United States Patent [19]

Mooney et al.

[11] **3,793,963**

[45] **Feb. 26, 1974**

[54] **TRANSPORTATION SYSTEM AND VEHICLE THEREFORE**

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[73] Assignee: **Transportation Technology, Inc.**, Denver, Colo.

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[52] **U.S. Cl.** **104/130**, 104/105

[51] **Int. Cl.** **E01b 25/12**

[58] **Field of Search** .... 104/96, 105, 130; 191/29 R, 191/49

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Primary Examiner—Gerald M. Forlenza
Assistant Examiner—D. W. Keen
Attorney, Agent, or Firm—Reising, Ethington & Perry

[57] **ABSTRACT**

A transportation system including a vehicle guideway system having a main line, a branch line diverging from the main line, and a pair of fixed switching rails at the junction of the main and branch lines, including a main line switching rail following the main line past the junction and a branch line switching rail following the branch line past the junction. A vehicle traveling over the guideway includes a pair of switch members, one of which is movable between an active position in which it can engage the main line switching rail to cause the vehicle to follow the main line past the junction, and an inactive position in which it cannot engage a switching rail, the other of the switch members being movable between an active position in which it can engage the branch line switching rail to cause the vehicle to follow the branch line past the junction, and an inactive position in which it cannot engage a switching rail. The switch members are connected together by a switch mechanism operable to cause one of the switch members to move from its active to inactive position in response to movement of the other switch member from its inactive to active position. The switch mechanism includes over-center locking means connected with the switch members for locking the active switch member against movement from the active position in response to a force exerted on the switch member.

27 Claims, 7 Drawing Figures

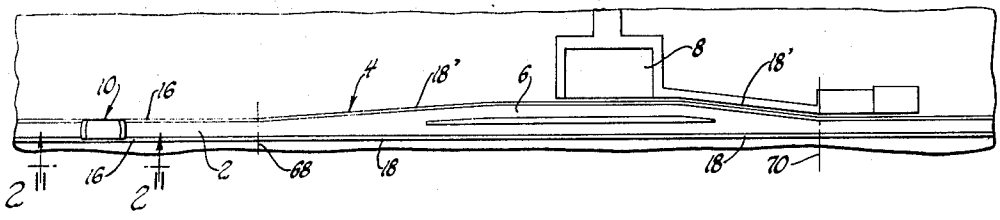

Fig. 1

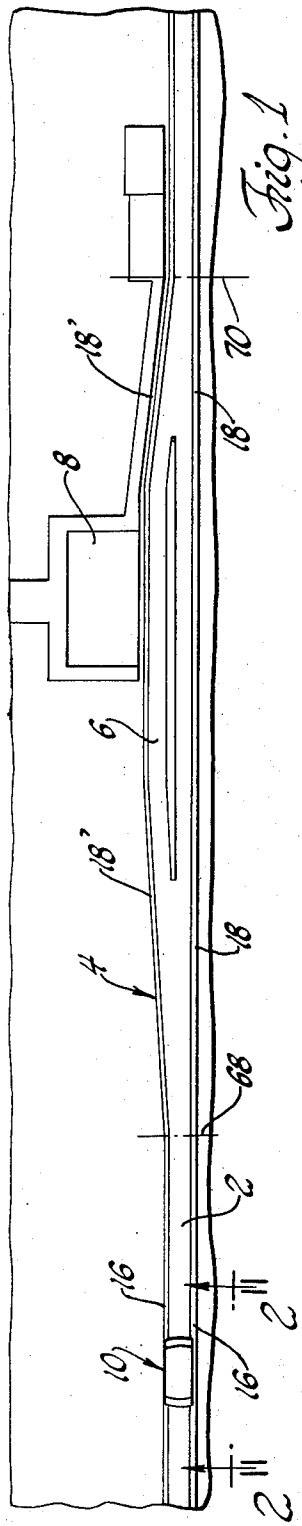
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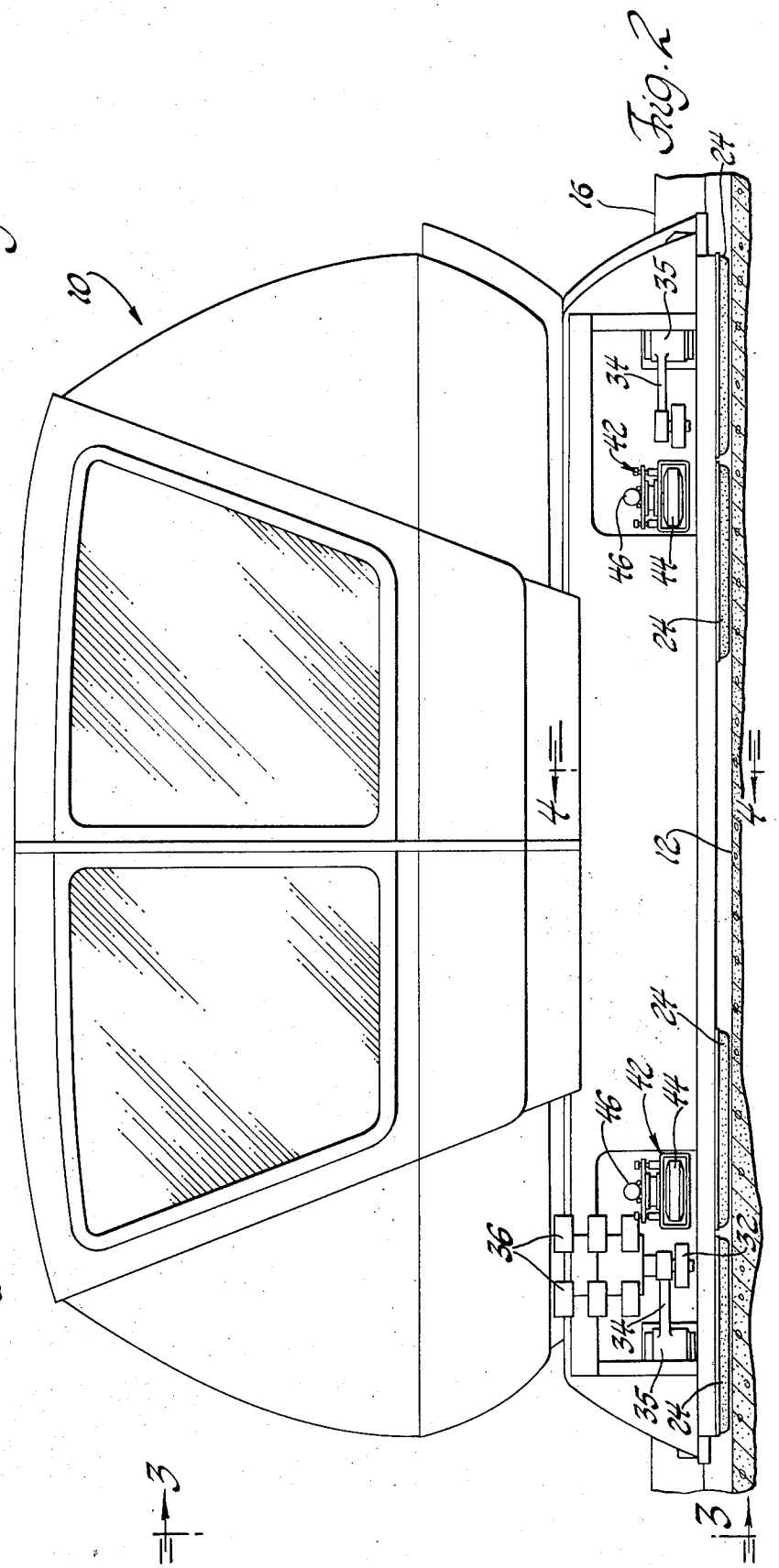
Fig. 2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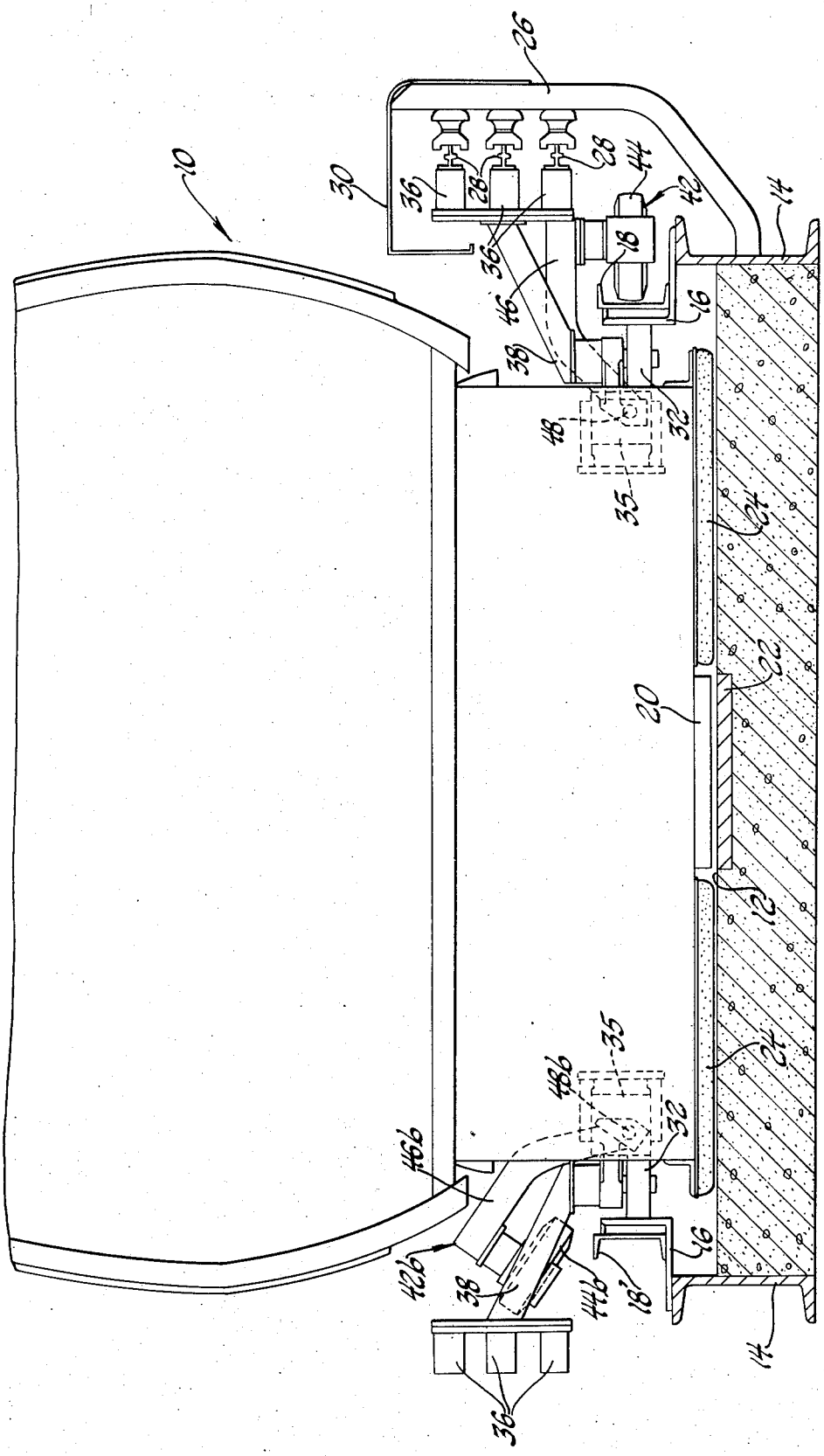
26
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46b
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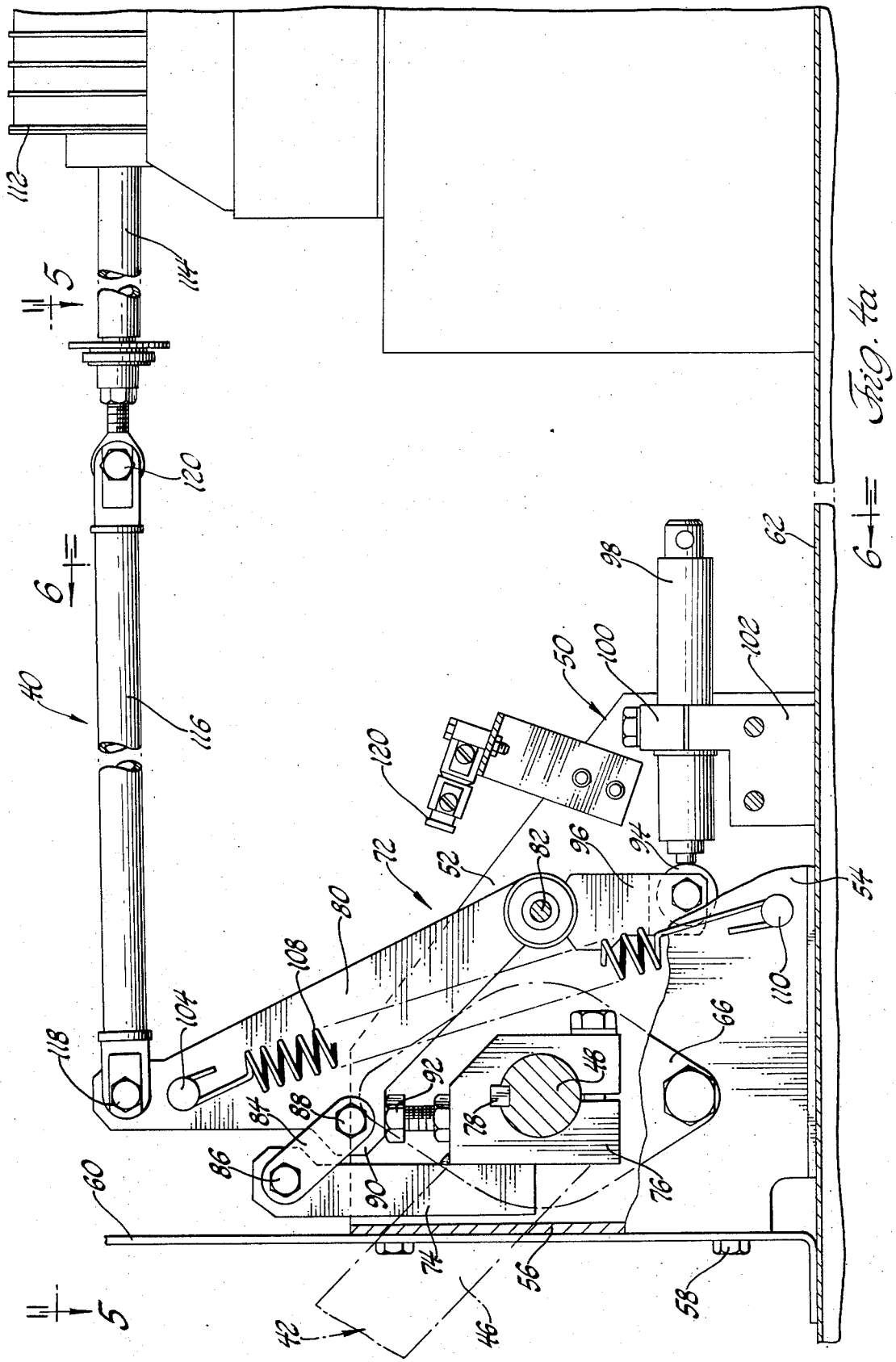
48b
32
46a
42b
38
44b
18'
16
14
36

Fig. 3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40
116
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42
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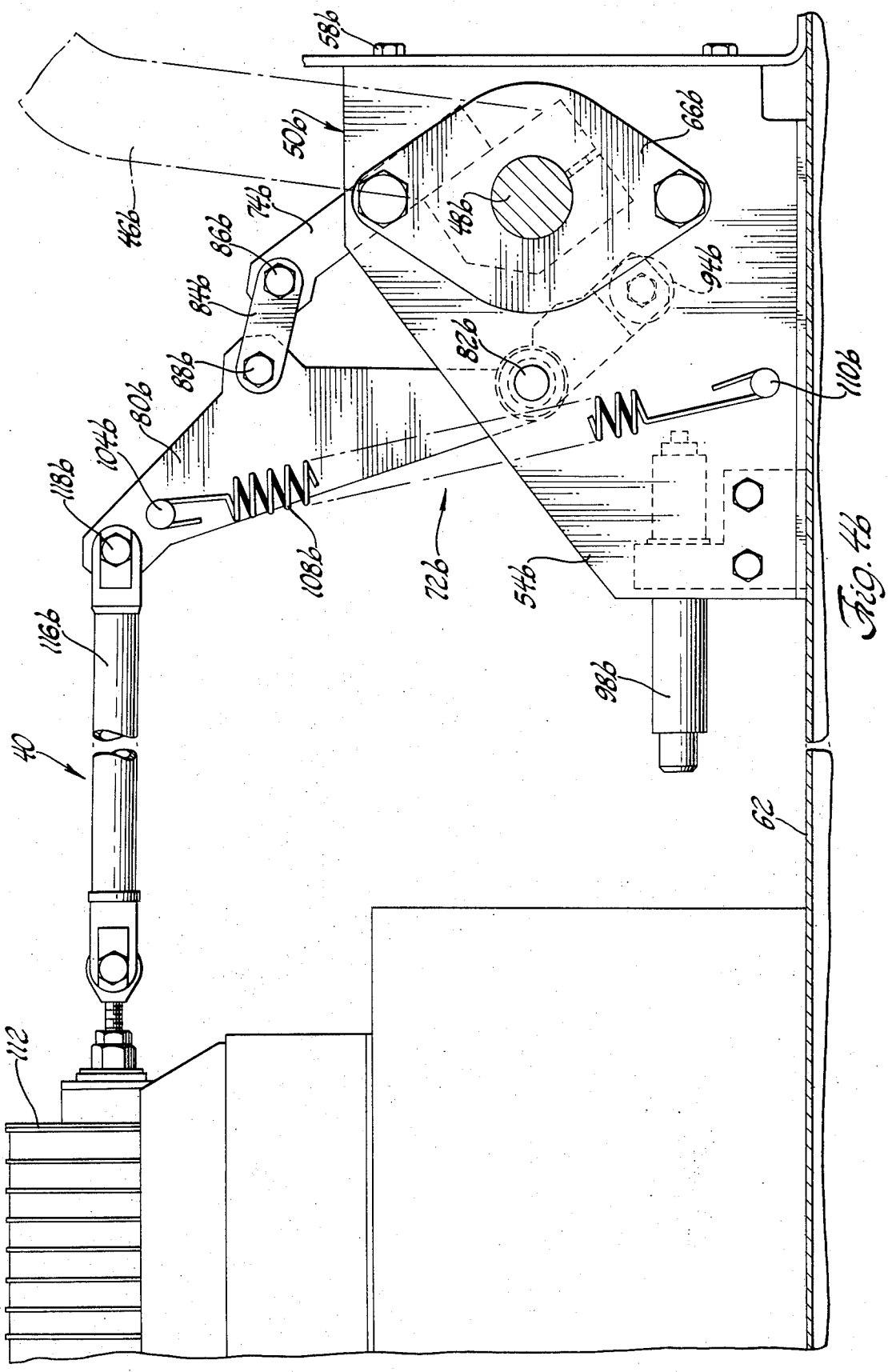
Fig. 4a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54b
116b
98b
40
62
112

Fig. 4b

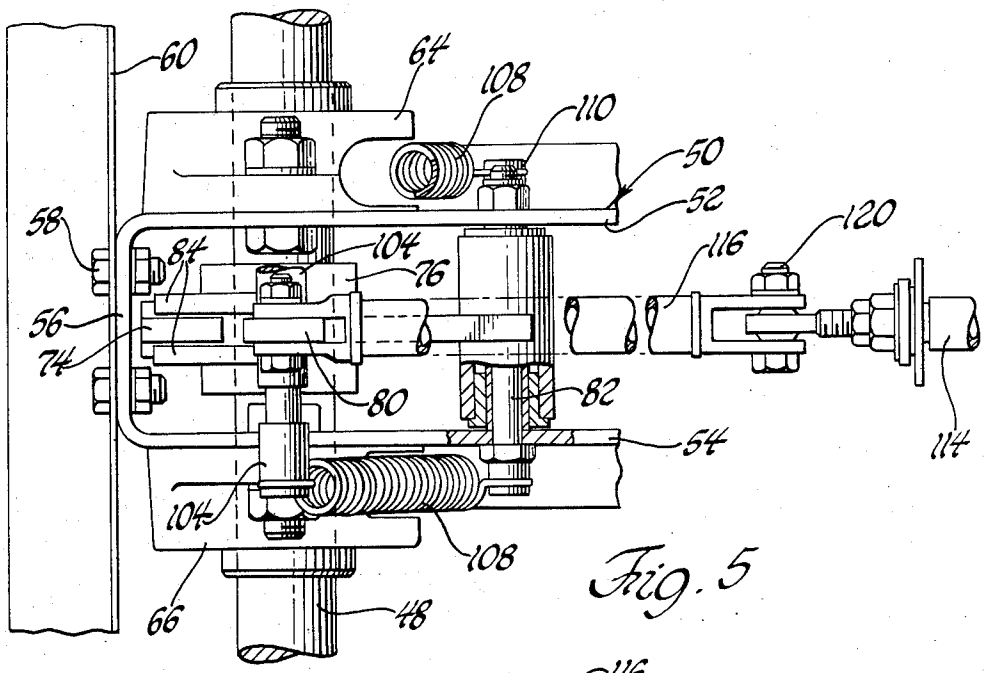
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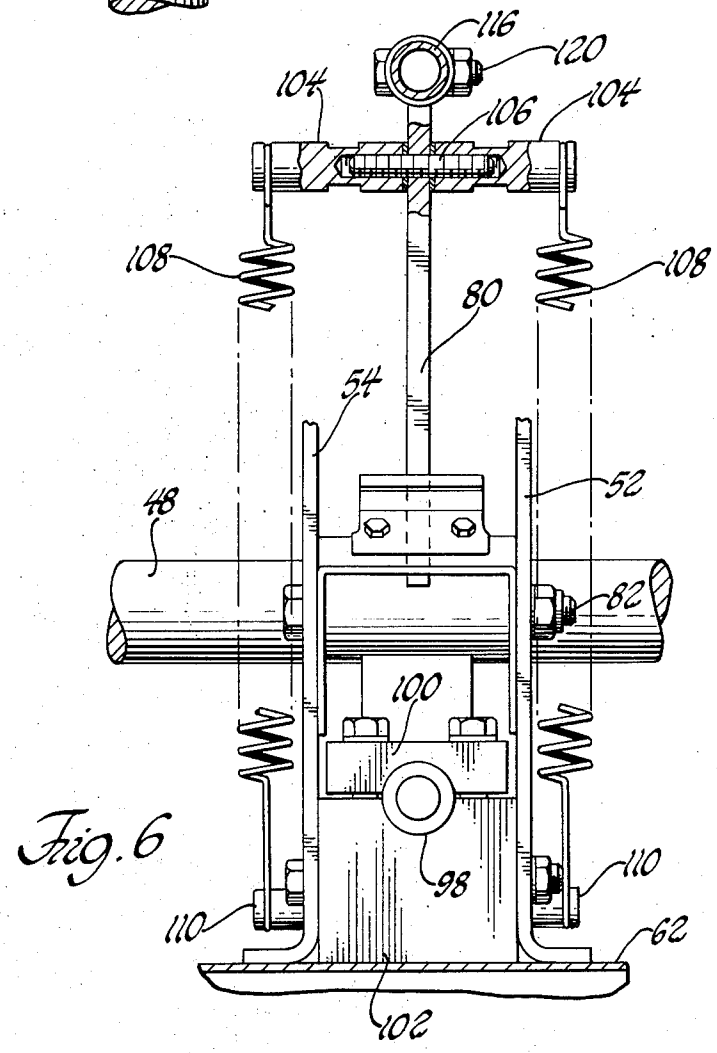
Fig. 5


116
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98
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62
102

Fig. 6

TRANSPORTATION SYSTEM AND VEHICLE THEREFORE

This invention relates generally to transportation systems of the type wherein vehicles are propelled over a fixed trackway or guideway system, and is particularly concerned with such systems having vehicle operated switching devices.

A growing need has developed in recent years for transportation systems in shopping centers, airports, university campuses, industrial complexes, parks and other centers of major activity for moving individuals or small groups of passengers from one point to another over planned routes. Vehicles having omnidirectional running gear, such as air cushion devices, have several advantages in this type of system over vehicles having conventional, wheeled running gear. The omnidirectional running gear provides greater flexibility in moving the vehicle into and out of storage areas, or from one traffic lane to another since the vehicle can be moved transversely of its longitudinal axis if desired. Furthermore, at junctions of several paths or lines of the guideway or track system, wheeled vehicles must be steered from one line to another, and switching devices must be integrated with the steering system so that switching of the vehicle from one line to another will cause rotation of the steering wheels of the vehicle about a vertical axis to cause proper tracking of the wheels. Furthermore, in systems having wheeled vehicles, the radius of curvature of the track or guideway must be kept within limits determined by the length or wheel base of the vehicle. Examples of prior art systems using wheeled vehicles are disclosed in U.S. Pat. Nos. 3,098,454; 3,363,584 and 3,593,665.

It is also conventional in some prior art systems to include movable switch sections or rails in the track or guideway at junctions. This type of switching device presents special maintenance problems and is, of course, subject to malfunction and jamming caused by rocks and the like, as well as by ice in extreme weather conditions. This type of switch also requires complex control systems separate from the vehicle. Accordingly, there are many advantages in having switching systems controlled by the vehicle, and the guideway or trackway maintenance problems are substantially reduced by the elimination of movable switch sections so that the direction of the vehicle is determined by a switch member on the vehicle engaging a fixed guide rail or guide surface in the guideway.

In the latter type of system, the switch member is of course subjected to high centrifugal forces as the vehicle negotiates curves. In general, at least two switch members are carried by the vehicle in such a manner that one can be moved into an active position to engage a particular fixed switching rail while the other is in an inactive position, the direction of travel through a junction being determined by actuation of one switch member and deactivation of the other switch member. It is, of course, essential that the active switch member not be moved from its active position by the forces applied to the switch member by the switching rail, which forces can be extremely high due to the centrifugal forces acting on the vehicle. In the prior art, this problem is generally accounted for by the use of very high strength switch members together with the application of a great amount of power to hold the active switch member in position during its engagement with the fixed switching rail or surface. Additional examples of prior art devices of this general type are disclosed in U.S. Pat. Nos. 3,368,496 and 3,500,765.

An object of this invention is to provide a transportation system having fixed switching rails at junctions with vehicle operated switch mechanism for determining the direction of the vhicle at a junction including a switch member movable between active and inactive positions in which the switch mechanism has an over-center condition to provide a positive lock of the switch member in its active position.

Another object is to provide a vehicle for traveling over a guideway having fixed switching rails with vehicle mounted switching mechanism particularly suitable for vehicles having omnidirectional running gear such as air cushion devices.

In carrying out the foregoing, and other objects, a transportation system according to the present invention may comprise a guideway system including a main line, a branch line diverging from the main line, and a pair of fixed switching rails at the junction of the main and branch lines. The switching rails include a main line switching rail following the main line past the junction and a branch line switching rail following the branch line past the junction. The vehicle for traveling over the guideway system includes at least one switch member movable relative to the vehicle between an active position to engage one of the fixed switching rails, and an inactive position in which it cannot engage a switching rail. In the system specifically disclosed, the vehicle has a pair of switch members which are alternately movable between their respective active and inactive positions. However, it is within the scope of the invention for the system to have one type of means to cause the vehicle to travel in one direction at a junction when a switch member is in an inactive position, which means can be overridden by movement of the switch member to an active position to cause the vehicle to travel in another direction through the junction. For example, the system could be such that the vehicle could be attracted to remain on a main line by centrifugal force or by magnetic or vacuum attraction with the mechanical engagement of the switch member with a switching rail being sufficient to overcome the attraction of the vehicle to the main line direction to cause the vehicle to travel through the junction on a branch line.

However, in the disclosed system, a pair of switch members is mounted on the vehicle, one of which is movable between an active position in which it can engage the main line switching rail to cause the vehicle to follow the main line past the junction and an inactive position in which it cannot engage a switching rail, the other of the switch members being simultaneously movable between an active position in which it can engage the branch line switching rail to cause the vehicle to follow the branch line past the junction and an inactive position in which it cannot engage a switching rail. The switch members are interconnected by a switch mechanism including motion transmitting means connected with each of the switch members, the motion transmitting means having an over-center locked condition in the active position of the associated switch member to lock the switch member against movement from its active position in response to forces acting on the switch member.

The switch members in the disclosed embodiment are mounted on shafts rotatably mounted on opposite sides of the longitudinal axis of the vehicle. The switch member, or members, on one side of the vehicle are nonrotatably secured to the shaft on that side of the vehicle, and the switch member, or members, on the opposite side of the vehicle are nonrotatably secured to the shaft on that side of the vehicle. Motion transmitting means is associated with each of the shafts, and includes a lever nonrotatably mounted on its associated shaft, a pivotal input member, and a locking link pivotally connected between the input member and the lever in such a manner that movement of the input member in a direction to activate its associated switch member causes the locking link to move to an over-center locking position with respect to the lever when the switch member assumes its active position so that forces on the switch member tending to move the switch member to its inactive position tend to further urge the input member in the direction to activate the switch member and thus lock the switch member in its active position. The input members of the motion transmitting means on opposite sides of the vehicle are connected together by a power actuator operable to move the respective input members in opposite directions to alternately activate and deactivate the switch members.

The switch mechanism in the disclosed system is particularly suitable for vehicles having omnidirectional running gear such as air cushion devices. However, the switching mechanism can be used with vehicles having conventional wheeled type running gear, although, as pointed out above, such wheeled vehicles would have to be steered in some manner through junctions and around curves. In the disclosed system, since the vehicle employs omnidirectional running gear, it is not necessary to integrate the switch mechanism with steering mechanism for the vehicle since the vehicle automatically follows the path of the switch member engaged with the fixed switching rail. The omnidirectional running gear is provided in the disclosed system by air cushion devices, although it is theoretically possible for omnidirectional support to be provided by casters, balls or spherical rollers, or for air cushion devices or the like to be mounted in the bed of the track or guideway.

In the disclosed embodiment, the vehicle is propelled by a linear induction motor having its secondary mounted in the bed of the guideway and its primary carried by the vehicle. However, the invention is not limited to the use of any specific propulsion means for the vehicle within the system. For example, a conventional power plant may be provided on the vehicle and traction provided by a wheel or wheels engaging a traction surface as, for example, in U.S. Pat. No. 3,164,103.

Side rails project upwardly from the guideway, and the vehicle travels between the side rails and has laterally extending suspension wheels or the like engaging the side rails to center the vehicle in the guideway. The suspension wheels rotate about vertical axes and may have pneumatic tires or the like to provide shock absorbance and to smooth the lateral forces and resulting side sway on the vehicle.

The switching rails in the disclosed system are in the form of channels having an upper flange for constraining the switch member in the vertical direction to prevent inadvertent disengagement of the switch member from the switching rail. The switch member in the disclosed system is in the form of a wheel mounted on an arm nonrotatably secured to the shafts of the switch mechanism. In the active position of the switch member, the wheels rotate about a vertical axis. Since the guideway has no moving parts at junctions, switching is initiated on straightaways ahead of the junction by actuating the switch mechanism to transfer the selected switch member to its active position and the other switch member or members to the inactive positions. As the vehicle enters the junction, the active switch member will engage the switching rail to cause the vehicle to follow the direction of the switching rail.

Other objects, advantages and features of the invention will become apparent from the following description, taken in connection with the accompanying drawings in which:

FIG. 1 is a plan view of a portion of a transportation system embodying the invention and illustrating the construction of the guideway system at a junction of the main line with a branch line;

FIG. 2 is a side elevational view of the vehicle in the system illustrated in FIG. 1 and taken on lines 2—2 of FIG. 1;

FIG. 3 is an end view of the vehicle and a cross-sectional view of the guideway as taken on lines 3—3 of FIG. 2;

FIGS. 4*a* and 4*b* constitute an enlarged detailed view of the switching mechanism carried by the vehicle, taken approximately on lines 4—4 of FIG. 2, FIG. 4*a* illustrating the left hand portion of the switching mechanism and FIG. 4*b* illustrating the right-hand portion of the switching mechanism;

FIG. 5 is a top plan view of a portion of the switching mechanism taken on lines 5—5 of FIG. 4*a* with certain parts being shown partially in section or broken away for clarity; and

FIG. 6 is a view taken on line 6—6 of FIG. 4*a* with certain parts being shown partially in section or broken away for clarity.

FIG. 1 partially illustrates a transportation system including a trackway or guideway including a main line 2 with a junction or switch section indicated generally by reference numeral 4 wherein a branch line 6 diverges from the main line 2. A loading and unloading platform or station 8 is located at one side of the branch line 6. The terms "main line" and "branch line" are terms of convenience only, it being understood that the principle of the invention applies to any junction of one or more lines or paths of travel of a vehicle. Reference numeral 10 indicates a vehicle for traveling over the guideway system, the vehicle 10 in FIG. 1 being located to the left of the junction 4.

In the illustrated embodiment, the guideway comprises a concrete bed or surface 12 extending between side channel members 14 (FIGS. 2 and 3). Mounted on the upper edges of the side channels 14 are side rails 16, which, in the illustrated embodiment, are in the form of angle sections. Attached to the side rails 16 at the junction 4 are fixed switching rails 18 which are in the form of channel sections in the illustrated embodiment. In FIG. 3, the right-hand switching rails 18 follow the path of the main line 2 past the junction 4 toward the right in FIG. 1 and may be referred to as the main line switching rail, while the left-hand switching rail 18' follows the path of the branch line 6 past the junction as the vehicle moves toward the right in FIG. 1 from its

illustrated position, the left-hand switching rail **18'** being referred to as the branch line switching rail.

In the illustrated embodiment, the vehicle **10** is propelled by a linear induction motor having one element **20** (FIG. **3**) carried by the vehicle **10** and the other element **22** embedded in the surface of the guideway. The element **20** may be the primary element of the linear induction motor, and the element **22** the secondary of the linear induction motor. The vehicle **10** is provided with omnidirectional running gear in the form of air cushion devices **24.** The air cushion devices **24** may be of the type disclosed in U.S. Pat. Nos. 3,357,511; 3,385,228 and 3,470,827, although the invention is not limited to any specific form of air cushion device.

As shown in FIG. **3,** a power rail support arm **26** is mounted on the right-hand side channel **14,** and a plurality (in the case, three) of power rails **28** are mounted on the power rail support **26** which are connected with a source of electricity. A cover **30** is mounted on the power rail support **26** and may define an emergency walkway alongside the guideway.

The vehicle **10** is suspended laterally between the side rails **16** by lateral suspension devices in the form of suspension wheels **32,** each of which is supported on a suspension wheel support arm **34** extending from a torsion bushing **35** (FIGS. **2** and **3**). As shown in FIGS. **2** and **3,** four suspension wheels **32** are provided, two on each side of the vehicle located at the ends thereof. The torsion bushing **35** may be of rubber or similar elastomeric material, as well as of some other spring material.

Also mounted on the suspension wheel support arms **34** at the left-hand end of the vehicle as viewed in FIG. **2** is a supporting frame **38** for a plurality of electrical contact devices or brushes **36.** As illustrated, there are two brushes or contact devices **36** for each of the power rails **28.** The brushes **36** and frame **38** define a power collector assembly for engaging the power rails to thereby transmit electricity to the vehicle **10** from the power rails to run the environmental control system of the vehicle such as lights, air conditioning and heating systems, and for powering the suspension air motors for the air cushion devices **24** of the vehicle. The power rails **28** are connected with a source of electricity and supply electricity to the vehicle **10** at all times when the vehicle contacts **36** are in engagement with the power rails. The power rails may extend along one side of the main line throughout the system with additional power rails on all branch lines for engagement by the power collector assembly on the left-hand side of the vehicle of FIG. **3** when the vehicle is switched to a branch line at a junction.

Switching of the vehicle from one line to another is accomplished by switching mechanism designated collectively by reference numeral **40** in FIGS. **4***a* and *b*, and including movable switch members **42** mounted on each side of the vehicle. As shown in FIGS. **2** and **3,** the switch members **42** comprise guide wheels **44** mounted on the ends of support arms **46.** The support arms **46** are in turn nonrotatably secured to longitudinal shafts **48** spaced on opposite sides of the longitudinal axis of the vehicle. In the illustrated embodiment, four switch members **42** are provided, two on each side of the vehicle, both switch members on each side of the vehicle being mounted on the same shaft **48.** Since the switch members and associated mechanism on one side of the vehicle are identical to the switch members and associated mechanism on the other side of the vehicle, except that one is right hand and the other left hand, like reference numerals will be used to designate the corresponding parts of both sides, except that the switch members and associated parts on the left hand side in FIG. **3** will be followed by the subscript *b*. Thus, two switching members **42** are nonrotatably secured to the shaft **48** on the right-hand side of the vehicle in FIG. **3,** and two switching members **42***b* are mounted on the shaft **48***b* on the left-hand side of the vehicle in FIG. **3.**

With refererence to FIGS. **4***a* and **4***b*, each shaft **48** and **48***b* is rotatably mounted in support means in the form of a bracket **50** secured to the body of the vehicle. Each bracket **50** is of generally U-shape in plan and includes a pair of leg members **52** and **54** spaced from each other and joined together at one end by a base member **56.** The base member **56** is secured by conventional fasteners **58** to an upright frame member **60** of the vehicle body, the legs **54** and **56** of the bracket being seated on a horizontal frame member **62** of the vehicle body as shown in FIGS. **4***a*, **4***b*, **5** and **6.** Each of the shafts **48** is rotatably mounted in bearing members **64** and **66** secured by conventional fasteners to leg members **52** and **54,** respectively, of bracket **50.**

Again, referring to FIG. **1,** the switching rails **18** and **18'** are located only at the junctions and, in the illustrated arrangement, extend between the points indicated approximately by the phantom lines **68** and **70** in FIG. **1.** As shown in FIG. **3,** the left-hand switch member **42***b* is in a raised, inactive position in which it cannot engage the switching rail **18',** while the right-hand switching members **42** is in a lowered, active position in which it can engage the switching rail **18.** In the active position of the switching member **42,** the guide wheel **44** can be received between the upper and lower horizontal flanges of the channel-shaped switching rail. Consequently, the guide wheel **44** is constrained in the vertical direction against disengagement from the switching rail **18** by the flanges of the switching rail. Thus, as the vehicle **10** moves from left to right in FIG. **1,** the direction of the vehicle through the junction **4** is determined by which switching members **42** are in the active position when the vehicle **10** reaches the switching rails **18** and **18'** at the location identified approximately at phantom line **68.** If the switching members **42** on the right-hand side of the vehicle as viewed from the left end of FIG. **1,** and assuming the vehicle moving toward the right in FIG. **1** toward the junction **4,** the vehicle will follow the main line **2** through the junction since the switch members **42***b* on the left-hand side of the vehicle will be in the raised, inactive position and cannot engage the left-hand switching rail **18'.** Conversely, movement of the left-hand switching members **42***b* to the active position will cause the vehicle to switch from the main line **2** to the branch line **6** as it moves through the junction **4.**

Actuation of the switch members **42** between their active and inactive positions is provided by the switch mechanism **40** illustrated in detail in FIGS. **4***a*, **4***b*, **5** and **6.** The switch mechanism **40** includes motion transmitting means indicated collectively by reference numerals **72** and **72***b* in FIGS. **4***a* and **4***b*, respectively, for moving the switch members **42** between their inactive and active positions, the motion transmitting means having an over-center locked condition in the active position of its associated switch member to lock the switch member against movement from its active posi-

tion in response to forces acting on the switch member. The motion transmitting means 72 of FIG. 4*a* is shown in its locked condition.

Since the motion transmitting means 72 in FIG. 4*a* is identical to the motion transmitting means in FIG. 4*b* except that one is the right-hand portion of the switching mechanism and the other is the left-hand portion, only the motion transmitting mechanism of FIG. 4*a* will be described in detail. Like reference numerals will be employed to designate corresponding parts of the motion transmitting mechanism in FIG. 4*b* with the subscript *b* added to reference numerals designating specific parts of the mechanism of FIG. 4*b*.

The motion transmitting mechanism 72 includes a lever 74 which is nonrotatably secured to shaft 48 by a clamp 76 and key 78. The switch members 42 on shaft 48 in FIG. 4*a* are in the lowered, active position to engage the switching rail 18. In order to raise the switch members 42 to their inactive positions about the axis of shaft 48 in FIG. 4*a*, shaft 48 and lever 74 are rotated in a clockwise direction by an input member 80 and a pair of locking links 84. The input member 80 is pivotally supported between arms 52 and 54 of the support bracket 50 by a pin 82. The locking links 84 each have one end pivotally connected by a pin 86 with the upper end of lever 74 and their other end pivotally connected by a pin 88 with the input member 80. Pin 88 extends through an outwardly projecting seat portion 90 of the input member 80 which serves as an abutment for engaging an adjustable stop member 92 mounted in the clamping member 76. The seat portion 90 of the input member 80 engages the stop member 92 in the active position of the shaft 48 to limit counterclockwise movement of shaft 48.

Clockwise movement of shaft 48 is further limited by the engagement of a follower 94 with a shock absorber or cushioning device 98. The follower 94 is carried on the lower end of an arm 96 formed on the input member 80 and depending beneath the pivot pin 82. The shock absorber 98 is clamped by conventional fasteners between members 100 and 102 of a clamp assembly, member 102 being secured by conventional fasteners between the arms 52 and 54 of the bracket 50 (FIG. 6). The shock absorber 98 may be of any conventional construction to provide yielding resistance to further counterclockwise movement of the input member 80 from the position illustrated in FIG. 4*a* due to the engagement with the left end of shock absorber 98 by the follower 94.

In the position illustrated in FIG. 4*a*, any forces acting on the switch member 42 tending to rotate the shaft 48 in a clockwise direction is resisted due to the position of the locking link 84 with respect to lever 74 and the input member 80. Any clockwise movement of shaft 48, and hence lever 74, tends to cause pivot point 86 to rotate in a clockwise direction about pivot pin 88 of the locking link 84, the latter movement in turn tending to urge the input member 80 in a counterclockwise direction about the axis of pin 82. Consequently, the over-center relationship of pins 86 and 88 provide a positive lock of the switch members 42 in their active position against forces acting on the switch members. Thus, shaft 48 can be rotated in a clockwise direction from its position shown in FIG. 4*a* only by clockwise rotation of input member 80 about the axis of pin 82 to in turn cause the locking link 84 to pivot in a counterclockwise direction until the lines of force through the locking link 84 are positioned to pull the lever 74, through pin 86, in a clockwise direction. This is the position of the mechanism 72*b* in FIG. 4*b*.

Projecting laterally from opposite sides of the input member 80 near its upper end is a pair of spring support members 104 (FIG. 6). The spring support members 104 are each mounted on a threaded rod 106 extending transversely through an opening in the input member 80. The upper ends of a pair of over-center springs 108 are engaged with the spring support members 104, and the lower ends of springs 108 are engaged with studs 110 mounted on the bracket arms 52 and 54. When the input member 80 moves in the clockwise direction from its position in FIG. 4*a* to cause the switch members 42 to move to their inactive positions, the axes of springs 108 pass over the axis of pin 82 so that the springs 108 provide a resilient resistance to movement of the input member in either direction.

The input member 80 is caused to rotate about its pivot axis 82 between its active position shown in FIG. 4*a* and an inactive position corresponding to the position of input member 80*b* in FIG. 4*b* by an actuating rod 116 which is secured to the movable armature 114 of an electromagnetic actuator 112. The actuating rod 116 is pivotally secured by a pin 118 with the upper end of the input member 80 and by a pin 120 with the actuator element 114. The actuator element 114 is caused to move to the left or right as viewed in FIG. 4a depending upon the type of energization of the electromagnetic actuator 112. Movement of the actuating rod assembly 114, 116, 116*b* toward the right causes the input member 80*b* to move in its switch member activating direction and the input member 80 to move in its switch member deactivating direction. When the input member 80 reaches its switch member deactivating position, the position corresponding to the position of input member 80*b*, it engages an indicating switch 120 connected with an indicator in a control panel to provide a signal indicating which of the switch members are in the active position and which of the switch members are in the inactive position. As the input member 80b is caused to rotate in a clockwise direction about its pivot pin 82*b*, link 84*b* cause the lever 74*b* and shaft 48*b* to rotate in a clockwise direction until the switch members 42*b* reach their active position. During this movement, the pivot pin 88*b* moves in a counterclockwise direction about the pivot pin 86*b*, and the springs 108*b* move across the axis of pin 82*b* to assume positions corresponding to the positions of the pins 86, 88 and springs 108 in FIG. 4*a*.

While one specific form of the invention has been illustrated and described in the foregoing specification and accompanying drawings, it should be understood that the invention is not limited to the exact construction shown. Alterations and variations in the construction and arrangement of parts, all falling within the scope and spirit of the invention, will be apparent to those skilled in the art.

I claim:

1. A vehicle adapted to travel over a guideway having fixed switching rails at junctions engageable by the vehicle for guiding the vehicle past the junction in a direction determined by the switching rail, said vehicle comprising: a body; at least one switch member mounted on said body for movement between an active position in which it can engage a switching rail when the vehicle is traveling over the guideway and an inactive position

in which it cannot engage a switching rail; motion transmitting means for moving said switch member between its active and inactive positions, said motion transmitting means having an over-center locked condition in the active position of said switch member to lock the switch member against movement from its active position in response to forces acting on the switch member; said motion transmitting means including an input member movable in a first direction to move said switch member to its active position from its inactive position and a second direction to move said switch member to its inactive position from its active position; said motion transmitting means further including over-center locking means operable to urge said input member further in said first direction when said switch member is in its active position in response to forces on said switch member tending to urge the switch member to return to its inactive position.

2. A vehicle as claimed in claim **1** further including support means on said body; a shaft rotatably mounted on said support means, said switch member being nonrotatably secured to said shaft.

3. A vehicle as claimed in claim **2** wherein said motion transmitting means includes a lever nonrotatably mounted on said shaft, and means connected between said lever and support means for actuating said switch member through said lever between its active and inactive positions.

4. A vehicle as claimed in claim **2** wherein said support means comprises a pair of brackets mounted on said body on opposite sides of the longitudinal axis of said vehicle, and further including a pair of shafts, each of said shafts being rotatably mounted in one of said brackets, and wherein there are at least two switch members each of which is nonrotatably secured to a respective one of said shafts, and wherein there is a pair of motion transmitting means, one for each shaft and its associated bracket.

5. A vehicle as claimed in claim **4** whrein each motion transmitting means includes a lever nonrotatably mounted on its associated shaft, and means connected between said lever and its associated support bracket for actuating the associated switch member through said lever between its active and inactive positions.

6. A vehicle adapted to travel oer a guideway having fixed switching rails at junctions engageable by the vehicle for guiding the vehicle past the junction in a direction determined by the switching rail, said vehicle comprising: a body; at least one switch member mounted on said body for movement between an active position in which it can engage a switching rail when the vehicle is traveling over the guideway and an inactive position in which it cannot engage a switching rail; motion transmitting means for moving said switch member between its active and inactive positions, said motion transmitting means having an over-center locked condition in the active position of said switch member to lock the switch member against movement from its active position in response to forces acting on the switch member; support means on said body; a shaft rotatably mounted on said support means, said switch member being nonrotatably secured to said shaft; said motion transmitting means including a lever nonrotatably mounted on said shaft, and means connected between said lever and support means for actuating said switch member through said lever between its active and inactive positions; said last named means comprising an input member pivotally mounted on said support means, and a locking link pivotally connected between said input member and said lever, said input member being movable in a first direction to move said switch member to its active position from its inactive position and a second direction to move said switch member to its inactive position from its active position, said locking link being movable to an over-center locking position with respect to said lever and input member upon movement of said switch member to its active position such that a force on said switch member in a direction to move the switch member from the active to inactive position tends to urge said input member further in said first direction.

7. A vehicle as claimed in claim **6** further including a spring having one end connected with said support means on one side of the pivot point of said input member and its other end connected with said input member on the other side of the pivot point of said input member, the line of action of said spring moving across the pivot point of said input member on said switch member is actuated between its active and inactive positions.

8. A vehicle as claimed in claim **7** further including a stop member on said lever engageable by said input member when said switch member is in its active position.

9. A vehicle as claimed in claim **8** further including shock absorbing means mounted on said body, and an arm on said input member engageable with said shock absorbing means as said switch member is moved into its active position by said motion transmitting means.

10. A vehicle as claimed in claim **8** further including a position indicating switch on said support means and engageable by said input member in the inactive position of said switch member.

11. A vehicle as claimed in claim **10** wherein said switch member comprises a support arm nonrotatably mounted on said shaft, and a guide wheel rotatably mounted on said support arm for engaging a switching rail.

12. A vehicle as claimed in claim **11** wherein said guide wheel is rotatable about a vertical axis in the active position of said switch member.

13. A vehicle adapted to travel over a guideway having fixed switching rails at junctions engageable by the vehicle for guiding the vehicle past the junction in a direction determined by the switching rail, said vehicle comprising: a body; at least one switch member mounted on said body for movement between an active position in which it can engage a switching rail when the vehicle is traveling over the guideway and an inactive position in which it cannot engage a switching rail; motion transmitting means for moving said switch member between its active and inactive positions, said motion transmitting means having an over-center locked condition in the active position of said switch member to lock the switch member against movement from its active position in response to forces acting on the switch member; support means on said body; a shaft rotatably mounted on said support means, said switch member being nonrotatably secured to said shaft; said support means comprising a pair of brackets mounted on said body on opposite sides of the longitudinal axis of said vehicle, and further including a pair of shafts, each of said shafts being rotatably mounted in one of said brackets, and wherein there are at least

two switch members each of which is nonrotatably secured to a respective one of said shafts, and wherein there is a pair of motion transmitting means, one for each shaft and its associated bracket; each motion transmitting means including a lever nonrotatably mounted on its associated shaft, and means connected between said lever and its associated support bracket for actuating the associated switch member through said lever between its active and inactive positions; said last named means comprising an input member pivotally mounted on said associated support bracket, and a locking link pivotally connected between said input member and said lever, said input member being movable in a first switch member activating direction to move the associated switch member to its active position from its inactive position and a second switch member deactivating direction to move said associated switch member to its inactive position from its active position, said locking link being movable to an over-center locking position with respect to said lever and input member upon movement of said associated switch member to its active position such that a force on said switch member in a direction to move the switch member from the active to inactive position tends to urge said input member further in said first direction.

14. A vehicle as claimed in claim **13** further including an actuating rod connecting the input members of both motion transmitting means, said actuating rod being movable in one direction to cause one of said input members to move in its switch member activating direction and the other input member to move in its switch member deactivating direction, said actuating rod being movable in the opposite direction to cause said one input member to move in its switch member deactivating direction and said other input member to move in its switch member activating direction.

15. A vehicle as claimed in claim **14** further including power means on said body for moving said actuating rod in said one and opposite directions.

16. A vehicle as claimed in claim **15** wherein said power means comprises an electromagnetic actuator.

17. A vehicle as claimed in claim **14** further including a position indicating switch on at least one of said brackets engageable by the associated input member in one of the active or inactive positions of the associated switch member.

18. A vehicle as claimed in claim **14** wherein each switch member comprises a support arm nonrotatably mounted on the associated shaft, and a guide wheel rotatably mounted on said support arm for engaging a switching rail.

19. A vehicle as claimed in claim **18** wherein said guide wheel is rotatable about a vertical axis in the active position of said switch member.

20. A transportation system comprising: a vehicle guideway including a main line, a branch line diverging from said main line, and a pair of fixed switching rails at the junction of said main and branch lines, said pair of fixed switching rails including a main line switching rail following said main line past the junction and a branch line switching rail following said branch line past the junction; a vehicle in said guideway; at least a pair of switch members mounted on said vehicle, one of said switch members being movable between an active position in which it can engage the main line switching rail to cause the vehicle to follow the main line past the junction and an inactive position in which it cannot engage a switching rail, the other of said switch members being movable between an active position in which it can engage the branch line switching rail to cause the vehicle to follow the branch line past the junction and an inactive position in which it cannot engage a switching rail; actuator means connected between said switch members to cause one switch member to move from its active to inactive position in response to movement of the other switch member from its inactive to active position; and over-center locking means connected with said switch members for locking the active switch member against movement from the active position in response to a force exerted on the switch member; further including side rails on each side of the guideway, and lateral suspension means on said vehicle engaging said side rails; said switching rails each comprising an outwardly extending channel section mounted on respective ones of said side rails at the junction, the active switch member being engaged with the channel section of its associated switching rail and constrained in a vertical direction by the flanges thereof as the vehicle passes through the junction.

21. A system as claimed in claim **20** wherein said lateral suspension means comprises a plurality of suspension wheel support arms projecting laterally from said vehicle with at least one suspension wheel support arm on each side of said vehicle, and a suspension wheel rotatably mounted on each of said suspension wheel support arms for engagement with the adjacent side rail.

22. A system as claimed in claim **21** further including a plurality of power rails extending alongside the guideway, and a power collector assembly carried by at least one of the suspension wheel support arms for electrical engagement with the power rails as the vehicle travels along the guideway.

23. A vehicle adapted to travel over a guideway having fixed switching rails at junctions, said vehicle comprising: a body; a pair of longitudinally extending shafts rotatably mounted on said body in spaced, parallel relationship with each other, said shafts being located on opposite sides of the longitudinal axis of said body; at least one switching member on each of said shafts movable upon rotation of said shafts between an active position in which it can engage a switching rail and an inactive position in which it cannot engage a switching rail; switching mechanism connecting said shafts to cause one of said shafts to rotate in a direction to move its switch member from the active to inactive position in response to rotation of the other of said shafts in a direction to move its switch member from the inactive to active position; and lateral suspension means on said body for engaging guideway side rails; said actuator means including an input member movable in a first direction to move one of said switch members to its active position from its inactive position and a second direction to move said one switch member to its inactive position from its active position; said actuator means further including over-center locking means operable to urge said input member further in said first direction when said one switch member is in its active position in response to forces on said one switch member tending to urge said one switch member to return to its inactive position.

24. A vehicle as claimed in claim **23** wherein said switch members each comprises a support arm nonrotatably mounted on its associated shaft, and a guide

wheel rotatably mounted on said support arm for engaging a switching rail to restrain the vehicle against lateral movement with respect thereto.

25. A vehicle as claimed in claim **24** wherein said guide wheel is rotatable about a substantially vertical axis in the active position of said switch member.

26. A vehicle as claimed in claim **24** wherein said lateral suspension means comprises a plurality of suspension wheel support arms projecting from said body on opposite sides thereof, and a suspension wheel rotatably mounted on each of said support arms.

27. A transportation system comprising: a vehicle guideway including a main line, a branch line diverging from said main line, and a pair of fixed switching rails at the junction of said main and branch lines, said pair of fixed switching rails including a main line switching rail following said main line past the junction and a branch line switching rail following said branch line past the junction; a vehicle in said guideway; at least a pair of switch members mounted on said vehicle, one of said switch members being movable between an active position in which it can engage the main line switching rail to cause the vehicle to follow the main line past the junction and an inactive position in which it cannot engage a switching rail, the other of said switch members being movable between an active position in which it can engage the branch line switching rail to cause the vehicle to follow the branch line past the junction and an inactive position in which it cannot engage a switching rail; actuator means connected between said switch members to cause one switch member to move from its active to inactive position in response to movement of the other switch member from its inactive to active position; and over-center locking means connected with said switch members for locking the active switch member against movement from the active position in response to a force exerted on the switch member; said actuator means including an input member movable in a first direction to move said switch member to its active position from its inactive position and a second direction to move said switch member to its inactive position from its active position; said actuator means further including over-center locking means operable to urge said input member further in said first direction when said switch member is in its active position in response to forces on said switch member tending to urge the switch member to return to its inactive position.

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