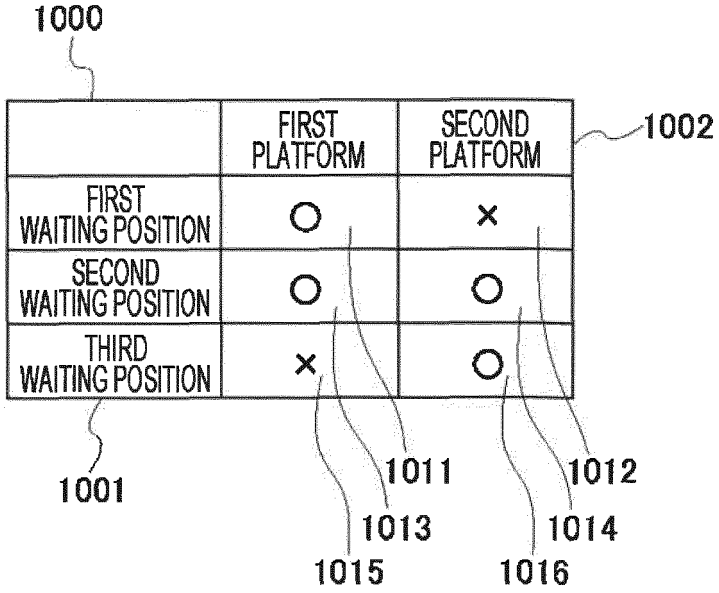

1000
FIRST PLATFORM
SECOND PLATFORM
1002
FIRST WAITING POSITION
SECOND WAITING POSITION
THIRD WAITING POSITION
1001
1011
1012
1013
1014
1015
1016

FIG. 18

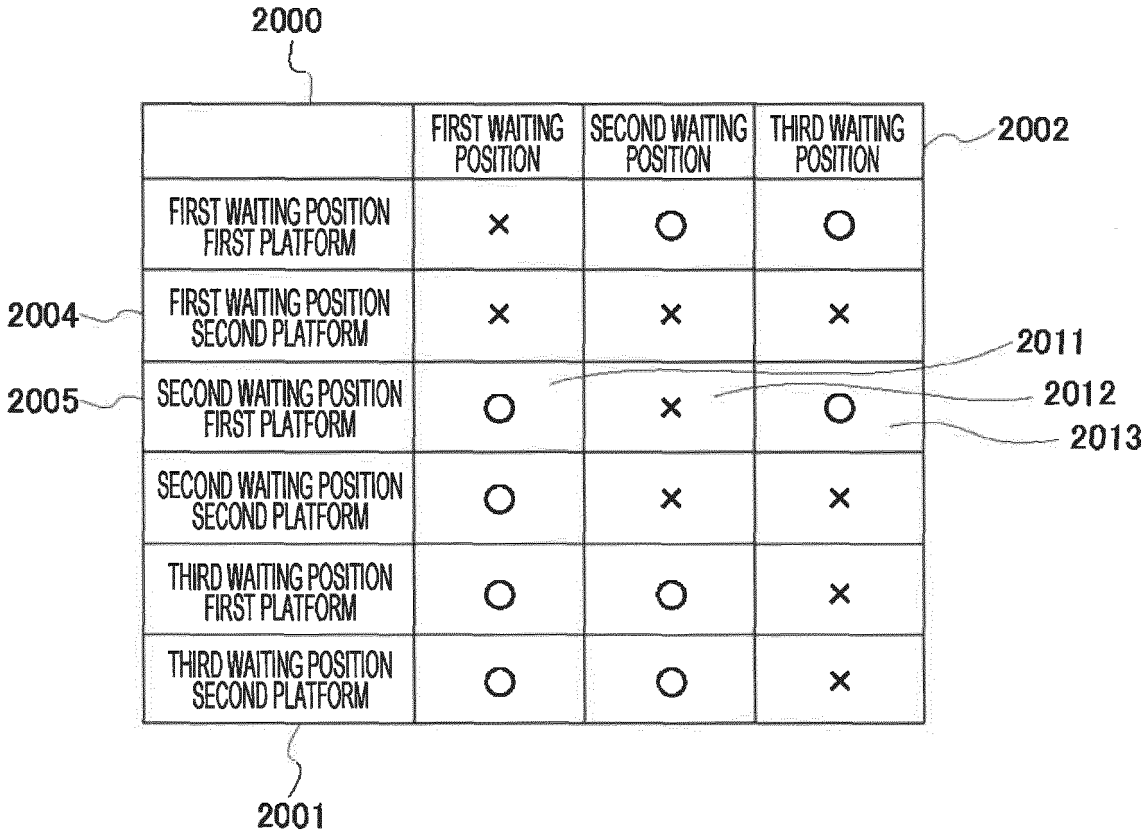

2000
FIRST WAITING POSITION
SECOND WAITING POSITION
THIRD WAITING POSITION
2002
FIRST WAITING POSITION FIRST PLATFORM
FIRST WAITING POSITION SECOND PLATFORM
2004
SECOND WAITING POSITION FIRST PLATFORM
2005
SECOND WAITING POSITION SECOND PLATFORM
THIRD WAITING POSITION FIRST PLATFORM
THIRD WAITING POSITION SECOND PLATFORM
2011
2012
2013
2001

FIG. 19

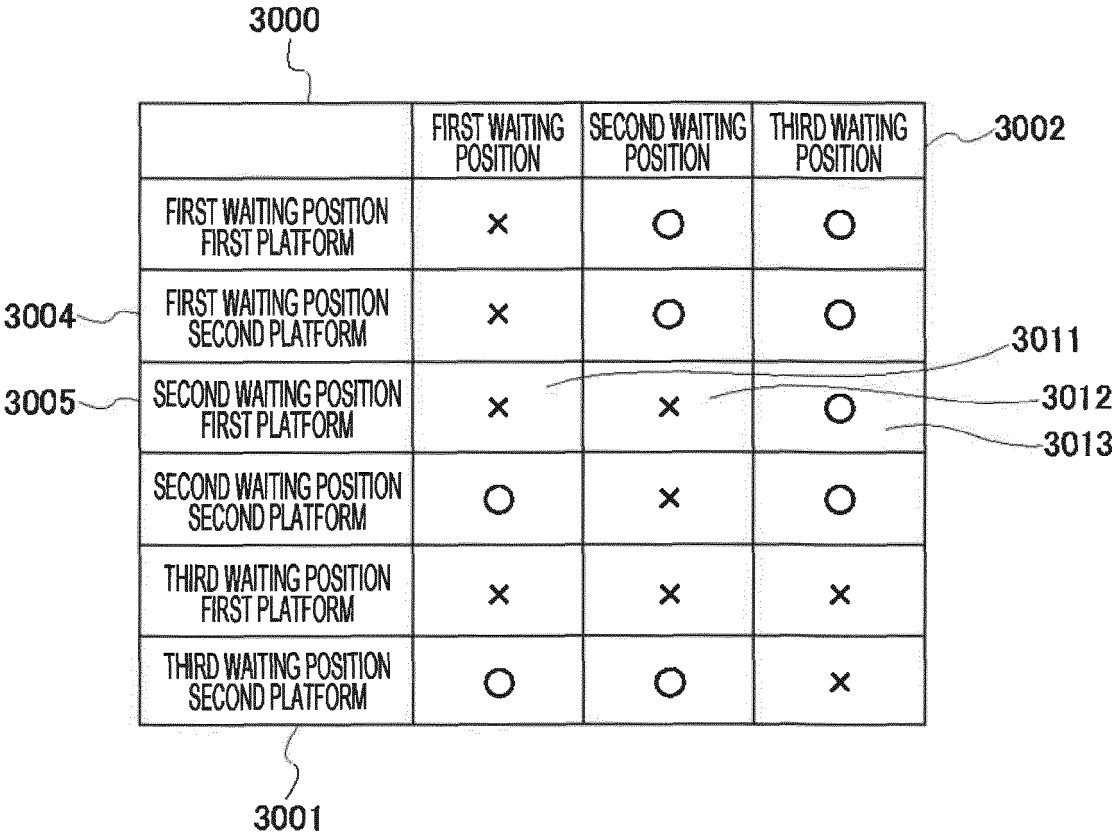

3000
FIRST WAITING POSITION
SECOND WAITING POSITION
THIRD WAITING POSITION
3002
FIRST WAITING POSITION FIRST PLATFORM
FIRST WAITING POSITION SECOND PLATFORM
3004
SECOND WAITING POSITION FIRST PLATFORM
3005
SECOND WAITING POSITION SECOND PLATFORM
THIRD WAITING POSITION FIRST PLATFORM
THIRD WAITING POSITION SECOND PLATFORM
3011
3012
3013
3001

FIG. 20

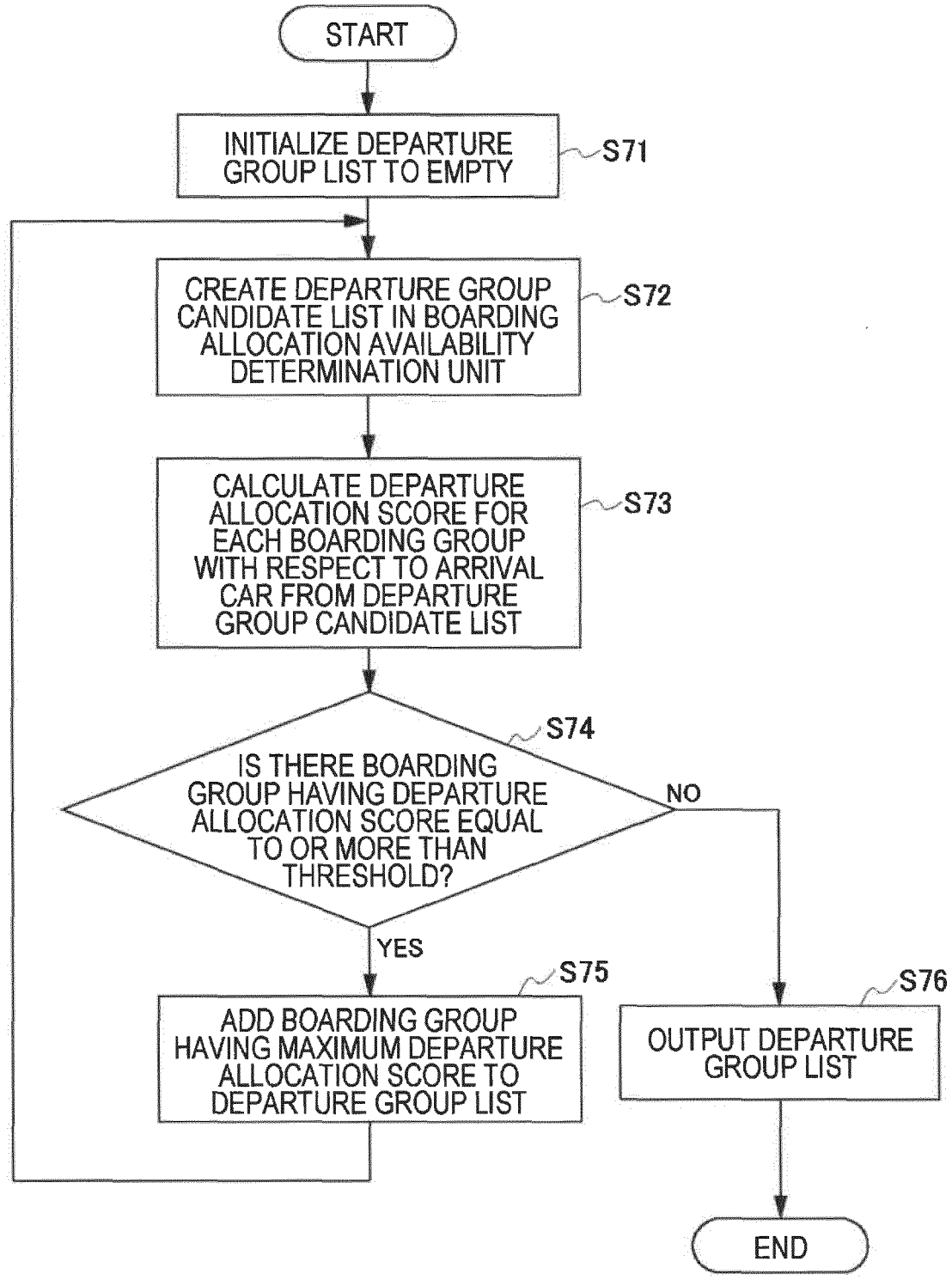
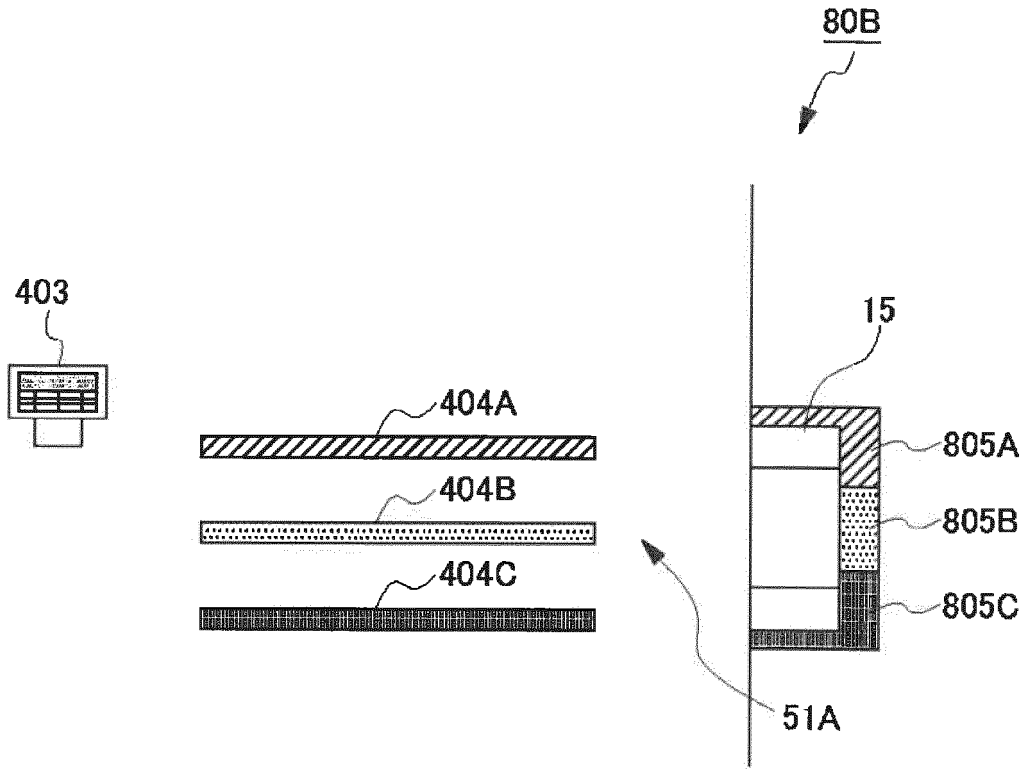

START
INITIALIZE DEPARTURE GROUP LIST TO EMPTY
S71
CREATE DEPARTURE GROUP CANDIDATE LIST IN BOARDING ALLOCATION AVAILABILITY DETERMINATION UNIT
S72
CALCULATE DEPARTURE ALLOCATION SCORE FOR EACH BOARDING GROUP WITH RESPECT TO ARRIVAL CAR FROM DEPARTURE GROUP CANDIDATE LIST
S73
S74
IS THERE BOARDING GROUP HAVING DEPARTURE ALLOCATION SCORE EQUAL TO OR MORE THAN THRESHOLD?
NO
YES
S75
ADD BOARDING GROUP HAVING MAXIMUM DEPARTURE ALLOCATION SCORE TO DEPARTURE GROUP LIST
S76
OUTPUT DEPARTURE GROUP LIST
END

FIG. 21



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/016805

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. B66B3/00(2006.01)i, B66B1/18(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)
Int.Cl. B66B3/00-B66B3/02, B66B1/18

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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	JP 2016-193772 A (FUJITEC CO., LTD.) 17 November 2016, paragraphs [0011]-[0029], [0057]-[0059], [0189], [0210], fig. 1-3, 7 (Family: none)	1-3, 6 4-5
Y	JP 7-277609 A (HITACHI, LTD.) 24 October 1995, paragraphs [0017]-[0039], fig. 1-3 (Family: none)	1-3, 6
Y	JP 2015-218015 A (MITSUBISHI ELECTRIC CORP.) 07 December 2015, paragraphs [0012]-[0025], fig. 1-2 (Family: none)	2
A	WO 2008/043877 A1 (KONE CORPORATION) 17 April 2008 & FI 20060905 A	1-6

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"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	Date of mailing of the international search report
26 June 2019 (26.06.2019)	09 July 2019 (09.07.2019)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009519876 T **[0004]**