United States Patent

Webb

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[54] RAIL CAR AND SUPPORTING TRACK AND SWITCH SYSTEM

[72] Inventor: **Austin A. Webb,** 337 Espanola Ave., Kalamazoo, Mich. 49004

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[52] **U.S. Cl.** **104/130,** 104/91, 104/96, 104/105

[51] **Int. Cl.** **E01b 25/06**

[58] **Field of Search** ..... 104/88, 89, 91, 93, 96, 105, 104/106, 110, 111, 130; 105/148, 150, 215, 215 C

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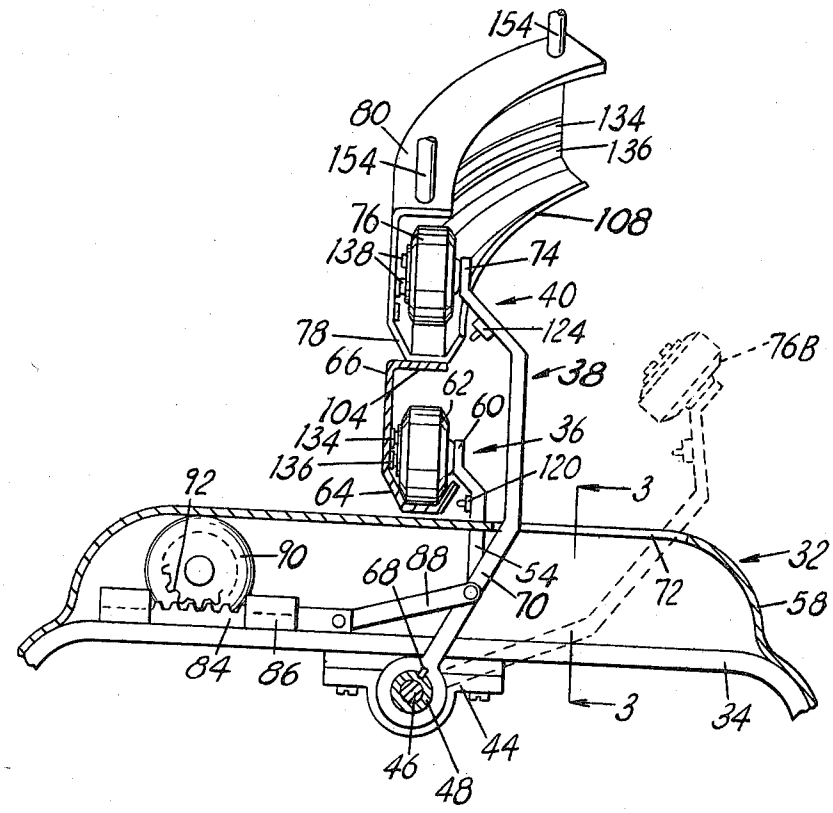
Primary Examiner—Arthur L. La Point
Assistant Examiner—Robert Saifer

[57] **ABSTRACT**

A rail car having two sets of supporting wheels swingable to upright operative car supporting positions at different elevations above the car, from laterally displaced inoperative positions; a track system having rails that converge and diverge at junction points, parallel reaches in said rails at the incoming ends of the junction points spaced vertically to support one set of wheels and register in unsupporting relation to the other set of wheels while the other wheels are moved into registry with the other track, vertically divergent portions at the ends of the parallel reaches arranged to transfer the support of the car from one set of wheels to the other, and selectively operable means to swing the sets of wheels to operative position to effect switching of the car from one rail to the other at transfer points.

A refinement shows stretches of rails at an intermediate spacing, along which the car may be supported and driven by both sets of wheels, for high-speed operation.

8 Claims, 6 Drawing Figures



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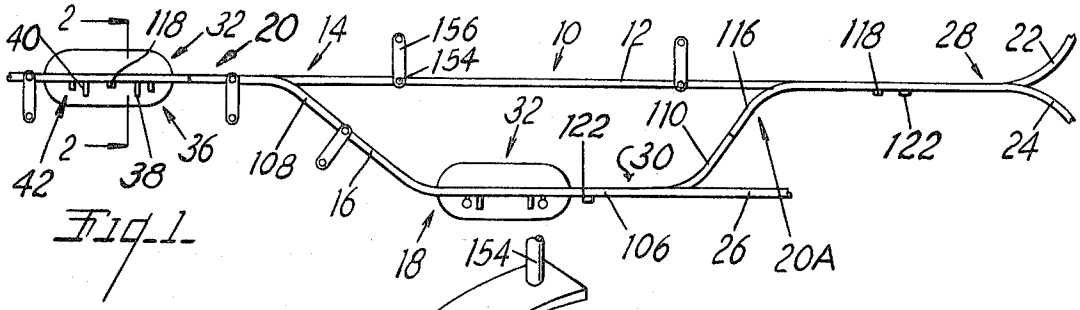

Fig. 1

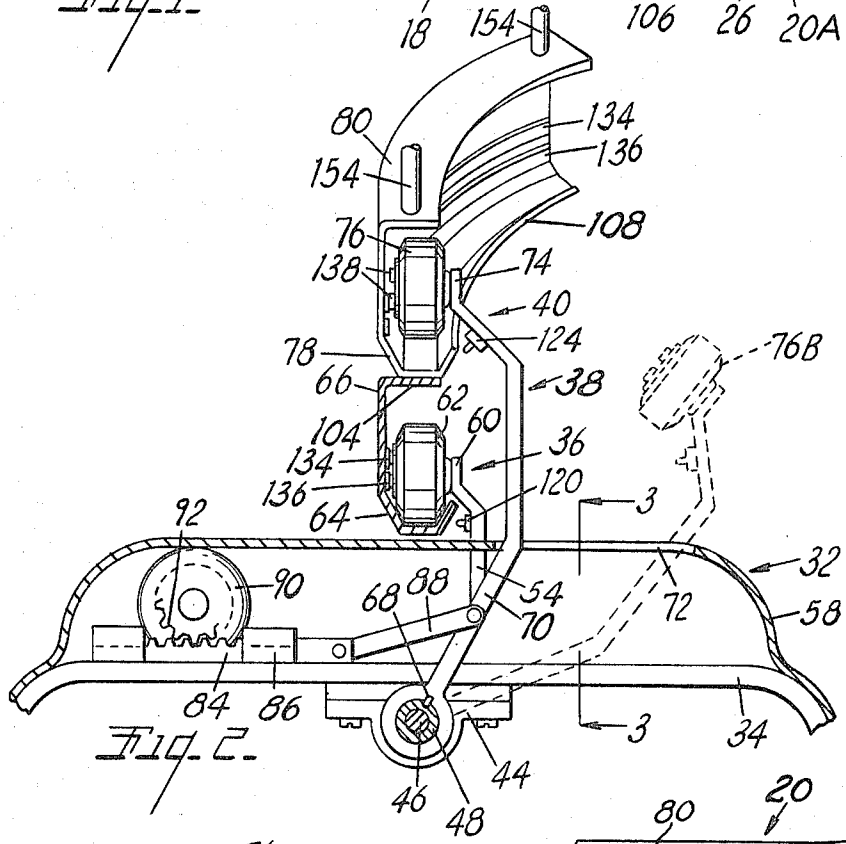

Fig. 2

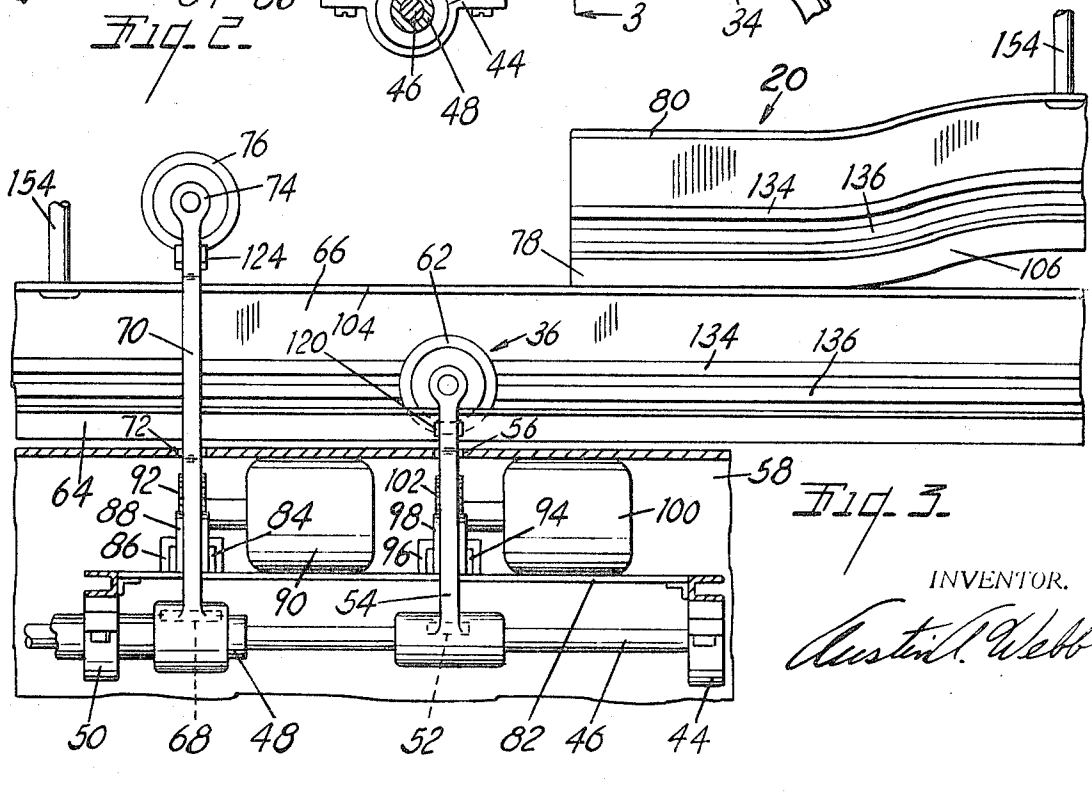

Fig. 3

INVENTOR.

Austin L. Webb

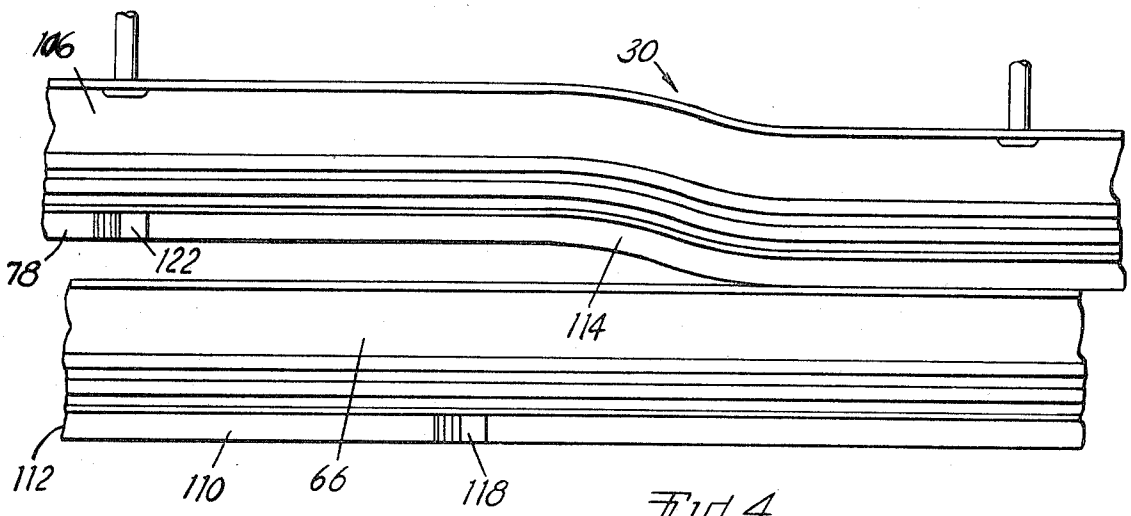

Fig. 4

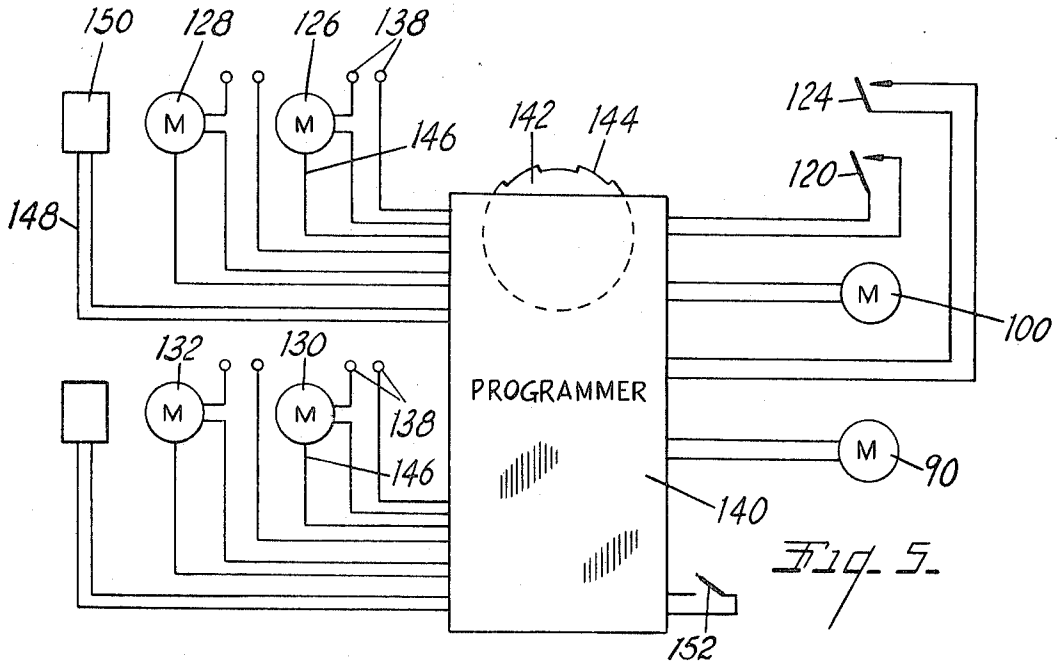

Fig. 5

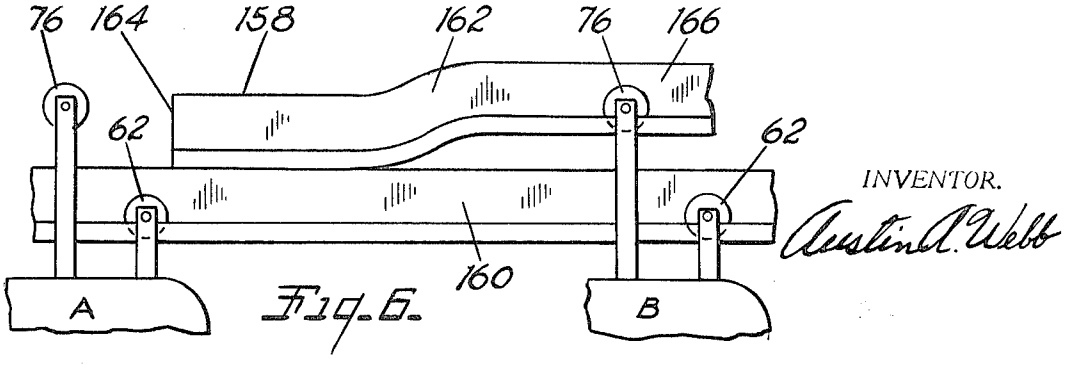

Fig. 6

INVENTOR.

Austin A. Webb

RAIL CAR AND SUPPORTING TRACK AND SWITCH SYSTEM

OUTLINE OF INVENTION

A track system has fixed supporting rails with branches coming together in parallel relation at transfer or switch points. Cars movable along the track system have two sets of supporting wheels that are selectively swingable from laterally displaced, inoperative, positions, to upright, operative, positions in which they supportingly engage rails at different, displaced parallel positions. At the entrance to the switch points, the parallel reaches of the rails are in registry with the operative positions of both sets of wheels, to receive one set of wheels in continuing supporting engagement on the incoming rail, and in spaced, nonsupporting relation to the other set of wheels. After the car and both sets of wheels are in registry with both rails, the rails converge or diverge so that the support of the vehicle is transferred to the other rail and the other set of wheels by continued motion of the vehicle along the track.

Switching of the vehicle is thus controlled from within the vehicle, by selectively swinging the sets of wheels to operative supporting position. If it is not desired to transfer or switch from one rail to another, the inactive set of wheels is left in inoperative position at a transfer point. The vehicle accordingly continues along the same incoming supporting rail as it travels along the track system.

By placing switch tripping or other sensing elements along the rails, and interconnecting the sensing elements with the mechanism for moving the sets of wheels, the movement of the car may be preprogrammed to travel to any one of a multiplicity of stations along the system.

A refinement shows stretches of the track system with rails spaced to support both sets of wheels, so that driving force from all four supporting wheels can drive the car at higher speed than when it is supported by a single set of wheels.

Various objects and advantages of the invention will be apparent from a consideration of the following description and claims. The drawings of which there are two sheets illustrate a highly practical form of the transportation system.

FIG. 1 is a fragmentary view conventionally illustrating a portion of the supporting and guiding track system with vehicles supported thereon.

FIG. 2 is an enlarged fragmentary cross-sectional view taken along the plane of the line 2—2 in FIG. 1 and illustrating the supporting and guiding relation between the rails of the track system and a portion of one of the vehicles thereon.

FIG. 3 is a fragmentary vertical cross-sectional view taken along the plane of the line 3—3 in FIG. 2 and showing the vehicle supporting and driving mechanism and track system rails in side elevation.

FIG. 4 is an enlarged fragmentary side elevational view of a reentry point of a sidetrack or switch to a main or through portion of the track system.

FIG. 5 is a schematic view illustrating the control system for the vehicle drive, and destination selection of the vehicles of the system.

FIG. 6 is a fragmentary side elevational view of an alternative, high-speed section of the track system.

The transportation system of the invention is designed for high density but selective destination transportation of individuals and small groups of individuals, or relatively small shipments of goods, between plural destinations or stops along a permanently installed supporting and guiding track system. FIG. 1 illustrates a portion of such a track system, indicated generally by the reference numeral 10. The track system includes sections such as 12 for normal rapid movement of vehicles connected to transfer sections indicated generally at 14 and branch sections 16 which may lead to destination points or stops such as that indicated generally by the numeral 18. The destination point or stop 18 is selectively connected to the high-speed travel section 12 by an entry section indicated by the numeral 20 and station exit section 20A. Alternate travel

sections of the rail system are indicated at 22, 24 and 26 with transfer sections 28 and 30 connecting the branches of the system to the rapid transit section 12 and the station 18 as will be evident from the description of the details of the supporting and guiding track structure and the construction of the vehicles associated therewith. The track system can be built, according to requirements, over a wide variety of geographic patterns. It is a characteristic of the system that the cars usually travel in only one direction, and that the track will therefore consist of a number of interconnected loops, not shown.

Vehicles indicated generally at 32 are arranged to be supported and directed by manually or automatically controlled means along a wide variety and selectively predetermined paths to various stations along the track system. No attempt is made herein to illustrate the details of construction of the vehicles other than to show a practical supporting and guiding relationship between the vehicles and the track; but it is contemplated that each vehicle will be relatively small and adapted to hold two to four individuals. The vehicle 32 consists of a suitable framework 34 to which is attached a first supporting system consisting of a front support indicated at 36 and a rear support indicated at 38 with, a second supporting system consisting of a second front support 40 and a second rear support indicated at 42. The rear system of supports 40 and 42 is identical with the front system 36 and 38 so a description of the supports, as shown in greater detail in FIGS. 2 and 3, will be sufficient for an understanding of the operation of the structure.

Extending longitudinally of the vehicle between suitable bearings 44 is a first or inner shaft 46 positioned near the top of the vehicle. Intermediate of its ends the inner shaft 46 is provided with an outer telescoping sleeve 48 that is further supported by additional intermediate bearings 50. Mounted on the projecting ends of the shaft 46 and connected to rotate therewith as by the key 52 is a front short suspension arm 54 which projects upwardly and laterally swingably through a slot 56 in the upper shell or roof 58 of the vehicle. The upper end of the short suspension arm 54 is laterally offset at 60 and supports a lower wheel 62 in a generally vertical plane through the axis of the shaft 46 and the transverse center of the vehicle. The wheel 62 is adapted to be supported in the lower angled flange 64 of a lower rail 66 which will be described in greater detail presently.

The forward end of the sleeve 48 is nonrotatably connected as by a key 68 to a forward long suspension arm 70 that projects upwardly and laterally swingably through a second slot 72 in the shell of the vehicle. The long suspension arm 70 is laterally offset at its upper end as at 74 to rotatably support a front upper suspension wheel 76 so that the upper wheel is adapted to engage and be supported by the lower angled flange 78 of an upper rail 80 of channel-shaped cross section.

Suitably supported from the frame structure 34 of the vehicle as by a plate 82 (See FIG. 3) is a front interior rack bar 84 arranged for transverse movement within suitable guides 86. A link 88 is pivotally connected between the rack bar and the long suspension bar 70 to swing the long suspension bar laterally and downwardly to the dotted line position 76B of the wheel 76. A first motor 90 or other driving means mounted on the plate 82 is connected by a suitable driving connection such as the pinion 92 to reciprocate the rack bar 84. It will be appreciated that movement of the rack bar 84 moves the sleeve 48 so that both the long suspension arms 70 of the front and rear supporting systems 36 and 38 are moved simultaneously.

A second rack bar 94 transversely slidably guided by suitable guides 96 (see FIG. 3) is connected by a link 98 to the short suspension arm 54. A second motor or other driving means 100 is connected as by the pinion 102 to the rack bar 94 and to the keyed connection 52 between the short suspension bars and the shaft 46, the lower suspension wheels 62 at the front and rear of the vehicle swing simultaneously as will be appreciated.

The channel-shaped rails **80** and **66** of the track section are each wide enough so that the wheels **62** and **76** may be swung laterally outwardly from within the channel section of the rails. At the first transfer section **14** which is shown in side elevation in FIG. **3** the lower flange **78** of the upper rail **80** is positioned in abutting or closely spaced relation to the upper flange **104** of the lower rail **66** but the upper rail curves longitudinally upwardly away from the lower rail **66** as at **106**. The relative lengths of the short suspension arms **54** and long suspension arms **70** are such that the lower wheel **62** will support the vehicle with the upper wheel **76** spaced above the lower flange **78** of the upper rail and opposite the open side of the channel-shaped upper rail. When the vehicle moves forwardly to the right as shown in the drawings, the upward curve **106** of the upper rail picks up the upper wheel **76** and raises the vehicle until the lower wheel **62** is vertically clear of the angled lower flange **64**, and the vehicle is supported on the long interior suspension bars **70**. After the vehicle and the wheel **76** are supported from the upper rail **80**, the rail is curved transversely and concavely relative to the open sides of the rails as at **108** into the branch section **16** of track system. Once the lower wheels **62** are clear of the lower rail, the motor **100** can be energized to swing the short suspension arms **54** laterally out of the path of the lower rail **66**.

From the foregoing it will be apparent that the vehicle **32** may approach the transfer section **14** while being supported by the wheels **62** on the lower rail **66**. The longer upper suspension arms **70** may be swung into upright position, by manually or automatically controlled means to be described, to enter and engage the upper rail **80** when it is desired to transfer or switch the vehicle from the lower rail **66** which is part of the high-speed track **12** at this point. If no transfer or switching is desired, the upper suspension arm **70** is merely left in its retracted position indicated at **76B** and the vehicle continues along the main travel section **12** of the track, with the wheel **62** passing in clearing relation under the curved portion **108**.

In order to return the vehicle from the stopping point or station **18** to the main track section **12**, the transfer section **30** provides a lower rail section **110** with an entrance end **112** (see FIG. **4**) spaced below the upper rail **106** of the track in the stop **18**. The upper rail **106**, which at this point is supporting the vehicle by means of the upper wheels **76**, is curved downwardly as at **114** so that the weight of the vehicle is transferred to the lower wheels **62** and the lower rail **110**. Simultaneously the upper wheel **76** is relatively elevated until it clears the lower flange **78** of the upper rail at which time the motor **90** is actuated to retract the long suspension bar **70** to the position **76B** so that the vehicle follows the switch path to the reentry transfer section **20A**. Upper rail **106** may continue into branch section **26**.

The construction of the reentry switch **20A** is similar to but reversed from that shown in FIG. **4**. The car, supported from lower rail **110** first moves under a superimposed rail **116** so that support can be transferred to upper wheel **76**. The rail **116** curves over main rail **12** so that both wheels are in alignment with both rails. Rail **116** then curves downwardly to transfer support to lower rail **12** and wheel **62**, and upper wheel **76** is rocked to laterally displaced position. The car will then continue on lower wheel **62** into branch track **22**. If the lower wheel **62** is not swung up to operative position at transfer **28**, the upper wheel will continue to support the car onto branch track **24**.

Movement of vehicles along the various rails and sections of the track system may be automatically controlled by means of actuating devices positioned along the rails. The actuating devices may be of various types to transmit a signal to the vehicle when a given point in the rail is passed. In the example illustrated the lower rail **66** is provided with mechanical cams or projections **118** (see FIG. **4**) which coact with the actuate sensing switches **120** mounted on one of the short suspension arms **54**. The flange **78** of the upper rail **116** is provided with similar cams or sensing projections **122** which engage and actuate sensing devices such as the switches **124** mounted on one of the long suspension arms **70**. It is apparent that neither position sensing switch **120** or **124** will be operative until the suspension arm on which it is mounted is swung upwardly into operative vehicle supporting position.

The vehicles **32** may be driven along the several switches of the track by any suitable means. In the example illustrated the upper wheels **76** have integral internal electric motors **126** and **128** as shown in the schematic wiring diagram appearing in FIG. **5**. The lower wheels **62** are provided with similar motors **130** and **132**. The motors may be energized from bus or conductor bars **134** and **136** carried in insulated relation along the inner sides of the upper and lower rails **12–66** and **116**. Suitable trolleylike brushes or pickup elements **138** are mounted on the sides of the motors for receiving energy from the bus bars.

With the foregoing physical structure it is feasible and practical to provide a fully automatic, selective destination, system for all vehicles on the track system. The position sensing switches **120** and **124** are wired into a programmer or automatic electric switching apparatus indicated conventionally at **140**, as are the motors **90** and **100** for swingably operating the short suspension arms **54** and the long suspension arms **70**. The motors **126**, **128**, **130** and **132** are also connected into the programmer to be selectively energized in accordance with the positions of the sensing switches **120** and **124** and the requirements of the programmer as determined by a destination indicating device such as a program disc **142** having a preselected varied contour or controlled surface **144** for predetermining the energization of the suspension positioning motors **90** and **100**. The programmer may include braking circuits **146** to the several driving motors and safety circuits **148** extending to sensing devices **150** for sensing various dangerous conditions or signals from safety devices positioned along the track system or on other vehicles. The system may also have a manually or automatically actuated safety switch **152** in the interior of the vehicle for introducing emergency stop signals into the programmer circuit.

With the foregoing structure it is possible and practical for a passenger at one destination or stopping point **18** to purchase a preset program device such as the disc **142** for any other destination in the system and enter the first vacant vehicle **32** at his point of departure. By placing his purchased program disc in the programmer **140** the vehicle can be programmed to advance through various transfer points to the selected destination. The program discs **142** can be designed to automatically return the vehicle to the original, or to a different stopping point. An attendant at a parking yard or section of the system may dispatch vehicles to selected stopping points as demand requires.

In the example illustrated the rails are shown as being suspended by hangers **154** from suitable supports **156** but it is apparent that the rails could be positioned below the vehicles either by providing transversely spaced pairs of rails or means for supporting the vehicles in upright position on a single set of lower rails.

A modification or alternative addition to the track section is shown in FIG. **6** wherein a second rail **158** is superimposed over a section **160** of a lower rail. The upper rail diverges upwardly at **162** from an entrance end **164** to a midsection **166** that is spaced just far enough from the lower rail for both the upper wheels and the lower wheels to be in driving engagement with a rail. Thus, the car A will be driven by two supporting wheels, but car B will be driven by four supporting wheels. The additional driving power may be used for high-speed operation along selected sections **166** of the track system.

The system can be operated as an automatic taxi system, or for unattended delivery and distribution of bulk mail or parcels, throughout a city; and even for intercity transport. While the cars would mainly be owned by the operators of the system, it is entirely possible for some special cars to be leased to or owned by individuals.

It should further be noted that while the greatest flexibility of transfer and switching is obtainable by swinging both the

upper wheels 76 and the lower wheels 62 between operative positions, it is still possible to build an operative system in which only one wheel is movable to inoperative position, where it will clear the fixed rails at the desired transfer points.

What is claimed as new is:

1. A monorail and suspended car transportation system comprising,

a plurality of cars each having a first supporting wheel and a second supporting wheel mounted in superimposed relation and at different elevations relative to said car,

means carried by said car arranged to swing said second wheel laterally between operative car supporting position adjacent said first wheel and a displaced and laterally inclined inoperative position,

an overhead track system having static branch rails that diverge and converge laterally at junction points in the system and which are supported to present one exposed and open side,

first entry portions in said rails at the entry ends of diverging junction points of said system,

said first entry ends being vertically spaced to guidingly support said first wheel while receiving said second wheel in vertically registering but nonsupporting and nonguiding relation to said second wheel when said second wheel is in operative position,

relatively vertically angled portions in said rails at the outgoing ends of said first entry portions arranged to transfer the support and guidance of the car from said first wheel to said second wheel while moving said first wheel to nonguided and laterally disengageable relation to its associated rail,

said rails diverging in lateral directions from the outgoing ends of said angled portions with the rail engageable with said second wheel in clearing relation to the operative position of the first wheel,

second entry portions at the converging junction points of system,

said second entry portions being laterally convergent at different elevations to bring said first wheel into vertically aligned but nonsupporting relation to one of the branches of said rails,

second relatively vertically angled portions in said rails following said second entry portions arranged to transfer the support and guidance of the car from said second wheel to said first wheel while moving said second wheel to nonguided and laterally disengageable relation to its associated rail,

and power means on said car for moving the car along said rails.

2. A rail car transportation system as defined in claim 1 in which both said wheels are swingable laterally between operative and inoperative positions on said car.

3. A rail car transportation system as defined in claim 1 in which said cars have dual sets of said supporting wheels located at the front and rear of the cars.

4. A rail car transportation system as defined in claim 1 in which the means for driving the cars consists of motors drivingly connected to said wheels.

5. A rail car transportation system as defined in claim 1 in which said track system includes sections spaced to support and be drivingly engaged by both of the wheels of the cars at the same time.

6. A rail car transportation system as defined in claim 1 in which said track system has position indicating devices located therealong,

powered means in said cars mechanically connected to shift said wheels between operative and inoperative positions,

electrical switching apparatus in said cars connected to actuate said powered means in different preselected sequence,

and sensing apparatus carried by said cars to be actuated by said indicating devices, and connected to advance said switching mechanism in response to passage of said sensing apparatus over said indicating devices.

7. A monorail transportation system as defined in claim 1 in which the difference between the elevations of the centers of the wheels is at least equal to the sum of the radii of the wheels plus the thickness of the wheel supporting portion of the rails.

8. A monorail transportation system as defined in claim 7 in which said first and second wheels are arranged in tandam relation on said car.

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