



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
17.06.2009 Bulletin 2009/25

(51) Int Cl.:
B61B 1/02 (2006.01) B61L 27/00 (2006.01)

(21) Application number: **09004156.7**

(22) Date of filing: **29.07.2003**

(84) Designated Contracting States:
FR GB

(30) Priority: **31.07.2002 JP 2002222557**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
03254753.1 / 1 386 813

(71) Applicant: **Hitachi, Ltd.**
Chiyoda-ku,
Tokyo 101-8010 (JP)

(72) Inventors:
 • **Kawabata, Iko**
Tokyo 100-8220 (JP)

• **Amazawa, Toshiharu**
Tokyo 100-8220 (JP)
 • **Kasai, Syoji**
Tokyo 100-8220 (JP)
 • **Inoue, Tomomi**
Tokyo 100-8220 (JP)

(74) Representative: **Calderbank, Thomas Roger et al**
Mewburn Ellis LLP
33 Gutter Lane
London
EC2V 8AS (GB)

Remarks:

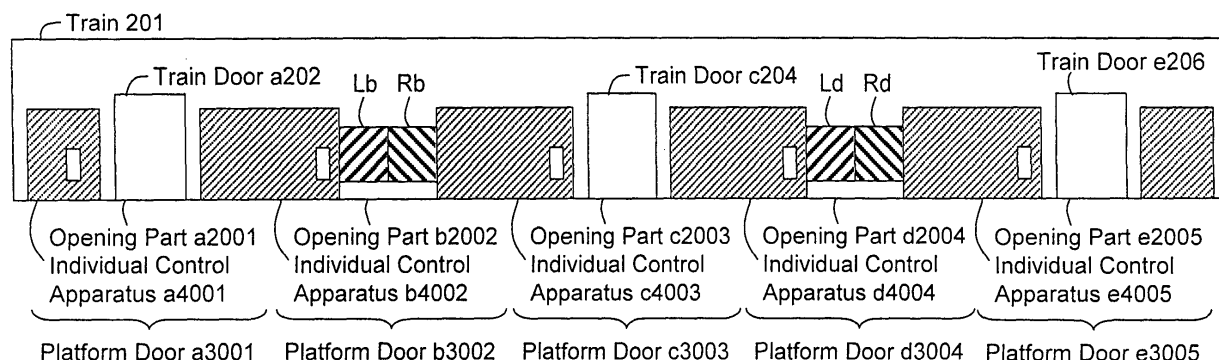
This application was filed on 24-03-2009 as a divisional application to the application mentioned under INID code 62.

(54) **Platform door control apparatus**

(57) A platform door control apparatus that enables installation of platform doors even though the number, location, and width dimensions of train doors of trains are different. In Fig. 2, when train 201 arrives at a platform, at platform door a an opening part a is in a fully open state; at platform door b, gate Rb and gate Lb of opening part b are in a fully closed state; at platform door c opening part c is in a fully open state; at platform door d, gate Rd and gate Ld of opening part d are in a fully closed state; and at platform door e opening part e is in a fully open

state. These data are registered in advance as command values in respective individual control apparatus a to e, and further, a moving distance for opening and closing of the gates of each platform door is determined beforehand in accordance with the formation information of each train. Then, when an "OPEN" command is transmitted from the train to the platform doors, the formation information of the train is also transmitted to each individual control apparatus to change the moving distance for opening and closing of gates at each platform door.

FIG.2



Description

[0001] The present invention relates to a platform door control apparatus, and more particularly to technology for controlling platform doors installed on a platform for an underground train or the like.

[0002] In recent years, the trend towards the use of one-man operated trains has been increasing. Accompanying this, platform doors are being installed on platforms to secure passenger safety. After a train arrives at a platform, an "OPEN" command is transmitted from the train and the gates of the platform doors open. After passengers have gotten off and on, a "CLOSE" command is transmitted from the train and the gates of the platform doors close and the train departs.

[0003] However, on train lines on which a large number of trains of different forms operate, or on lines on which one train company shares the tracks with another, the number, locations and width dimensions of the train doors differ according to the specifications of each train. Thus, since the locations of train doors and platform doors do not correspond, it constitutes an obstacle to the introduction of platform doors.

[0004] The present invention aims to provide a platform door control apparatus that enables the installment of platform doors even if trains differ in the number, locations and width dimensions of their train doors.

[0005] Accordingly, the platform door control apparatus of the present invention comprises a receiving means for receiving formation information of a train from the train, a storing means for storing information about a moving distance for opening and closing of a gate of each of the platform doors corresponding to the formation information of each train, and a control apparatus for controlling the moving distance for opening and closing of a gate of each of the platform doors based on the formation information of the train received by the receiving means and on the information about the moving distance for opening and closing of a gate of each of the platform doors stored in the storing means, whereby the moving distance for opening and closing of a gate of each platform door is changed.

[0006] Preferably, in accordance with the formation information of the train, when train doors of a train are not positioned at the gates of a relevant platform door, the gates do not open and close.

[0007] Preferably, a means is provided to inform passengers that it is not possible to get off or on at a platform door.

Fig. 1 is a schematic diagram illustrating the positional relationship between opening parts of platform doors and train doors of a train of formation information 1 in the present invention.

Fig. 2 is a schematic diagram illustrating the positional relationship between the opening parts of platform doors and the train doors of a train of formation information 2 in the present invention.

Fig. 3 is a schematic diagram illustrating the positional relationship between the opening parts of platform doors and the train doors of a train of formation information 3 in the present invention.

Fig. 4 is a schematic diagram illustrating the positional relationship between the opening parts of platform doors and the train doors of a train of formation information 4 in the present invention.

Fig. 5 is a schematic diagram showing a processing flow of individual control apparatus a 4001 of platform door a 3001 with respect to formation information of a train in the present invention.

Fig. 6 is a schematic diagram showing a processing flow of individual control apparatus b 4002 of platform door b 3002 with respect to formation information of a train in the present invention.

Fig. 7 is a schematic diagram showing a processing flow of individual control apparatus c 4003 of platform door c 3003 with respect to formation information of a train in the present invention.

Fig. 8 is a schematic diagram showing a processing flow of individual control apparatus d 4004 of platform door d 3004 with respect to formation information of a train in the present invention.

Fig. 9 is a schematic diagram showing a processing flow of individual control apparatus e 4005 of platform door e 3005 with respect to formation information of a train in the present invention.

Fig. 10 is a schematic diagram showing the system configuration of the platform doors of the present invention.

[0008] Hereafter, an embodiment of the present invention will be described referring to the figures.

[0009] A platform door control apparatus according to one embodiment of the present invention will be described using Figs. 1 to 4 and Figs. 5 to 9.

[0010] Fig. 1 illustrates the positional relationship between the opening part of platform doors and the train doors of a train 101 of formation information 1. Fig. 2 illustrates the positional relationship between the opening part of platform doors and the train doors of a train 201 of formation information 2. Fig. 3 illustrates the positional relationship between the opening part of platform doors and the train doors of a train 301 of formation information 3. Fig. 4 illustrates the positional relationship between the opening part of platform doors and the train doors of a train 401 of formation information 4.

[0011] Herein, the term "formation information of a train" refers to information concerning the number, locations and width dimensions of train doors of a train. Formation information 1 indicates a case where the number of train doors of train 101 is five, the five train doors are located at regular intervals, and the width dimensions of the train doors are wide. Formation information 2 indicates a case where the number of train doors of train 201 is three, the three train doors are located at regular intervals, and the width dimensions of the train doors are

wide. Formation information 3 indicates a case where the number of train doors of train 301 is five, the five train doors are located at regular intervals, and the width dimensions of the train doors are narrow. Formation information 4 indicates a case where the number of train doors of train 401 is two, the two train doors are positioned at the front and rear of the train, respectively, and the width dimensions of the train doors are narrow.

[0012] The moving distance for opening and closing of gates Ra and La, gates Rb and Lb, gates Rc and Lc, gates Rd and Ld, and gates Re and Le of the corresponding platform doors a to e, that corresponds to formation information 1-4 of the respective trains, is previously determined.

[0013] Fig. 1 shows a train 101 has arrived at a platform, and at a platform door a 3001 an opening part a 2001 is in a fully open state, at a platform door b 3002 an opening part b 2002 is in a fully open state, at a platform door c 3003 an opening part c 2003 is in a fully open state, at a platform door d 3004 an opening part d 2004 is in a fully open state, and at a platform door e 3005 an opening part e 2005 is in a fully open state. These data are previously registered as command values in an individual control apparatus a 4001, an individual control apparatus b 4002, an individual control apparatus c 4003, an individual control apparatus d 4004, and an individual control apparatus e 4005, respectively.

[0014] Fig. 2 shows a train 201 has arrived at a platform, and at platform door a 3001 the opening part a 2001 is in a fully open state; at platform door b 3002, a gate Rb and a gate Lb of opening part b 2002 are in a fully closed state; at platform door c 3003 the opening part c 2003 is in a fully open state; at platform door d 3004, a gate Rd and a gate Ld of opening part d 2004 are in a fully closed state; and at platform door e 3005 the opening part e 2005 is in a fully open state. These data are previously registered as command values in individual control apparatus a 4001, individual control apparatus b 4002, individual control apparatus c 4003, individual control apparatus d 4004, and individual control apparatus e 4005, respectively.

[0015] Fig. 3 shows a train 301 has arrived at a platform, and at platform door a 3001, a gate Ra and a gate La of opening part a 2001 are in a closed state and an open state, respectively; at platform door b 3002, a gate Rb and a gate Lb of opening part b 2002 are in an open state and a closed state, respectively; at platform door c 3003, a gate Rc and a gate Lc of opening part c 2003 are in a closed state and an open state, respectively; at platform door d 3004, a gate Rd and a gate Ld of opening part d 2004 are in an open state and a closed state, respectively; and at platform door e 3005, a gate Re and a gate Le of opening part e 2005 are in a closed state and an open state, respectively. These data are previously registered as command values in individual control apparatus a 4001, individual control apparatus b 4002, individual control apparatus c 4003, individual control apparatus d 4004, and individual control apparatus e 4005,

respectively.

[0016] Fig. 4 shows a train 401 has arrived at a platform, and at platform door a 3001, a gate Ra and a gate La of opening part a 2001 are each in a semi-open state; at platform door b 3002, opening part b 2002 is in a fully closed state; at platform door c 3003, opening part c 2003 is in a fully closed state; at platform door d 3004, opening part d 2004 is in a fully closed state; and at platform door e 3005, a gate Re and a gate Le of opening part e 2005 are each in a semi-open state. These data are previously registered as command values in individual control apparatus a 4001, individual control apparatus b 4002, individual control apparatus c 4003, individual control apparatus d 4004, and individual control apparatus e 4005, respectively.

[0017] Fig. 5 illustrates a processing flow of individual control apparatus a 4001 of platform door a 3001 with respect to formation information of a train.

[0018] When a train arrives at the platform, formation information is received from the control platform of the train (501). When the formation information is determined to be formation information 1 (502), a "FULL OPEN" command is sent to gate La and a "FULL OPEN" command is sent to gate Ra (503). When the formation information is determined to be formation information 2 (504), a "FULL OPEN" command is sent to gate La and a "FULL OPEN" command is sent to gate Ra (505). When the formation information is determined to be formation information 3 (506), a "FULL OPEN" command is sent to gate La and no command is sent to gate Ra and it remains in a "CLOSE" state (507). When the formation information is formation information 4, a "HALF OPEN" command is sent to gate La and a "HALF OPEN" command is sent to gate Ra (508).

[0019] Therefore, since platform door a 3001 opens and closes to a distance corresponding to train door a 102, 202, 302, and 402 of train 101, 201, 301, and 401, passengers are able to get off and on the trains without any hindrance, irrespective of differences in the forms of the trains.

[0020] Fig. 6 shows a processing flow of individual control apparatus b 4002 of platform door b 3002 with respect to formation information of a train.

[0021] When a train arrives at the platform, formation information is received from the control platform of the train (601). When the formation information is determined to be formation information 1 (602), a "FULL OPEN" command is sent to gate Lb and a "FULL OPEN" command is sent to gate Rb (603). When the formation information is determined to be formation information 2 (604), no command is sent to gate Lb and it remains in a "CLOSE" state and no command is sent to gate Rb and it remains in a "CLOSE" state, and passengers are informed that it is not possible to get on or off the train at this platform door (605). When the formation information is determined to be formation information 3 (606), no command is sent to gate Lb and it remains in a "CLOSE" state, and a "FULL OPEN" command is sent to gate Rb (607). When the

formation information is formation information 4, no command is sent to gate Lb and it remains in a "CLOSE" state and no command is sent to gate Rb and it remains in a "CLOSE" state, and passengers are informed that it is not possible to get on or off the train at this platform door (608).

[0022] Therefore, since platform door b 3002 opens and closes to a distance corresponding to train door b 103, 203, 303, and 403 of train 101, 201, 301, and 401, passengers are able to get off and on the trains without any hindrance, irrespective of differences in the forms of the trains.

[0023] Fig. 7 shows a processing flow of individual control apparatus c 4003 of platform door c 3003 with respect to formation information of a train.

[0024] When a train arrives at the platform, formation information is received from the control platform of the train (701). When the formation information is determined to be formation information 1 (702), a "FULL OPEN" command is sent to gate Lc and a "FULL OPEN" command is sent to gate Rc (703). When the formation information is determined to be formation information 2 (704), a "FULL OPEN" command is sent to gate Lc and a "FULL OPEN" command is sent to gate Rc (705). When the formation information is determined to be formation information 3 (706), a "FULL OPEN" command is sent to gate Lc and no command is sent to gate Rc and it remains in a "CLOSE" state (707). When the formation information is formation information 4, no command is sent to gate Lc and it remains in a "CLOSE" state and no command is sent to gate Rc and it remains in a "CLOSE" state, and passengers are informed that it is not possible to get on or off the train at this platform door (708).

[0025] Therefore, since platform door c 3003 opens and closes to a distance corresponding to train door c 104, 204, 304, and 404 of train 101, 201, 301, and 401, passengers are able to get off and on the trains without any hindrance, irrespective of differences in the forms of the trains.

[0026] Fig. 8 shows a processing flow of individual control apparatus d 4004 of platform door d 3004 with respect to formation information of a train.

[0027] When a train arrives at the platform, formation information is received from the control platform of the train (801). When the formation information is determined to be formation information 1 (802), a "FULL OPEN" command is sent to gate Ld and a "FULL OPEN" command is sent to gate Rd (803). When the formation information is determined to be formation information 2 (804), no command is sent to gate Ld and it remains in a "CLOSE" state and no command is sent to gate Rd and it remains in a "CLOSE" state, and passengers are informed that it is not possible to get on or off the train at this platform door (805). When the formation information is determined to be formation information 3 (806), no command is sent to gate Ld and it remains in a "CLOSE" state and a "FULL OPEN" command is sent to gate Rd (807). When the formation information is formation information 4, no com-

mand is sent to gate Ld and it remains in a "CLOSE" state and no command is sent to gate Rd and it remains in a "CLOSE" state, and passengers are informed that it is not possible to get on or off the train at this platform door (808).

[0028] Therefore, since platform door d 3004 opens and closes to a distance corresponding to train door d 105, 205, 305, and 405 of train 101, 201, 301, and 401, passengers are able to get off and on the trains without any hindrance, irrespective of differences in the forms of the trains.

[0029] Fig. 9 shows a processing flow of individual control apparatus e 4005 of platform door e 3005 with respect to formation information of a train.

[0030] When a train arrives at the platform, formation information is received from the control platform of the train (901). When the formation information is determined to be formation information 1 (902), a "FULL OPEN" command is sent to gate Le and a "FULL OPEN" command is sent to gate Re (903). When the formation information is determined to be formation information 2 (904), a "FULL OPEN" command is sent to gate Le and a "FULL OPEN" command is sent to gate Re (905). When the formation information is determined to be formation information 3 (906), a "FULL OPEN" command is sent to gate Le and no command is sent to gate Re and it remains in a "CLOSE" state (907). When the formation information is formation information 4, a "HALF OPEN" command is sent to gate Le and a "HALF OPEN" command is sent to gate Re (908).

[0031] Therefore, since platform door e 3005 opens and closes to a distance corresponding to train door e 106, 206, 306, and 406 of train 101, 201, 301, and 401, passengers are able to get off and on the trains without any hindrance, irrespective of differences in the forms of the trains.

[0032] In the above, formation information of the trains illustrated in Fig. 1 to Fig. 4 was described as one embodiment of the present invention. However, the present invention is not limited to this formation information, and it is clear that it can be suitably applied to the formation information of other trains.

[0033] Fig. 10 illustrates the system configuration of the platform doors.

[0034] When a train arrives at the platform and stops within a permitted range of stopping positions, a signal indicating doors can be opened is transmitted by a communication means 1019 from a way-side apparatus 1008 installed on the rail track to an on-board apparatus 1007 and a transceiver 1006, and is displayed in the control platform of the train (not shown in the figure). The operator of the train then operates a door control panel 1005 to press the "Open" switch.

[0035] At this time, an "OPEN" command and "Formation Information" are transmitted to communication means 1019 and way-side apparatus 1008 via transceiver 1006 and on-board apparatus 1007, to be transmitted to a repeater 1009 and an information transmission de-

vice 1010. The information transmission device 1010 transmits the "OPEN" command and "Formation Information" to a station control device 1011 of the platform in question. Upon receiving these signals, station control device 1011 transmits the "OPEN" command and "Formation Information" simultaneously via a line 1000 to individual control apparatus a 4001, individual control apparatus b 4002, individual control apparatus c 4003, individual control apparatus d 4004, and individual control apparatus e 4005 that control the platform doors.

[0036] Upon receiving the "OPEN" command and "Formation Information," individual control apparatus a 4001 controls the moving distance for gate La 1023 and gate Ra 1024 according to the processing flow shown in Fig. 5. When the moving distance for gate La 1023 and gate Ra 1024 is "0," platform door a 3001 does not perform any opening operation. At that time, passengers are informed by a display means a 1022 that it is not possible to get on or off the train at this platform door.

[0037] Upon receiving the "OPEN" command and "Formation Information," individual control apparatus b 4002 controls the moving distance for gate Lb 1033 and gate Rb 1034 according to the processing flow shown in Fig. 6. When the moving distance for gate Lb 1033 and gate Rb 1034 is "0," platform door b 3002 does not perform any opening operation. At that time, passengers are informed by a display means b 1032 that it is not possible to get on or off the train at this platform door.

[0038] Upon receiving the "OPEN" command and "Formation Information," individual control apparatus c 4003 controls the moving distance for gate Lc 1043 and gate Rc 1044 according to the processing flow shown in Fig. 7. When the moving distance for gate Lc 1043 and gate Rc 1044 is "0," platform door c 3003 does not perform any opening operation. At that time, passengers are informed by a display means c 1042 that it is not possible to get on or off the train at this platform door.

[0039] Upon receiving the "OPEN" command and "Formation Information," individual control apparatus d 4004 controls the moving distance for gate Ld 1053 and gate Rd 1054 according to the processing flow shown in Fig. 8. When the moving distance for gate Ld 1053 and gate Rd 1054 is "0," platform door d 3004 does not perform any opening operation. At that time, passengers are informed by a display means d 1052 that it is not possible to get on or off the train at this platform door.

[0040] Upon receiving the "OPEN" command and "Formation Information," individual control apparatus e 4005 controls the moving distance for gate Le 1063 and gate Re 1064 according to the processing flow shown in Fig. 9. When the moving distance for gate Le 1063 and gate Re 1064 is "0," platform door e 3005 does not perform any opening operation. At that time, passengers are informed by a display means e 1062 that it is not possible to get on or off the train at this platform door.

[0041] Meanwhile, station control device 1011 returns an "OPEN ACK" signal to information transmission device 1010 to indicate that it has received the "OPEN"

command and "Formation Information."

[0042] Information transmission device 1010 transmits this "OPEN ACK" signal to the train side via repeater 1009, way-side apparatus 1008, on-board apparatus 1007, and transceiver 1006. A train door device 1003 receives the "OPEN ACK" signal via a door operation relay panel 1004 and commences operation to open the train doors.

[0043] When the platform doors start opening operations, individual control apparatus a 4001, individual control apparatus b 4002, individual control apparatus c 4003, individual control apparatus d 4004; and individual control apparatus e 4005 each output an "OPEN START" signal to station control device 1011. When station control device 1011 receives any "OPEN START" signal, it starts output of an "ALL CLOSE OFF" (not all platform doors are closed) signal to information transmission device 1010. Thereby, an "ALL CLOSE OFF" signal is transmitted to the train side via repeater 1009, way-side apparatus 1008, on-board apparatus 1007, and transceiver 1006 to show the status display in the control platform of the train. The operator of the train thus knows by means of the status display that a platform door is "OPEN."

[0044] The operator of the train checks the passenger getting on or off situation by means of a device to monitor getting on or off of passengers or the like (not shown in the figure), and operates door control panel 1005 of the control platform to press the "CLOSE" switch. Thereby, train door device 1003 commences "CLOSE" operation, and at the same time, a "CLOSE" command is transmitted to communication means 1019 and way-side apparatus 1008 via transceiver 1006 and on-board apparatus 1007, to be transmitted to repeater 1009 and information transmission device 1010. Information transmission device 1010 then transmits a "CLOSE" signal to station control device 1011 of the platform doors in question. Upon receiving this signal, station control device 1011 transmits a "CLOSE" command simultaneously via line 1000 to individual control apparatus a 4001, individual control apparatus b 4002, individual control apparatus c 4003, individual control apparatus d 4004, and individual control apparatus e 4005 that control the platform doors. Upon receiving the "CLOSE" command signal, individual control apparatus a 4001, individual control apparatus b 4002, individual control apparatus c 4003, individual control apparatus d 4004, and individual control apparatus e 4005 commence closing operations of platform door a 3001, platform door b 3002, platform door c 3003, platform door d 3004, and platform door e 3005, respectively.

[0045] When the respective gates have moved to a fully closed position, individual control apparatus a 4001, individual control apparatus b 4002, individual control apparatus c 4003, individual control apparatus d 4004, and individual control apparatus e 4005 each output a "CLOSE COMPLETED" signal to station control device 1011.

[0046] Upon receiving the "CLOSE COMPLETED" signal of all of the platform doors of the track where the

passengers got off and on, station control device 1011 starts output of a "CLOSE CONFIRMED" signal to information transmission device 1010. Thereby, a "CLOSE CONFIRMED" signal is transmitted to the train side via repeater 1009, way-side apparatus 1008, on-board apparatus 1007 and transceiver 1006, and the status is displayed in the control platform of the train.

[0047] Having obtained a "CLOSE CONFIRMED" signal from train door device 1003 and the platform doors, train 1001 departs.

[0048] Further, in Fig. 10, each of the platform doors comprises door pockets La 1021 and Ra 1025, door pockets Lb 1031 and Rb 1035, door pockets Lc 1041 and Rc 1045, door pockets Ld 1051 and Rd 1055, and door pockets Le 1061 and Re 1065, respectively.

[0049] As described above, according to the present invention, formation information of trains is registered beforehand so that opening and closing of a gate of platform doors as well as the moving distance for opening and closing of the gate can be changed corresponding to each train. Therefore a plurality of trains of different forms can be introduced onto a train line, providing an advantage when the number, location and width dimensions of train doors vary among trains. Further, the invention also makes it unnecessary to modify the train doors of existing trains to conform to platform doors.

[0050] Further, when newly introducing trains to a line after adopting platform doors, it is not necessary to make the doors of the trains absolutely uniform, thus it is possible to simply support the new forms of trains.

[0051] In addition, on lines on which one train company shares the tracks with another, because the present invention makes it possible to cover some differences in the specifications of the trains it is possible to go ahead with introduction of platform doors.

[0052] Furthermore, on lines on which trains with different numbers of carriages are operating, a moving distance for opening and closing of gates of platform doors can be made "0" in accordance with formation information to make the setting "0" at platform doors at parts where doors of the train are not situated so that the platform doors remain closed, providing an easy solution to the problem. **Additional features of the invention are discussed in the following clauses:**

1. A platform door control apparatus comprising a platform door apparatus having a plurality of platform doors provided on a platform and an individual control apparatus provided in each of the platform doors, wherein a formation information of various types of trains for which the number, location, and width dimensions of train doors are different is registered beforehand in the individual control apparatus and a moving distance for opening and closing of gates of each of the platform doors is determined according to the formation information of each train, and wherein when transmitting an "OPEN" command to the platform doors from a train, formation information of

the train is also transmitted to the individual control apparatus to change a moving distance for opening and closing of gates for each of the platform doors.

2. The platform door control apparatus of clause 1, wherein, in accordance with the formation information of the train, when doors of the train are not situated at the gates of a relevant platform door, the gates do not open and close.

3. The platform door control apparatus of clause or 2, which comprises a means informing passengers that it is not possible to get on or off at a platform door.

Claims

1. A platform door control apparatus having a plurality of platform doors provided on a platform, the platform door control apparatus being **characterized by** compromising:

a receiving means for receiving formation information of a train from the train;

a storing means for storing information about a moving distance for opening and closing of a gate of each of the platform doors corresponding to the formation information of each train; and
a control apparatus for controlling the moving distance for opening and closing of a gate of each of the platform doors based on the formation information of the train received by the receiving means and on the information about the moving distance for opening and closing of a gate of each of the platform doors stored in the storing means.

2. The platform door control apparatus of claim 1, wherein the control apparatus and the storing means are individually installed at each of the platform doors.

3. The platform door control apparatus of claim 1, wherein a platform door whose gate's moving distance becomes "0" has a means informing passengers that it is not possible to get on or off at the platform door.

4. The platform door control apparatus of claim 1, wherein the receiving means is way-side apparatus installed on a rail track.

FIG.1

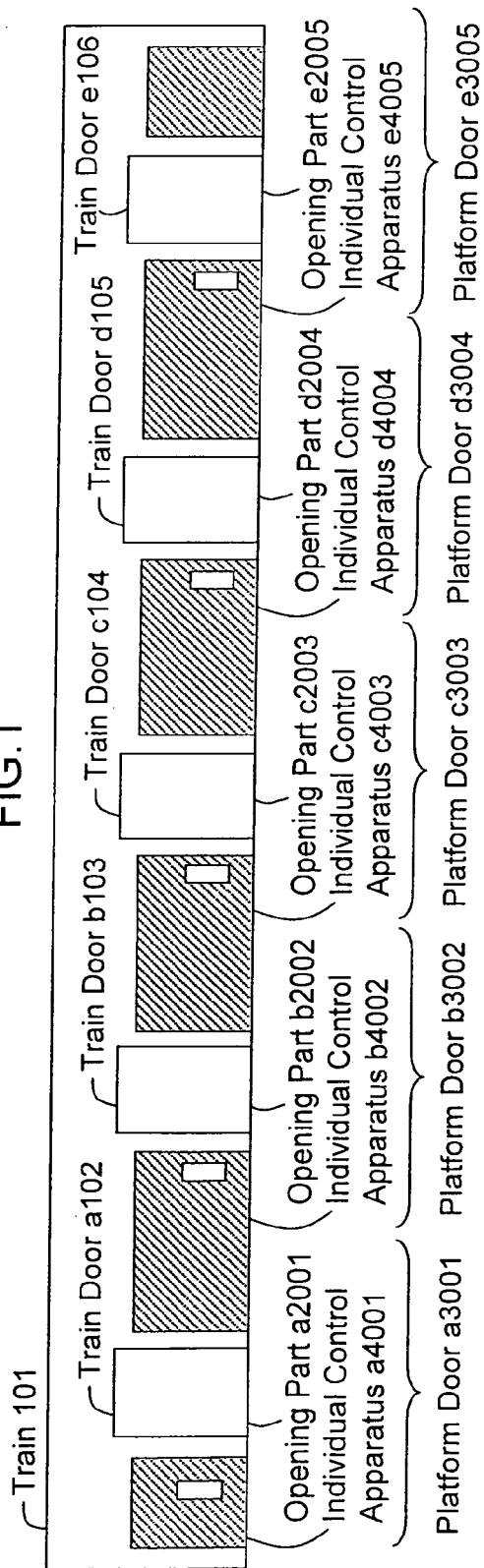


FIG.2

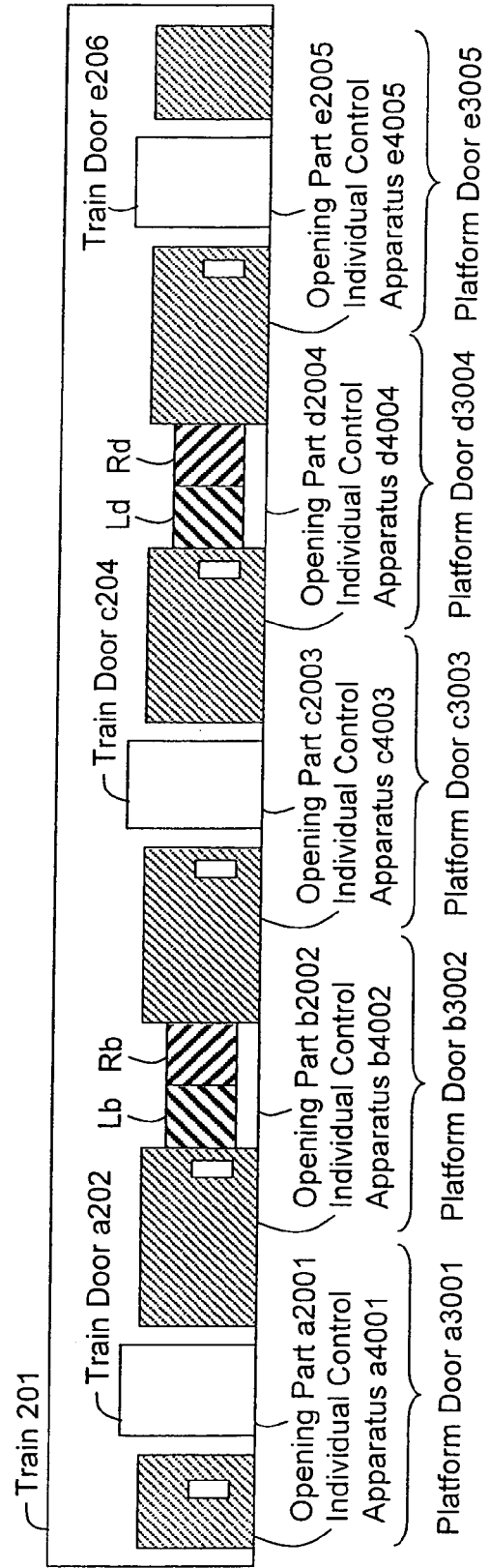


FIG.3

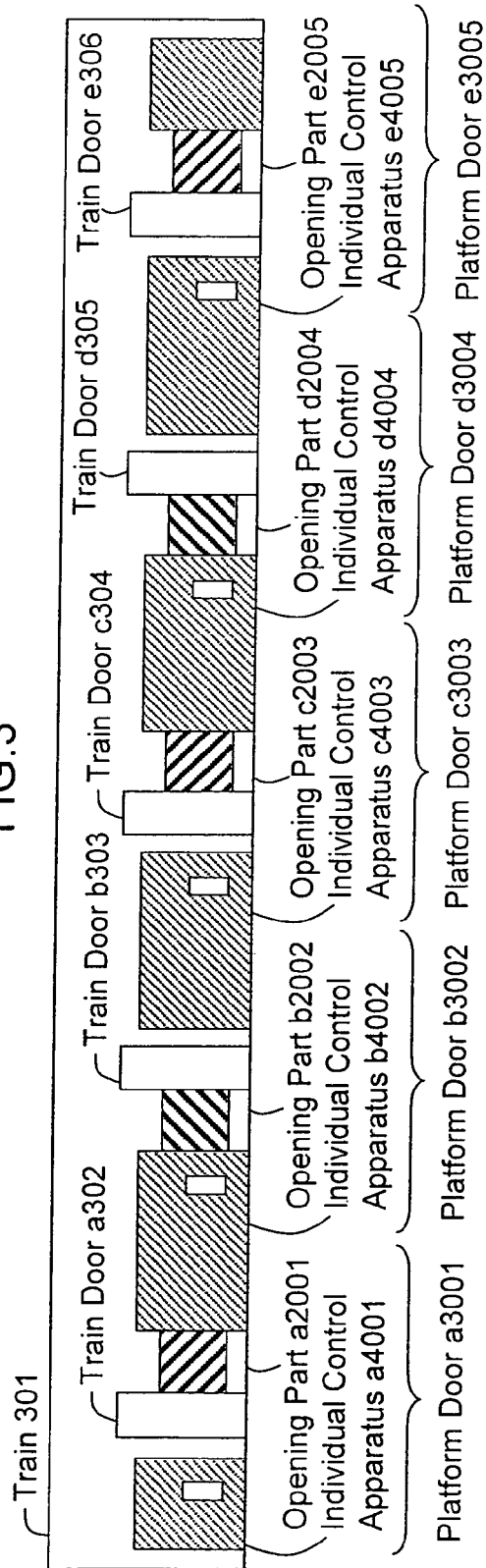


FIG.4

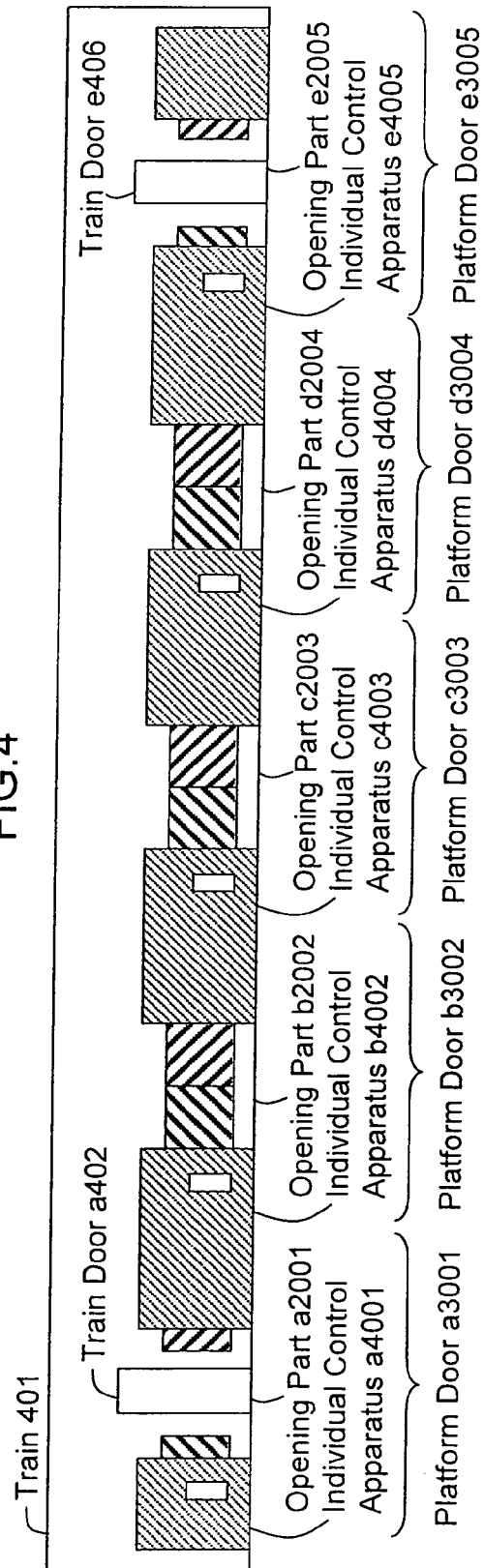


FIG.5

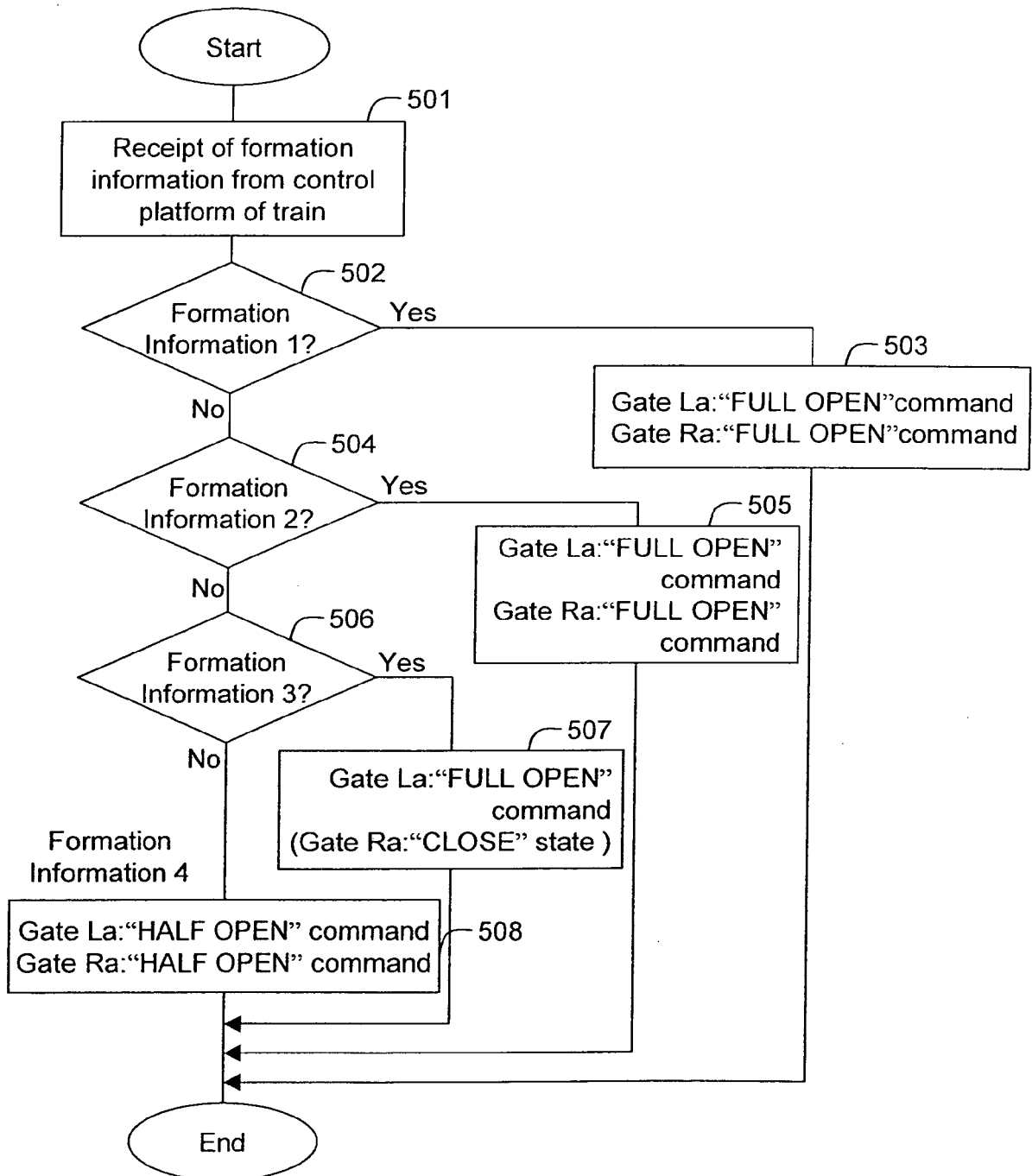


FIG.6

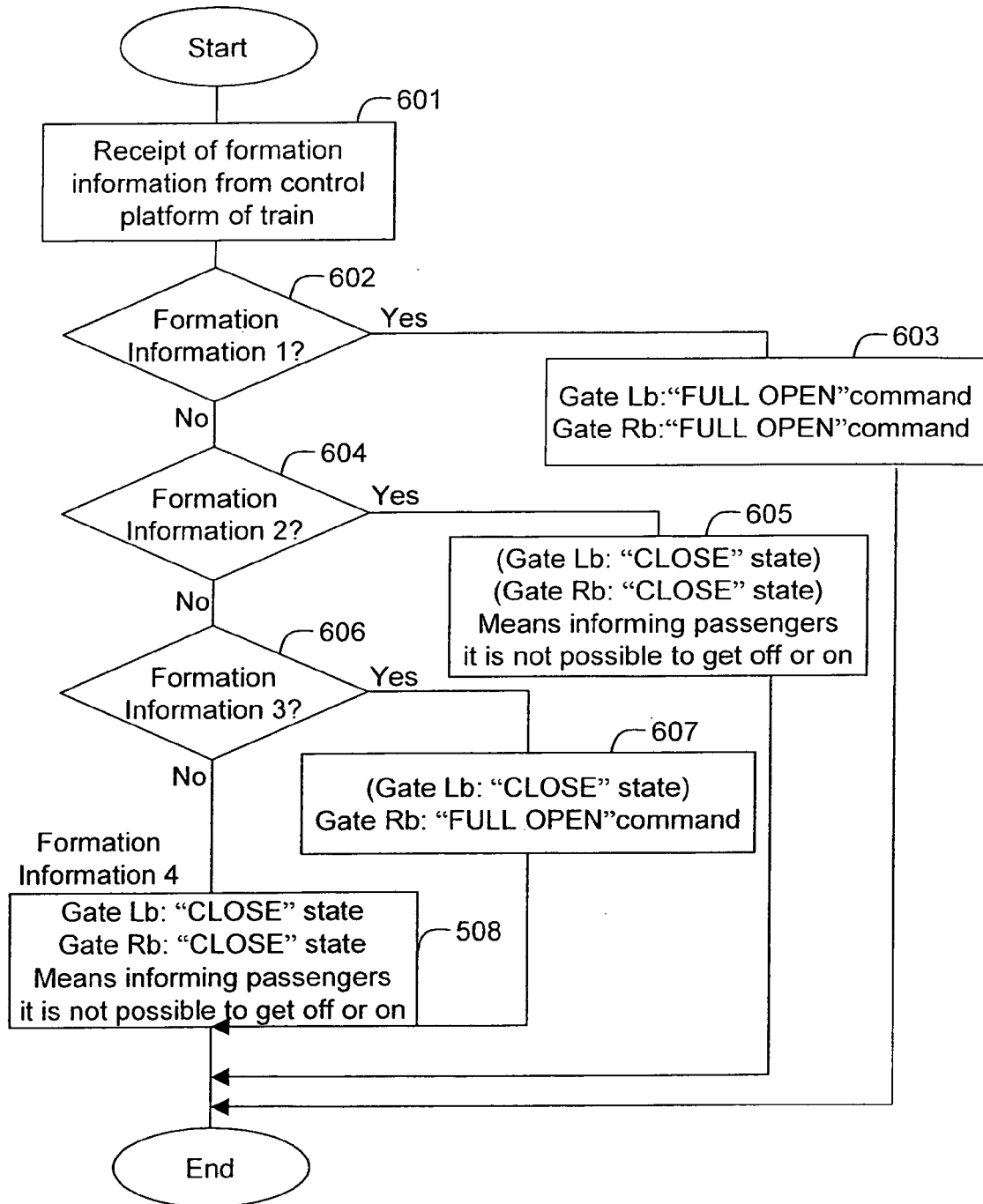


FIG.7

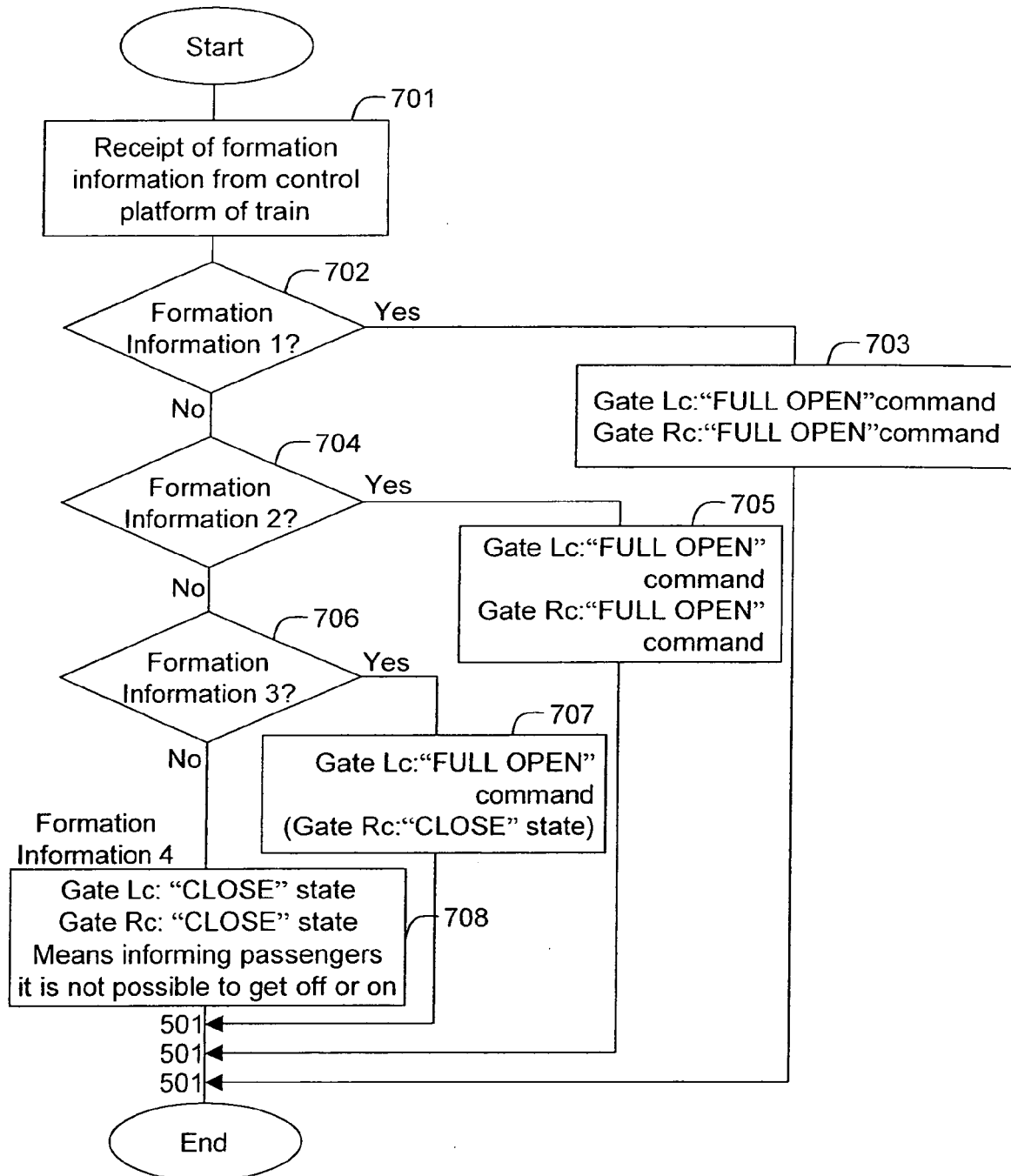


FIG.8

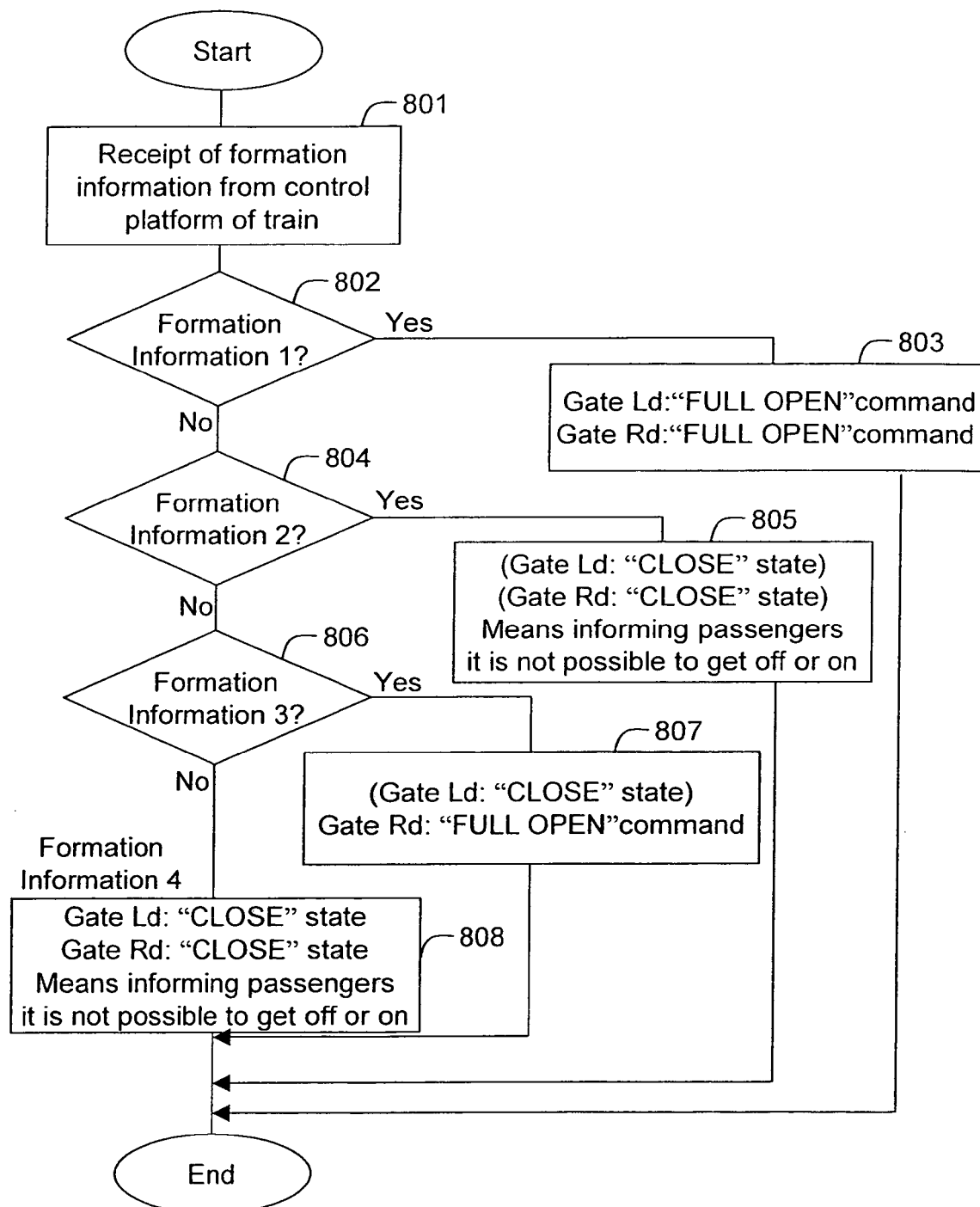


FIG.9

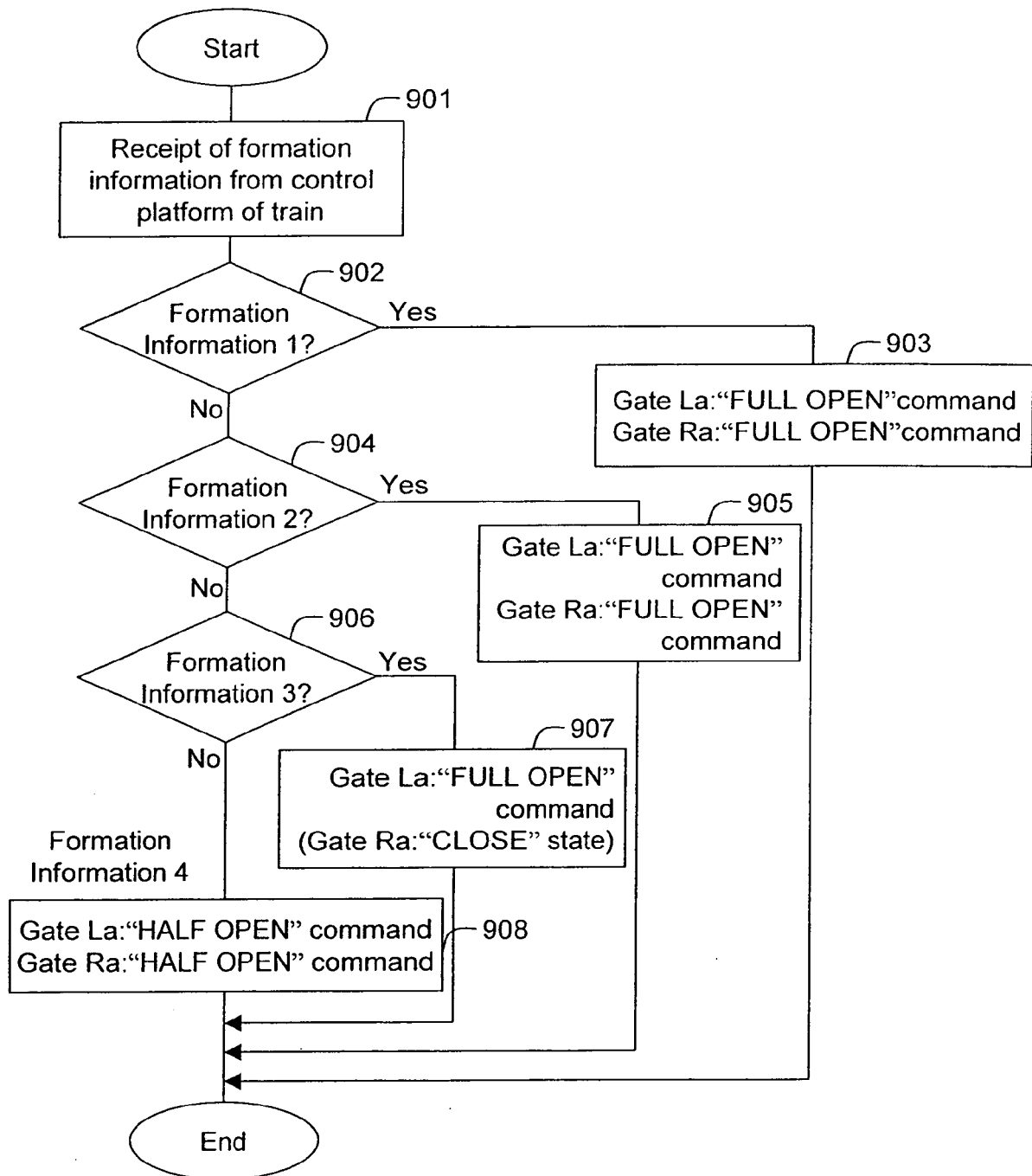


FIG.10

