

[54] SWITCHING SYSTEM WITH ONBOARD AND WAYSIDE SWITCHING

[75] Inventors: John H. Auer, Jr., Fairport; Lawrence M. Polsky, Rochester, both of N.Y.

[73] Assignee: General Signal Corporation, Rochester, N.Y.

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[51] Int. Cl.² E01B 25/12

[58] Field of Search 104/242, 243, 244, 244.1, 104/245, 246, 247, 248, 130, 96, 102, 103, 105, 104, 23 FS, 134; 246/415 R, 427

[56] References Cited

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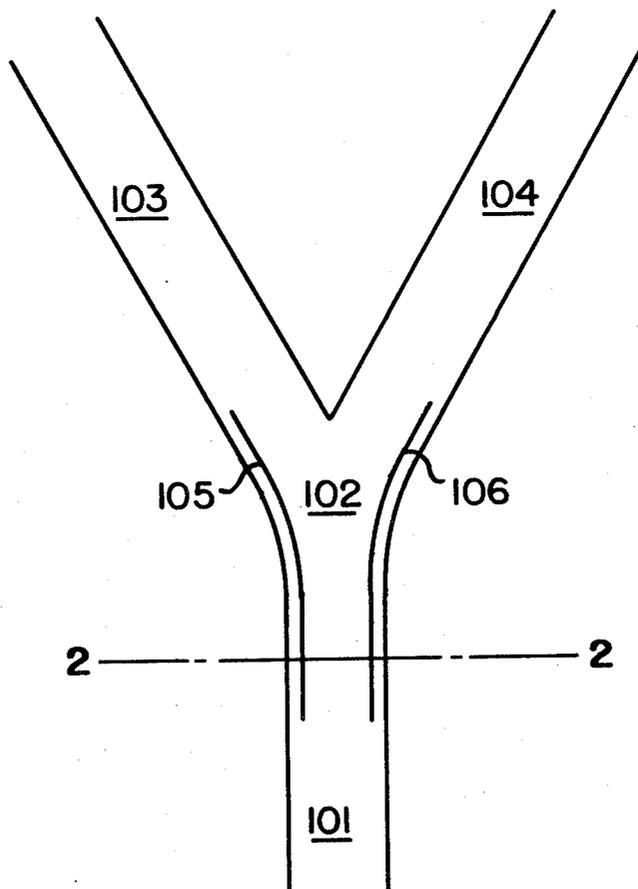
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Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—D. W. Keen
Attorney, Agent, or Firm—Milton E. Kleinman;
George W. Killian

[57] ABSTRACT

A personalized rapid transit system is disclosed using a combination of onboard and wayside switching for selecting the route of vehicles through selected diverge points. In predetermined locations diverge points employing wayside switching are employed and the setting of the onboard switching control has no effect. The onboard system is controlling as the vehicle traverses diverge points which do not have wayside control. By this means the overall system can enjoy the advantages of both onboard and wayside switching at the locations, and under the conditions, which offer advantages for each.

12 Claims, 4 Drawing Figures



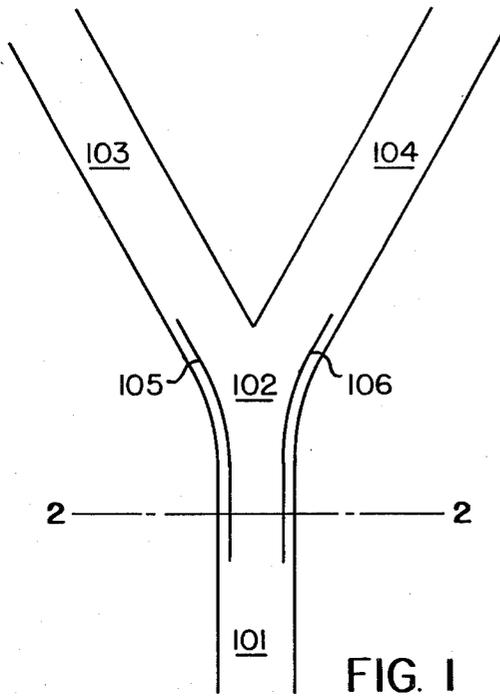


FIG. 1

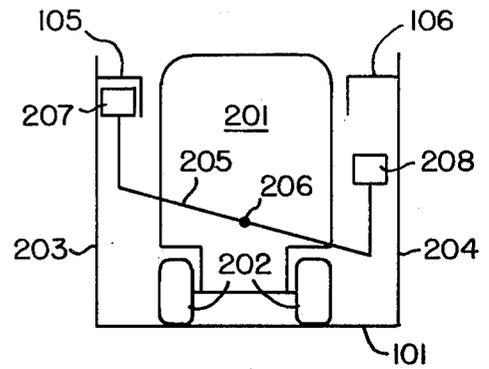


FIG. 2

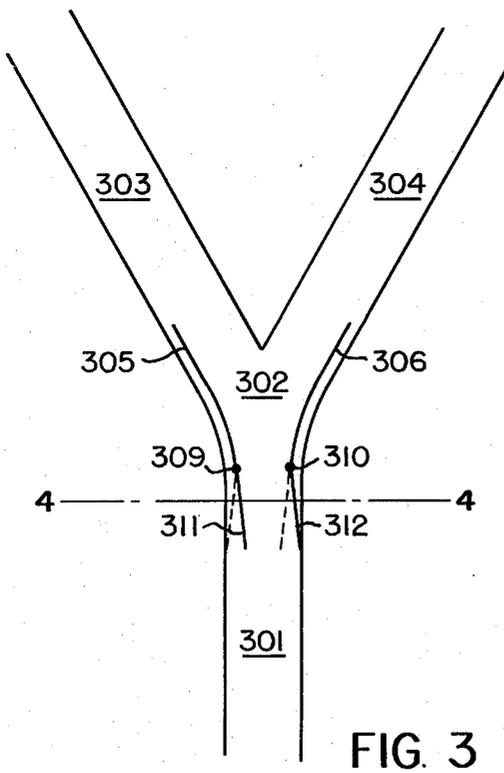


FIG. 3

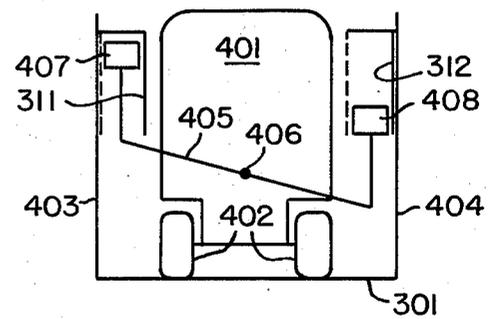


FIG. 4

SWITCHING SYSTEM WITH ONBOARD AND WAYSIDE SWITCHING

1. CROSS-REFERENCE TO RELATED APPLICATION

The invention disclosed herein is an improvement of the invention disclosed in co-pending U.S. Pat. application Ser. No. 494,433, filed Aug. 5, 1974. The teachings of the related application should be incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates to an improvement in Personalized Rapid Transit systems and more specifically to an improvement in a PRT system which employs a plurality of types of diverge points.

In the prior art a disadvantage arose in systems employing wayside switching in that the separation required between successive vehicles reduced the passenger handling capabilities. A system using onboard switching required excessive separation between two diverge points thereby creating a condition which is not acceptable at main junctions. The cited application discloses a system which does not require the wide separation between successive vehicles that is required in a wayside switching system, and which does not require the wide separation between diverge points which is required with an onboard switching system.

SUMMARY OF THE INVENTION

The present invention discloses a combination of onboard and wayside switching wherein, with certain diverge points, the diverge point and the vehicle cooperate one with the other so that the direction of exit from the diverge point is responsive to the setting of an onboard device. Another type of diverge point is provided which is wayside controlled and the direction of exit of a vehicle entering this diverge point is responsive to the setting of the wayside control and totally independent of the adjustment of the onboard switching element, notwithstanding the fact that the onboard switching element does cooperate with the diverge point as the vehicle passes through the point.

It is an object of the present invention to provide a new and improved Personal Rapid Transit System.

It is another, and more specific, object of the invention to provide a PRT system which employs both wayside and onboard switching.

It is another object of the invention to provide a PRT system incorporating onboard switching but wherein the direction of travel through selected diverge points is independent of the adjustment of the onboard switching mechanism.

It is another object of the invention to provide a PRT system wherein the number of onboard switching elements is reduced.

It is another object of the invention to provide a PRT system which can accommodate an increased number of vehicles and passengers without any reduction in safety.

It is another object of the invention to provide the advantages of both onboard and wayside switching.

BRIEF DESCRIPTION OF THE DRAWING

The foregoing and other objects, features and advantages of the present invention will be more fully appreciated, by those skilled in the related arts, by consider-

ing the following detailed description of an illustrative embodiment taken together with the drawing in which:

FIG. 1 illustrates a plan view of a guideway including a diverge point;

FIG. 2 comprises a cross-sectional view of the guideway of the FIG. 1 on the line 2—2 and illustrates a vehicle in the guideway;

FIG. 3 illustrates a guideway including a diverge point which is wayside controlled; and

FIG. 4 illustrates a cross-sectional view of the guideway at section line 4—4 and includes a vehicle in the guideway.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For the purposes of understanding systems and structures described herein, it should be understood that a "wayside" switching system comprises a system wherein the specific branch that a vehicle follows as it traverses a diverge point is established by the position, or condition, of a selectively positioned element or portion of the diverge point.

"Onboard" switching comprises a system wherein the direction taken by a vehicle as it traverses a diverge point is established by the position, or condition, of an element on, or directly associated with the vehicle and which is selectively positioned.

The following terminology relating to diverge points is also used herein:

An active diverge point comprises one wherein some part or component of the diverge point is adjusted, set or controlled to influence the emerge path of a vehicle entering the diverge point.

A passive diverge point comprises one which has no wayside control or other means for making any physical, mechanical or electrical adjustment, change or control of the diverge point.

In a personalized rapid transit system, vehicles may be guided in guideways such as shown in FIG. 1. The guideway of FIG. 1 includes a main trunk guideway 101 which leads to a diverge point 102 from which guideway branches 103 and 104 lead to the left and right, respectively. A vehicle (not shown) may travel on the main trunk guideway 101 and enter the diverge point 102 and be routed selectively to either the guideway branch 103 or 104. Some means must be provided for positively directing a travelling vehicle from the trunk guideway 101 to the selected one of the branches 103 or 104. The diverge point 102 cooperates with a vehicle having onboard switching. Associated with the diverge point 102 is a left guide rail 105 and a right guide rail 106.

Considering now more specifically FIG. 2, there will be seen a vehicle 201 which travels on power driven wheels 202 on the guideway 101 which has a left side wall 203 and a right side wall 204. As may be seen in FIG. 2 the left and right guide rail 105 and 106 may comprise members which extend outwardly and down from the side walls 203 and 204, respectively. The onboard switching device comprises an arm 205 which may pivot about point 206 to raise the left direction guide member 207 with respect to the right direction guide member 208 so that the left direction guide member 207 will be entrapped within an area defined by the left side wall 203 and the left guide rail 105. If the arm 205 is pivoted in the other direction about pivot point 206 so that the right direction guide member 208 is at

a higher level than the left direction guide member 207, the right direction member 208 will be entrapped within the area formed by the right side wall 204 and the right guide rail 106.

With the arm 205 in the position illustrated in FIG. 2, it will be evident that as the vehicle 201 travels along the main trunk 101 and approaches the diverge point 102 the left direction guide member 207 will be entrapped between the left side wall 203 and the left guide rail 105 and thereby direct the vehicle 201 from the main trunk guideway 101 to the left guideway branch 103. The right direction guide member 208 exercises no control over the vehicle 201 when the arm 205 is switched to the position illustrated.

The systems illustrated in FIGS. 1 and 2 comprises an onboard switching system and the onboard switch comprising the arm 205 and its associated elements 207 and 208 may be set and locked in the required position at any convenient time before the vehicle 201 is within the safe stopping distance of the diverge point 102. More specifically, the switch on board the vehicle 201 may be set and locked as soon as the vehicle 201 has negotiated any previous diverge point even though there may be additional vehicles between the vehicle 201 and the diverge point 102. As thus far described, the present system does not differ materially from onboard systems referred to in the cited application. The diverge point 102 comprises a passive diverge point.

Considering now more specifically FIG. 3, there will be seen a main trunk guideway 301 a diverge point 302 which may direct traffic from the main trunk guideway 301 to the left guideway branch 303 or to the right guideway branch 304. The diverge point 302, in this case, comprises a point which is controlled by a wayside switching element (not shown). The diverge point 302 includes a left guide rail section 305 and a right guide rail section 306. In addition there is a left switching guide rail section 311 and a right switching guide rail section 312 which may be pivoted in unison about pivot points 309 and 310, respectively. The left and right switching guidance sections 311 and 312 are shown in one position in solid lines and in the alternate position in dotted lines. With the left and right switching guide rail sections 311 and 312 in the position illustrated in solid lines a vehicle approaching on the main trunk guideway 301 will be directed to the left guideway branch 303. Conversely, when the left and right switching guide rail sections 311 and 312 of the diverge point 302 are in position illustrated by the dotted lines a vehicle approaching the diverge point 302 on the main trunk guideway 301 will be diverted to the right guideway branch 304. The diverge point 302 comprises an active point.

Consideration will now be given to FIG. 4 which comprises a cross-sectional view along line 4—4 of the active diverge point 302 shown in FIG. 3. There is shown a vehicle 401 which is moved along the main trunk guideway 301 by power driven wheels 402. The guideway 301 has a left and right side wall 403 and 404, respectively. The vehicle 401 has an arm 405 which may be selectively pivoted about point 406, as illustrated, to raise the left direction guide member 407 relative to the right direction guide member 408. As thus far described, the elements of FIG. 4 are substantially identical to corresponding elements in FIG. 2. To enhance the understanding of this similarity, corresponding elements have been given identifying numbers

which are identical except for the first digit. The distinctions relating to the wayside switching of the diverge point 302 will now be described.

As already indicated with respect to FIG. 3 it has been shown that when the left switching guide rail section 311 and the right switching guide rail section 312 are as shown in solid lines a vehicle will be directed from the main trunk guideway 301 to the left guideway branch 303. The left and right switching guide rail sections 311 and 312 of FIG. 3 are also shown and designated in FIG. 4 as elements 311 and 312, respectively. It should be noted that the left and right switching guide rail sections 311 and 312 extend downward towards the roadbed 301 considerably further than the corresponding elements of the guide rails 105 and 106 as shown in FIG. 2. More specifically, the left direction guide member 407 will be entrapped between the left switching guide rail section 311 and the left side wall 403 irrespective of the pivoting of the arm 405. That is, irrespective of whether or not the left direction guide member 407 is higher or lower relative to the right direction guide member 408 the left direction guide member 407 can be entrapped as mentioned above. Stated differently, this means that when the active wayside diverge point 302 is set and adjusted to the position shown in solid lines the setting of the onboard mechanism and the arm 405 will have absolutely no control concerning the direction that the vehicle 401 takes as it approaches and traverses the active diverge point 302. If it is desired to make the vehicle 401 pass through the diverge point 302 so as to go to the right guideway branch 304, the left and right switching guide rail section 311 and 312 will be moved by the wayside control (not shown) from their solid line positions to their dotted line positions. With the active diverge point 302 set as mentioned the right direction guide member 408 will be entrapped between the right switching guide rail section 312 and the right side wall 404 and guide the vehicle 401 from the main trunk guideway 301 to the right guideway branch 304; and this entrapment is true irrespective of the setting of arm 405.

It should be noted that the vehicle 201 of FIG. 2 and the vehicle 401 of FIG. 4 are identical and that the vehicle 401 could pass through the diverge point 102 in the manner described for vehicle 201. In a similar manner the vehicle 201 could pass through the diverge point 302 in the same manner described for vehicle 401. In summary, there has been shown a single type of vehicle and two different types of diverge points. The direction of the vehicle as it emerges from diverge points of type 102 will be determined by the setting of an onboard switching device. The direction of travel a vehicle as it emerges from a diverge point of type 302 is independent of the setting of the onboard switching device and depends upon the adjustment of the active diverge point 302. Accordingly, by the judicious placement of the diverge points of type 102 and type 302 various advantages may be obtained. More specifically, in systems employing passive diverge points of the type 102 and onboard switching it has not been practical to place a group of diverge points as close together as might be desirable at main junction points. In systems employing wayside switching, such as diverge point 302, safety considerations have required a substantial distance between vehicles approaching a diverge point. Accordingly, both onboard and wayside switching sys-

tems have individual advantages and disadvantages under different conditions. A system built employing the principles shown herein using passive diverge points, of the type 102, where such points may be widely separated; and using active diverge points, of the type 302 where diverge points must be in close proximity, provides a system having the best features of both a wayside switching system and an onboard switching system without incurring the disadvantages of either.

In summary there has been shown a PRT system which employs both wayside and onboard switching in such a manner that the onboard switching structure has no influence as the vehicle passes through an active diverge point with wayside control.

While there has been shown and described what is considered at the present to be the preferred embodiment of the invention, modifications thereto will readily occur to those skilled in the related arts. For example, in another system the coupling between the cooperating switching elements of the vehicle and the diverge point may comprise electronic and/or magnetic means rather than mechanical means. Other substitutions of known wayside and onboard switching devices could be made. It is believed that no further analysis or description is required and that the foregoing so fully reveals the gist of the present invention that those skilled in the applicable arts can adapt it to meet the exigencies of their specific requirements. It is not desired, therefore, that the invention be limited to the embodiments shown and described, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

- 1. A personalized rapid transit system comprising:
 - a. a vehicle guideway system having a plurality of diverge points for interconnecting the various branches of the guideway system;
 - b. a vehicle for traversing said guideway system from branch to branch via selected ones of said diverge points by cooperating with an encountered diverge point to form direction control means for controlling the direction of egress from the encountered diverge point;
 - c. said plurality of diverge points including active and passive diverge points; and
 - d. said direction control means comprising onboard control for cooperating with said active and passive diverge points to conjointly control the direction of egress from an encountered one of said active and passive diverge points.

2. The combination as set forth in claim 1 wherein said onboard control means may be selectively adjusted for exclusive control of the direction of egress from an encountered passive diverge point.

3. The combination as set forth in claim 1 wherein said onboard control means cooperates with an encountered active diverge point for determining the direction of egress therefrom but wherein the direction of egress is independent of the selected adjustment of said onboard control means.

4. The combination as set forth in claim 1 wherein said direction control means includes selectively adjusted means at each active diverge point for cooperating with said onboard control to determine the direction of egress therefrom.

5. The combination as set forth in claim 4 and wherein aid direction control means includes control elements onboard said vehicles for cooperating with all diverge points and for determining the direction of egress from a passive diverge point.

6. The combination as set forth in claim 5 wherein the direction of egress of said vehicle from an active diverge point is independent of the adjustment of the control elements onboard said vehicle.

- 7. A vehicle guidance system comprising:
 - a. a vehicle guideway having a trunk and a plurality of branches connected by a plurality of diverge points;
 - b. a plurality of individual vehicles travelling from the trunk to various branches of said guideway via selected ones of said plurality of diverge points;
 - c. said diverge points including: active diverge points, and passive diverge points;
 - d. each of said vehicles including a selectively adjustable vehicle direction control element responsive to onboard control;
 - e. said vehicle direction control element cooperating with passive ones of said diverge points for routing the vehicle through a passive diverge point in a direction responsive to the selected adjustment of the vehicle direction control element; and
 - f. said vehicle direction control element cooperating with active ones of said diverge points for routing the vehicle through an active diverge point in a direction responsive to the selected adjustment of the active diverge point.

8. The combination as set forth in claim 7 wherein the direction a vehicle is routed through an active diverge point is independent of the selected adjustment of said vehicle direction control element.

9. The combination as set forth in claim 8 wherein said vehicle direction control element may be selectively adjusted concurrent with the passage of said vehicle through an active one of said diverge points.

- 10. In a vehicle switching system;
 - a. a guideway having a plurality of branches;
 - b. a plurality of diverge points for connecting the various branches of said guideway;
 - c. said diverge points comprising both passive and active diverge points;
 - d. a vehicle for travelling along said guideway and traversing selected ones of said diverge points to selected ones of said branches;
 - e. selectively adjustable first direction control means associated with said vehicle and cooperating with a passive one of said diverge points for determining the direction of egress from one of said passive diverge points; and
 - f. selectively adjustable second direction control means association with an active one of said diverge points and cooperating with said first direction control means for determining the direction of egress from one of said active diverge points.

11. The combination as set forth in claim 10 wherein the direction of egress from one of said active diverge points is independent of the adjustment of said first direction control means.

12. The combination as set forth in claim 11 and including means onboard said vehicle for selectively adjusting said first direction control means between first and second adjustments concurrent with the cooperating of said first direction control means with an active one of said diverge points.

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