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Ishii et al.

[11] **3,844,224**

[45] **Oct. 29, 1974**

[54] **GUIDING SYSTEM FOR A COMPUTER CONTROLLED VEHICLE**

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[73] Assignee: **Japan Society for the Promotion of Machine Industry,** Tokyo, Japan

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[30] **Foreign Application Priority Data**

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Aug. 19, 1971 Japan 46-62589

[52] **U.S. Cl.** **104/244.1,** 104/130, 104/247
[51] **Int. Cl.** **B61f 9/00**
[58] **Field of Search** 104/244.1, 242, 243, 245, 104/247, 130, 105

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Primary Examiner—Trygve M. Blix
Assistant Examiner—Barry L. Kelmachter
Attorney, Agent, or Firm—Lane, Aitken, Dunner & Ziems

[57] **ABSTRACT**

A guiding system for a computer controlled vehicle including a flat track guide-way and a guide channel coextensive with and under the track surface. The vehicle is equipped with a steering guide link which carries at least two guide wheels in an offset or staggered relationship on a lower crank portion. Two of the guide wheels follow the vertical inner walls of the guide channel, and thus the vehicle follows the track.

3 Claims, 12 Drawing Figures

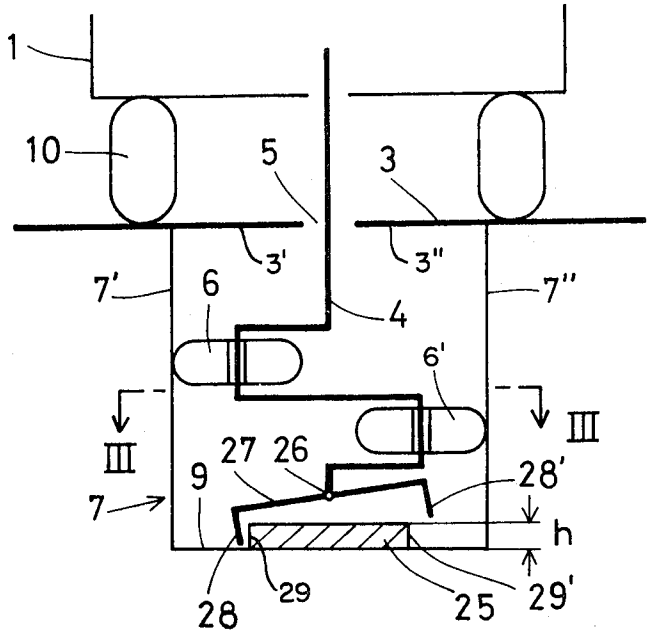


FIG. 1

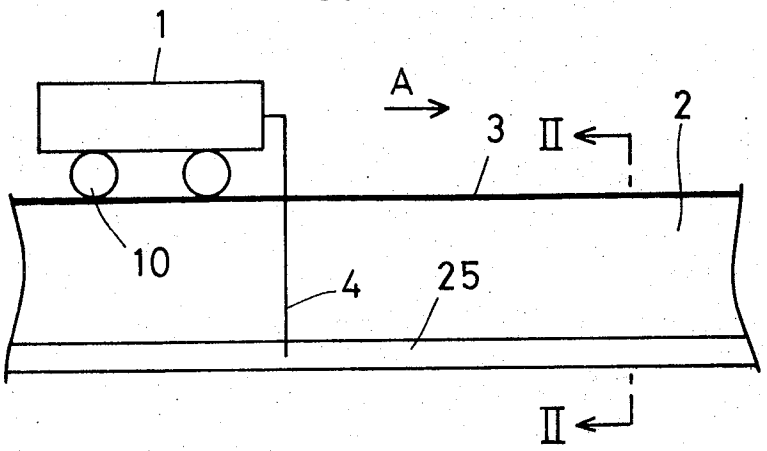


FIG. 2

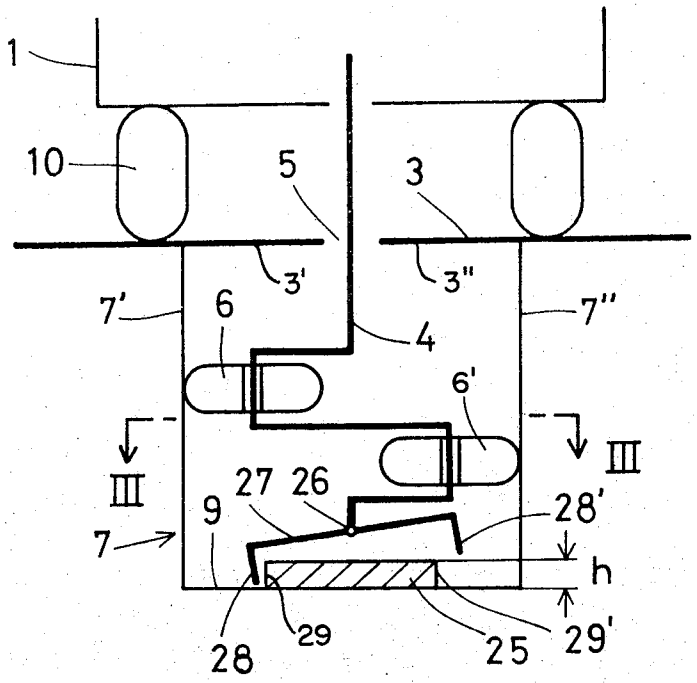


FIG. 3

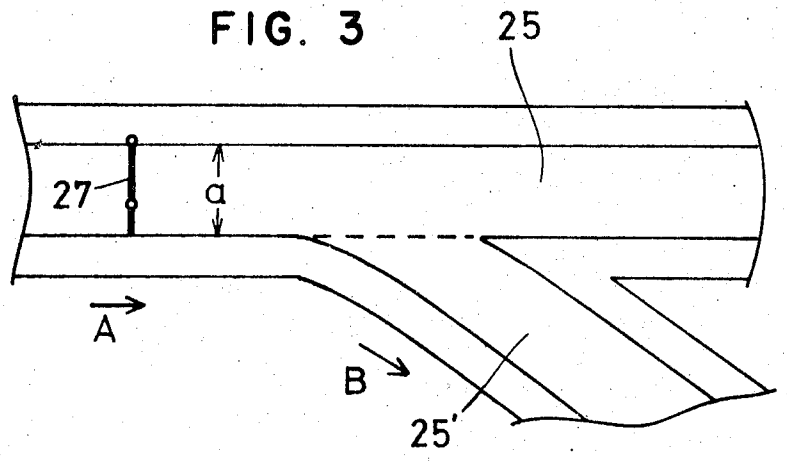


FIG. 4

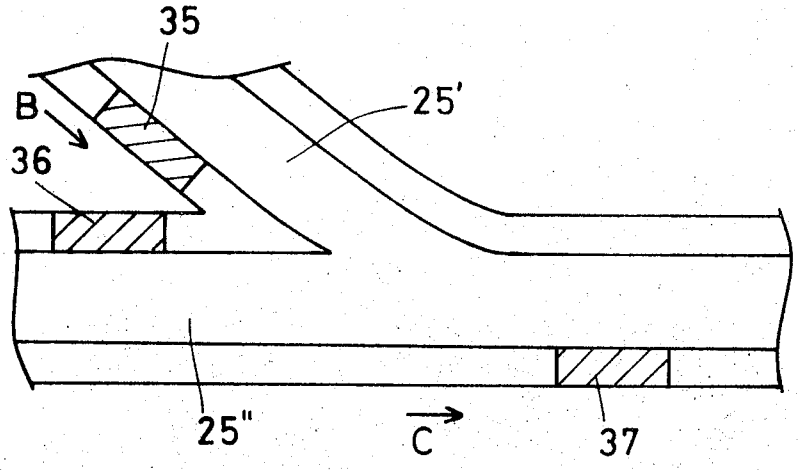


FIG. 5

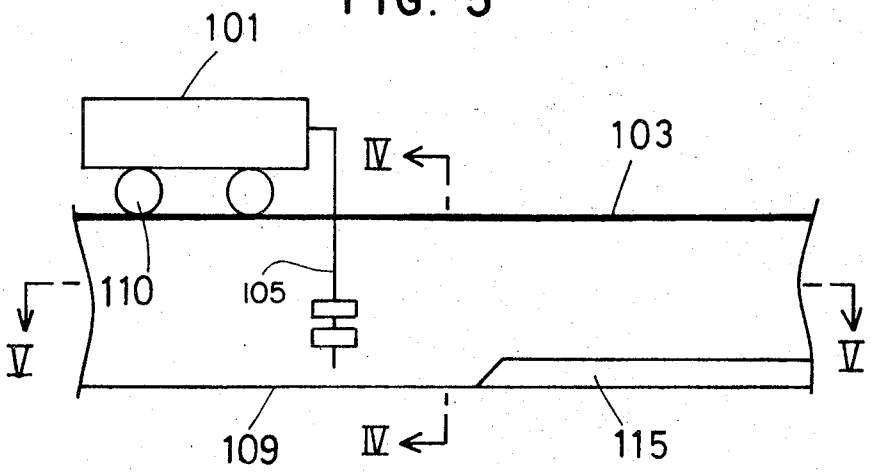


FIG. 6

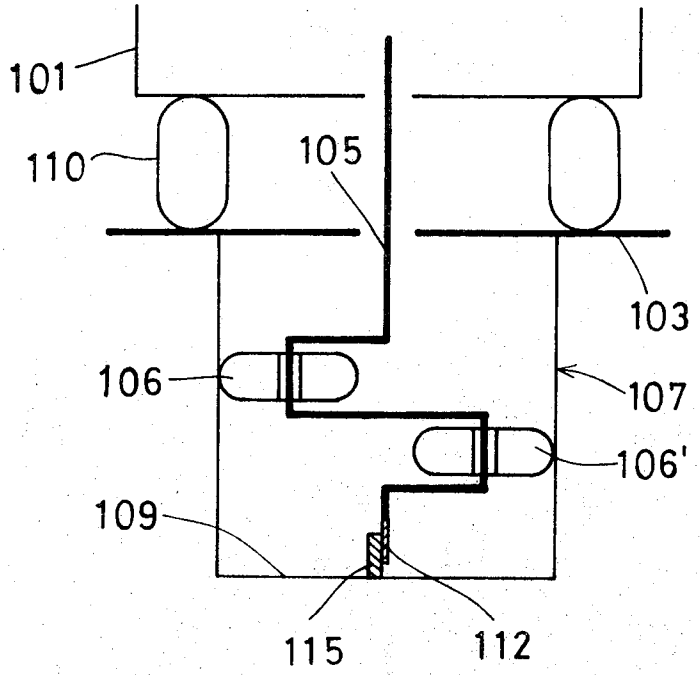


FIG. 7

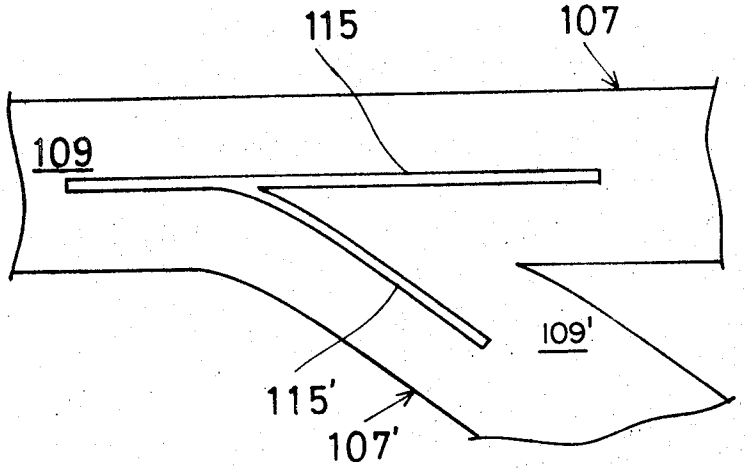


FIG. 8

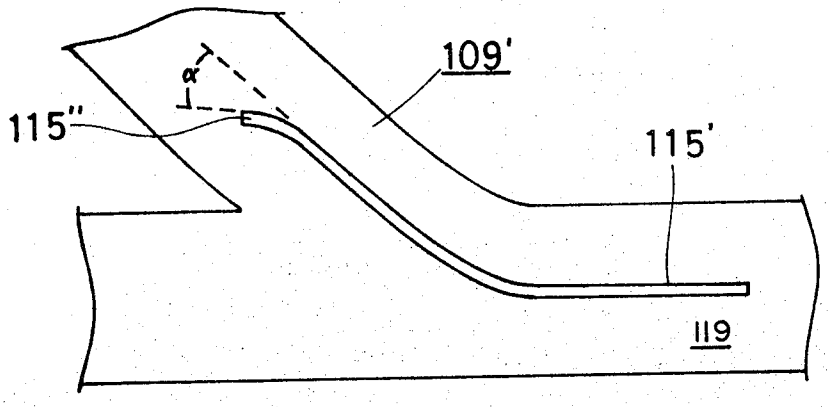


FIG. 9

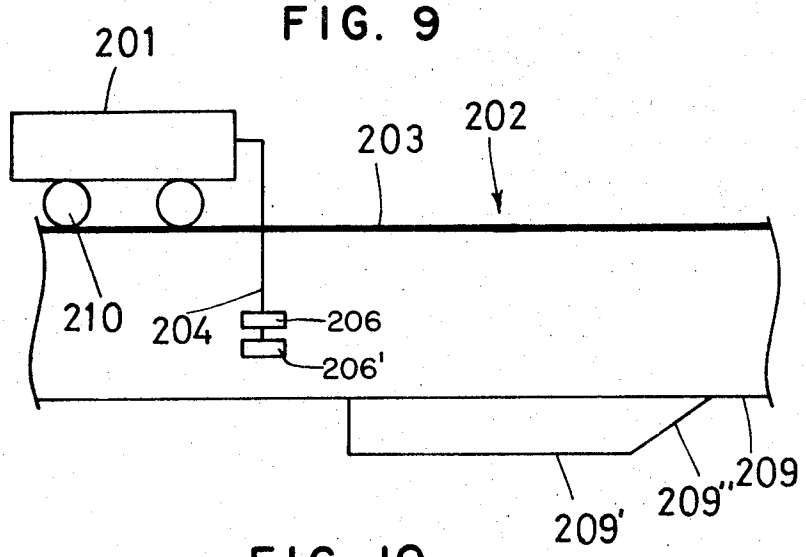

201
203
202
210
204
206
206'
209'
209''
209

FIG. 10

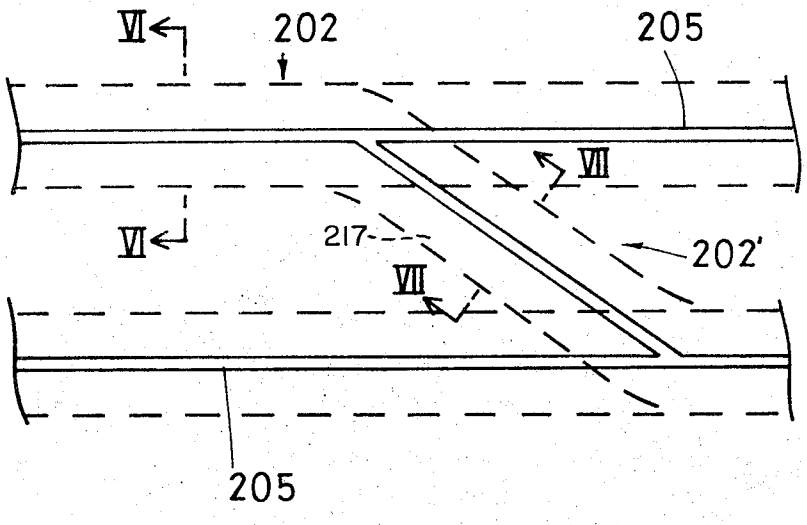

VI
202
205
VII
VI
217
202'
VII
205

FIG. 12

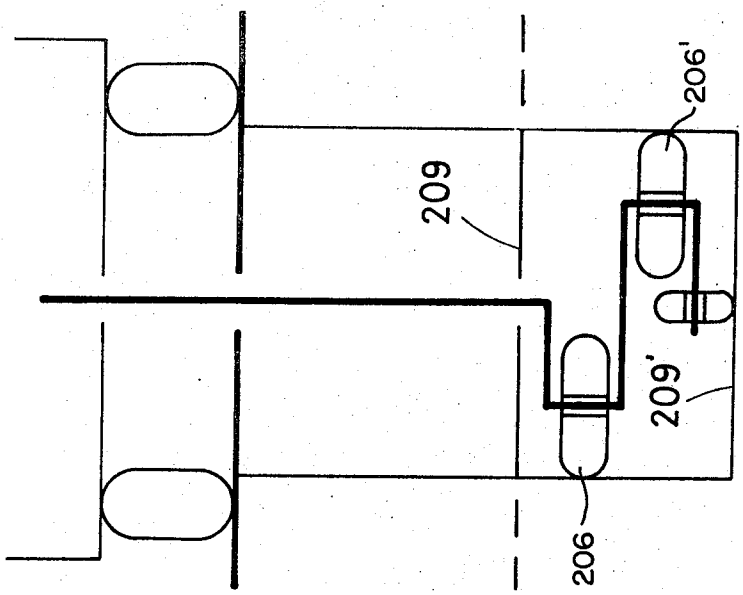
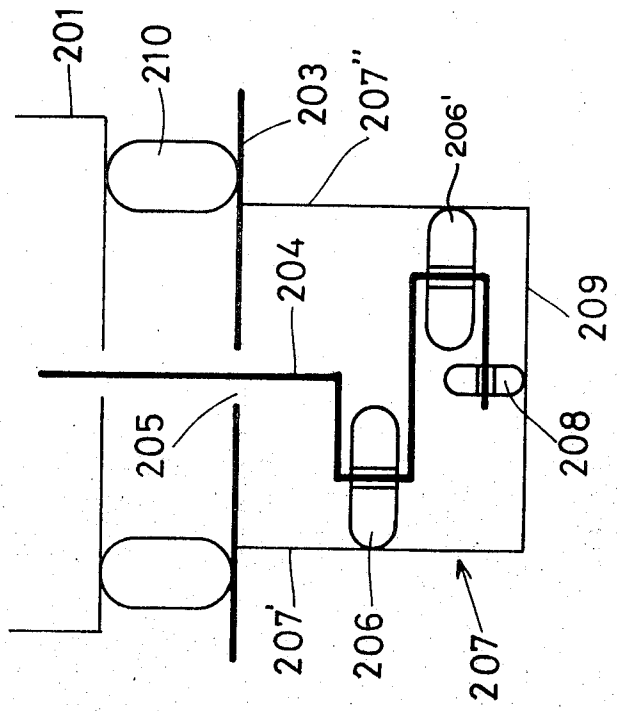


FIG. 11



GUIDING SYSTEM FOR A COMPUTER CONTROLLED VEHICLE

BACKGROUND OF THE INVENTION

This invention relates to a guiding system for a computer controlled vehicle along a selected path within a traffic network.

Many methods have been proposed for utilization of the computer as a means for controlling vehicular mass transportation in a traffic network. Several such schemes were disclosed in the International Fair held in Japan in 1970.

These traffic networks would provide for a plurality of vehicles all controlled by means of a computer so that each vehicle would follow a selected path so as to reach a desired point in a minimum period of time. In these methods, the vehicle must select the correct path within the traffic network without any malfunction. Such networks require provision of a simplified computer control logic and selecting mechanism to enable quick switching of a vehicle from one track or guideway to another.

In railways, monorails, and the like, the tracks themselves are moved by a switch to transfer the vehicle from one track to another. In a mass transit system, the mass of moving track portions would be considerable. Therefore, there exists a need for a substitute for conventional rail switches.

SUMMARY OF THE INVENTION

The features of the present invention include a flat track surface and a guide channel, under the surface thereof, having a rectangular cross section and transversing the length of the track. The bottom of the guide channel is provided with a guide reference means which may be one of a variety of forms. Another feature of the invention is the provision of a steering guide link on the vehicle, the steering linkage having two lower crank portions off-set or staggered with respect to the axis of the link proper, and carrying two guide wheels mounted on the respective crank positions. Accordingly, the two guide wheels are also positioned in an off-set or staggered relationship. The crank portions carrying the guide wheels are on the lower end of the steering guide link which extends through a slit in the track surface and into the guide channel. The two guide wheels contact the two vertical inner walls of the guide channel, thereby causing the wheels to follow the guide channel. The slit is defined by ribs extending from the upper edges of the channel inwardly. The guide link is further equipped with a guide follower means which is adapted to engage the guide reference means for the purpose of selection of a path at a branch or junction. The manner in which the guide follower means engages the guide reference means is controlled by means of a computer. In other words, the computer governs the manner in which the guide follower means engages the guide reference means, which means governs the guide wheels and steering guide link. The steering guide link, in turn, is operatively connected to the steering mechanism of the vehicle, so that the vehicle will follow the desired path or track.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of an embodiment of the control system of the present invention;

FIG. 2 is a cross-sectional view taken along the line II—II of FIG. 1;

FIG. 3 is a plan view showing a branch track or guideway intersecting a main track;

FIG. 4 is a plan view showing another track or guideway junction;

FIG. 5 is a cross-sectional view of another embodiment of the control system of the invention;

FIG. 6 is a cross-sectional view taken along the line IV'—IV' of FIG. 5;

FIG. 7 is a plan view of a junction of tracks or guideways;

FIG. 8 is a plan view showing tracks or guide-ways at a junction;

FIG. 9 is a cross-sectional view of yet another embodiment of the control system of the invention;

FIG. 10 is a plan view of the system of FIG. 9;

FIG. 11 is a cross-sectional view taken along line VI—VI of FIG. 10; and

FIG. 12 is a cross-sectional view taken along line VII—VII of FIG. 10.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 to 4 show one embodiment of the present invention. A vehicle 1 is shown as traveling on surface 3 of a transportation module track 2. The vehicle 1 has a steering guide link 4 extending downwardly from the vehicle 1 through a slit 5 in track surface 3 and into a guide channel 7. Slit 5 is coextensive with the length of track 2 and is defined by ribs 3' and 3'' of surface 3.

As shown in FIG. 2, the lower portion of the steering guide link 4 is of a double crank shape and carries two guide wheels 6 and 6' which are arranged horizontally and in contact with the vertical inner walls 7' and 7'', respectively, of the guide channel 7. Thus, the two guide wheels 6 and 6' are off-set, or staggered vertically within the guide channel 7 and are guided by the latter. The lower end of steering guide link 4, below the guide wheels 6 and 6', has a flat U-shaped guide follower 27 attached thereto by means of a toggle linkage 26. Guide follower 27 follows the path defined by guide rail 25.

The steering guide link 4 is operatively connected with the steering mechanism of the supporting wheels 10 of the vehicle 1 and thus governs the steering angle of the supporting wheels 10 in accordance with the position of the guide follower means 27.

The guide follower means 27 is normally spaced from or above the bottom surface 9 of the guide channel 7 as when the vehicle follows the linear track.

As indicated in FIGS. 2 through 4, located in the center of, and on the bottom of, the guide channel 7 is a rail or guide reference means 25 having a given width (a) and a given height (h). Rail 25' branches from guide rail 25, as shown in FIG. 3.

The leg portions 28 and 28' of the guide follower means 27 are designed to selectively contact either side 29 or side 29' of a rail 25 or 25' and to slide along the selected side of the rail. The selecting means (not shown) which controls the toggle mechanism 26 is mounted on vehicle 1 and is remotely controlled by means of a computer. Thus, when the vehicle 1 travels linearly, in the direction indicated by arrow A, the leg portion 28 will keep sliding along the left side 29 of the rail 25. The flat U-shaped guide follower means 27 will

remain biased by spring action against side **29** until another signal is received from the computer.

If the vehicle **1** is to leave track **25** and follow branch track **25'**, in the direction indicated by arrow B as shown in FIG. **3**, the toggle means **26** is operated, responsive to a computer signal, so as to cause the leg **28'** to slide along the right side **29'** of the rail **25.**

As shown in FIG. **4**, if the leg **28'** of the follower means **27** after transfer to the branch track **25'** continues in contact with the right side **29'** of the rail **25'** as viewed in the direction of arrow B, then the leg **28'** will catch at the point where rails **25'** and **25''** intersect, resulting in breakage. Accordingly, there is provided a sloped member **35** on the right side **29'** of the rail **25'** to restore the guide follower means **27** to the normal or neutral position, i.e., with leg **28** in contact with left side **29** of the rail.

On the other hand, if the vehicle is traveling toward the joining point of the tracks in the direction indicated by arrow C of FIG. **4**, the leg **28** of the guide follower means **27** is slidingly in contact with the left side of the rail **25''**. Therefore, if the leg keeps in contact with the left side of the rail **25** at the joining point of the rails **25'** and **25''**, the leg **28** will be broken. To avoid this, there is provided a sloped means downstream of the junction point which serves to lift the leg **28** and cause the right let **28'** to contact the right side of the rail **25''**. After passing the junction point of the tracks, the leg portion **28'** is restored to the normal position by another sloped means **37** on the right side of the rail **25''** to lift leg **28'** into the "normal" position.

FIGS. **5** through **8**, show a second embodiment of the invention. A vehicle **101** is shown on the surface **103** of transportation module track **102** similar to that shown in FIG. **1.** A steering guide link **105** and guide wheels **106** and **106'** are provided similar to those of the first described embodiment of the invention, except for an extension or contacting element **112** affixed to the lower end of the steering guide link **105.** In this case, the contacting element may assume the form of a round bar or of a flat bar. The steering guide link **105,** as in the first embodiment, is operatively connected to the steering mechanism of the vehicle **101** and governs the steering angle of the supporting wheels **110** of the vehicle in accordance with the selected position of the contacting element **112.** The contacting element **112** is so designed to remain spaced above the bottom surface **109** of the guide channel **107** when traveling along the linear track.

As shown in FIG. **7**, there is provided on the bottom of the guide channel **107** a run of rail **115** coextensive with the center line of the guide channel. There is also provided a branch rail **115'** on the bottom of a branch guide channel **107'**. The side of the rail **115** with which the element **112** is in contact will determine the path followed by the vehicle **101** at the branch or joining point of the tracks. The side selected by the contacting element **112** is controlled by means of, for example, electromagnetic means (not shown) which, in turn, is adapted to be controlled by a computer.

With reference to FIG. **8**, at the junction of tracks there is provided a rail **115'** extending from the branch track **109'** to a track **119.** To ensure the contact of the contacting element **112** with the rail **115'**, there is provided an outwardly bent portion **115''** having an angle α with respect to the rail **115'**. The manner of contact between element **112** and rail **115** or rail **115'** is similar to that of the first embodiment and therefore need not again be described.

FIGS. **9** through **12** show a third embodiment of the present invention. A vehicle **201** is shown in FIG. **9** on a transportation module track **202.** As in the first and second embodiments, the vehicle has a steering guide link **204** extending from the vehicle **201** through a slit **205** into a guide channel **207.** Guide link **204** carries two horizontally placed guide wheels **206** and **206'** on its lower crank portion. The two guide wheels **206** and **206'** are in contact with the vertical inner walls **207'** and **207''** of the guide channel **207** so as to be guided thereby. In this embodiment, another guide wheel **208** is affixed to the lower end of the steering guide link, contacting the bottom surface **209** of the guide channel **207.** The guide link **204** is connected to the steering mechanism of the vehicle **201** so as to steer the supporting wheels **210** of the vehicle **201,** i.e., by governing the steering angle of the supporting wheels.

The most important features of the third embodiment, which differ from the previously described embodiments, are 1) the guide follower means is eliminated, with the above two guide wheels themselves assuming that function and 2) the guide reference rail is also eliminated. The guide channels of the branch tracks of this embodiment have deeper or lower bottoms than the bottoms of the guide channels of the main tracks.

At a track junction, the bottom **209** of the branch track guide channel **217** is dug, as shown in FIG. **9,** to a level lower than that of the guide channel **207** of the main track **202.** If the vehicle **201** is to be diverted from the main track **202** onto the branch track **202'**, the guide wheels **206, 206'** and **208** of the steering guide link **204** are lowered into the deeper guide channel **217** in response to a computer signal, as shown in FIG. **12.** To facilitate the return of the guide wheels **206, 206'** and **208** to the level of the linear main guide channel **207,** there is provided a slope **209''** at the junction between the lower bottom **209'** and the normal bottom **209,** as shown in FIG. **9.** The steering guide link **204** is held in position by means of a ratchet mechanism. When the steering guide link **204** is to be lowered at the junction of tracks, the steering guide link **204** is released from engagement with the ratchet mechanism in response to a computer signal.

The guide wheel **208** serves only to contact the bottom surface of the guide channel. When the vehicle travels along a main track, the ratchet mechanism remains in engagement with the steering guide link. When the vehicle approaches a main track from a branch track, the steering guide link will be raised by slope **209''**, thus bringing that linkage back into engagement with the ratchet mechanism.

The invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the claims rather than by the foregoing description, and all changes which come within the meaning and range of the equivalents of the claims are therefore intended to be embraced therein.

We claim:

1. A guiding system for guiding a computer controlled vehicle through a network of main and branch tracks, said system comprising guide channels extend-

ing along the center lines of said tracks below the upper surfaces thereof, a guide rail formed at the bottom of said guide channels, and a flat U-shaped bar attached to the steering mechanism of said vehicle by a toggle means, said bar extending into said guide channels and adapted to selectively engage the sides of said rail to control the direction taken by the vehicle at a junction, said guide channels having a sloped portion at their bottoms to raise said bar out of contact with said rail when the vehicle approaches a track junction.

2. The guiding system of claim **1** wherein each track has a surface covering said guide channels, said surface having a longitudinal slit coextensive with its length and providing access to the interior of said guide channels.

3. The guiding system of claim **1** further comprising steering guide means connecting said steering mechanism to said toggle means, said steering guide means comprising a crank portion connected to said steering mechanism, at least two horizontally arranged guide wheels connected to said crank portion, said guide wheels adapted to contact the two vertical inner walls of said guide channels in an off-set staggered relationship with respect to the axis of said steering guide means.

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