United States Patent [19]

Hickman

[11] **3,735,710**

[45] **May 29, 1973**

[54] **TRANSPORTATION SYSTEM**

[76] Inventor: **Jack Hickman,** 5766 Fair Oaks Boulevard, Carmichael, Calif. 95608

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[21] Appl. No.: **119,738**

[52] **U.S. Cl.** **104/168,** 104/20, 104/131

[51] **Int. Cl.** **B61b 13/12,** B61b 13/10, B61b 13/04

[58] **Field of Search**.....104/168, 18, 20, 104/138, 131; 198/127 R

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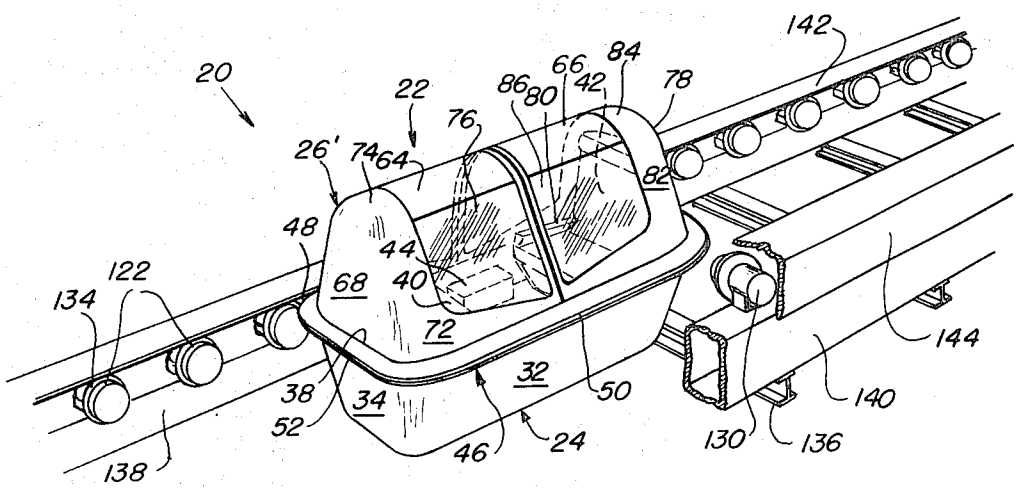
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Primary Examiner—Drayton E. Hoffman
Attorney—Bruce & McCoy

[57] **ABSTRACT**

A transportation system, providing a vehicle having two opposite side walls, each side wall being formed with an outwardly-projecting drive rail, a plurality of electrically-operated rotatable drive wheels being arranged to frictionally engage the undersides of both of the drive rails, for advancement of the vehicle.

15 Claims, 27 Drawing Figures



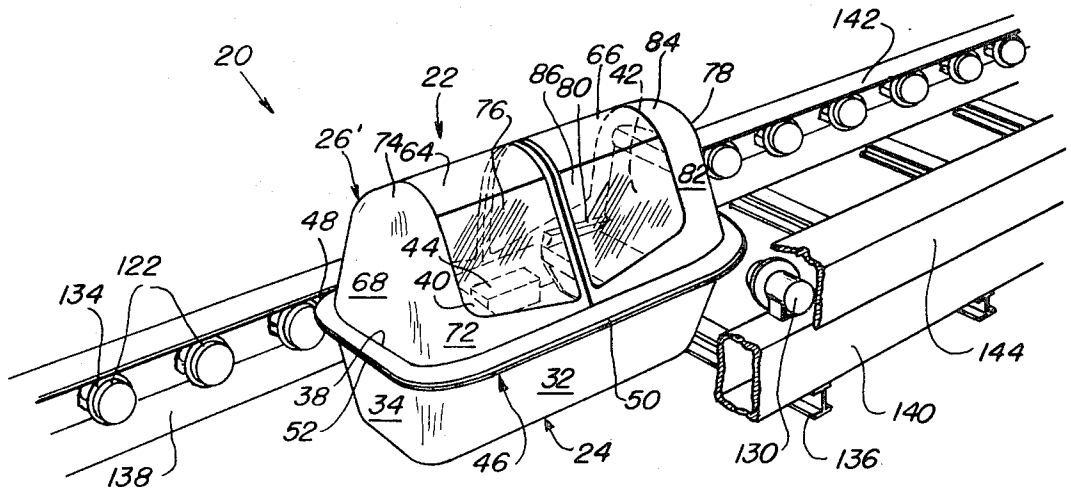


Fig. 1

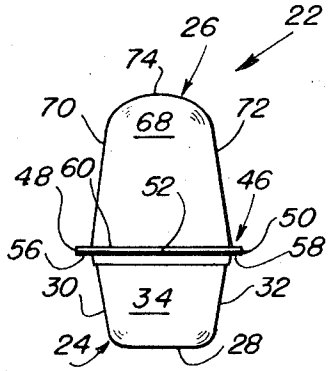


Fig. 2

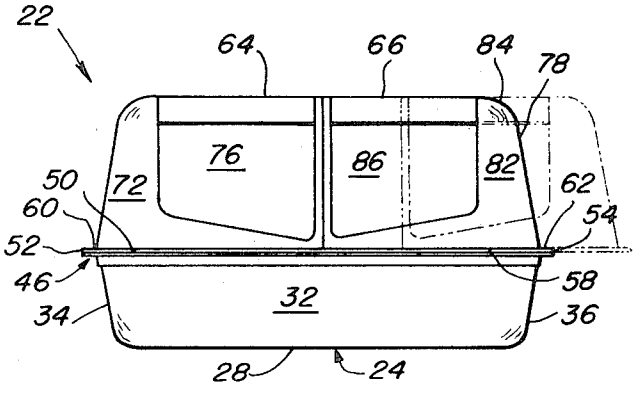


Fig. 3

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BY Bruce & McCoy
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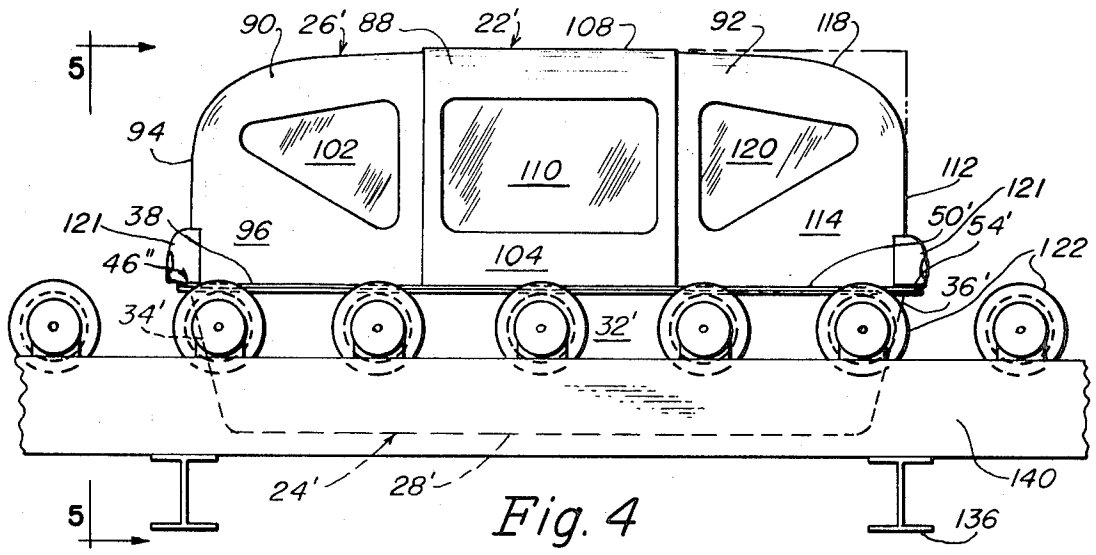


Fig. 4

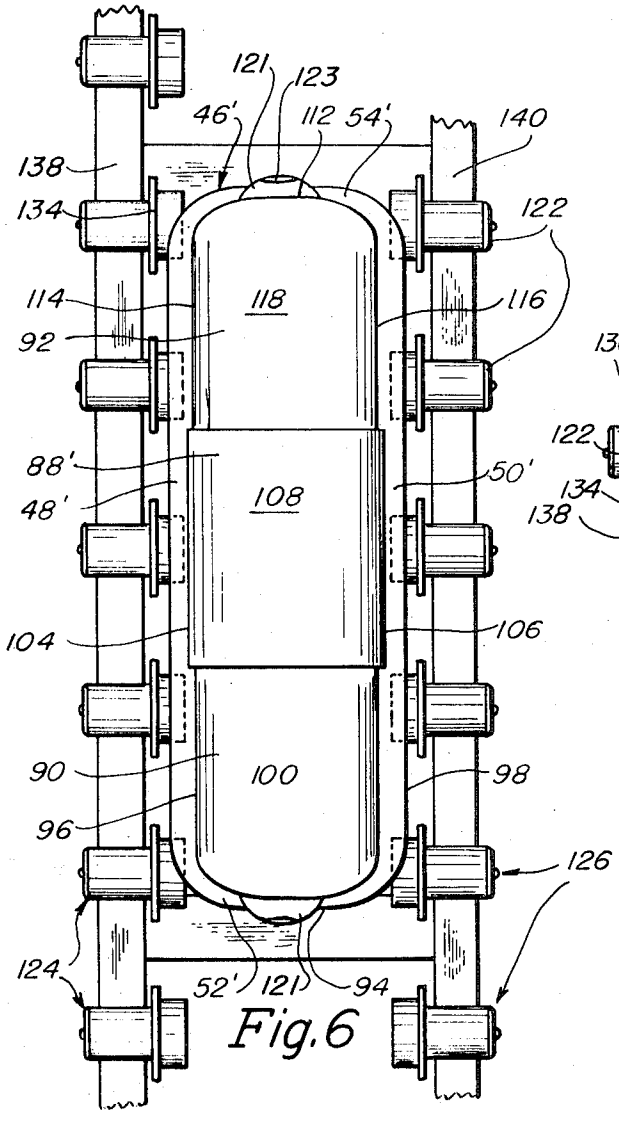


Fig. 6

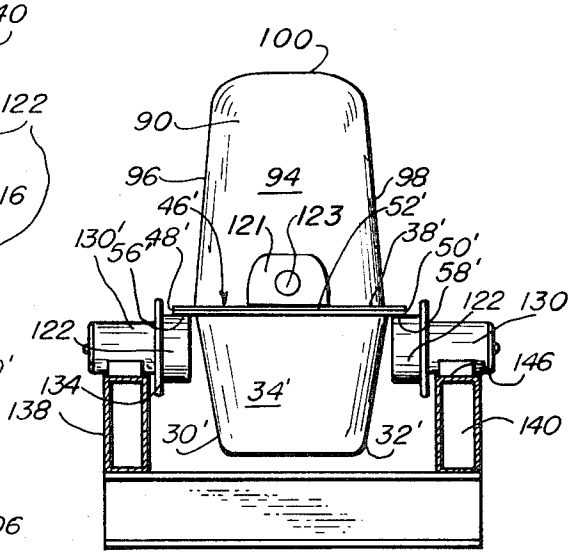


Fig. 5

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BY Bruce & McCoy
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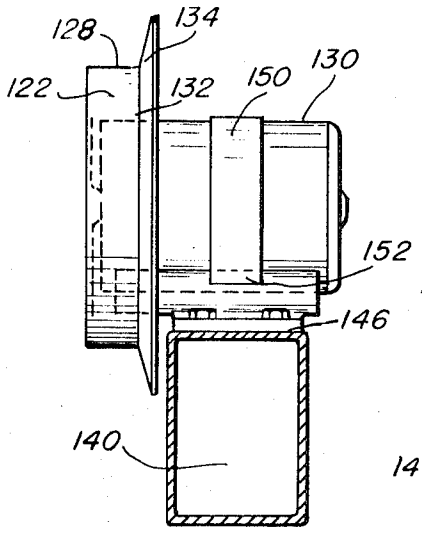


Fig. 7

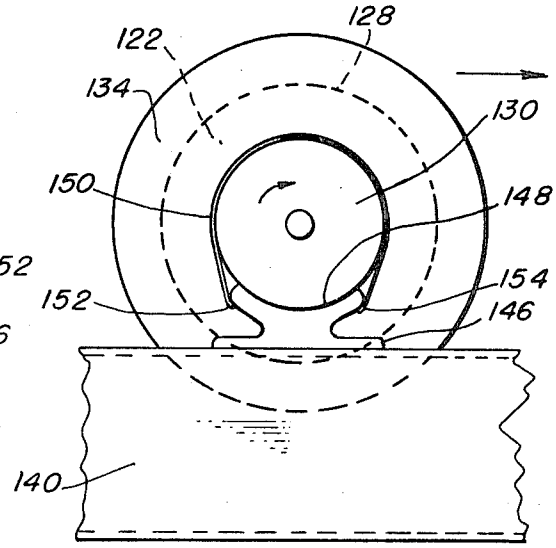


Fig. 8

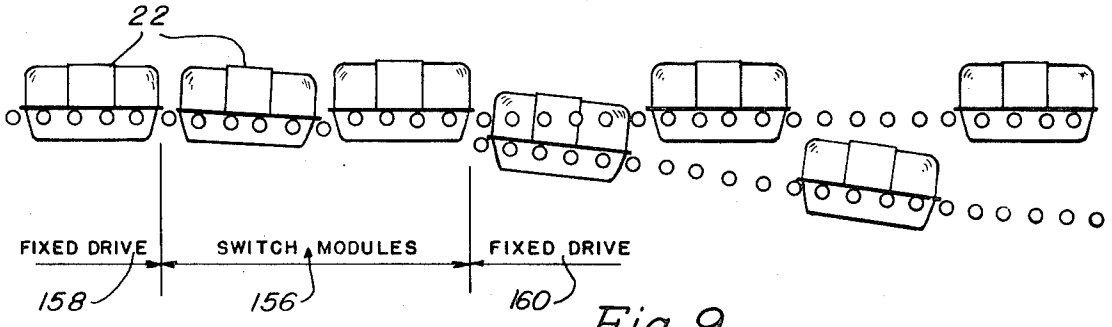


Fig. 9

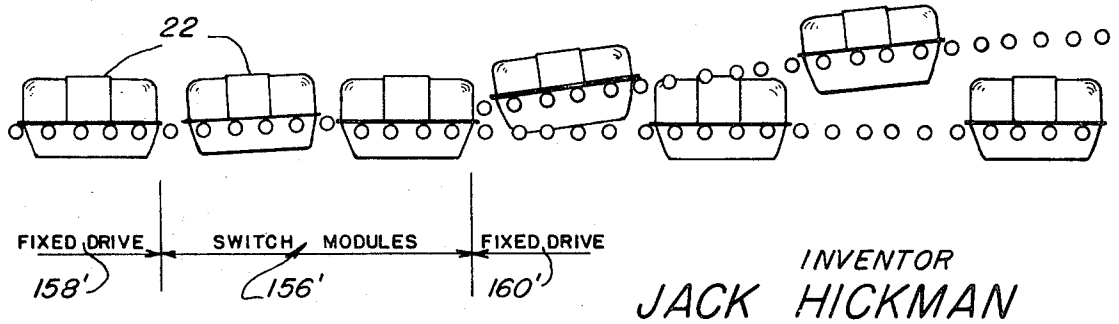


Fig. 10

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JACK HICKMAN
BY Bruce & McCoy
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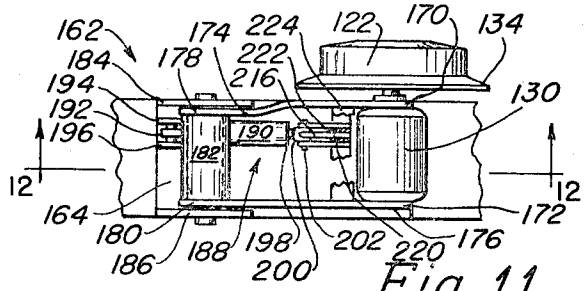


Fig. 11

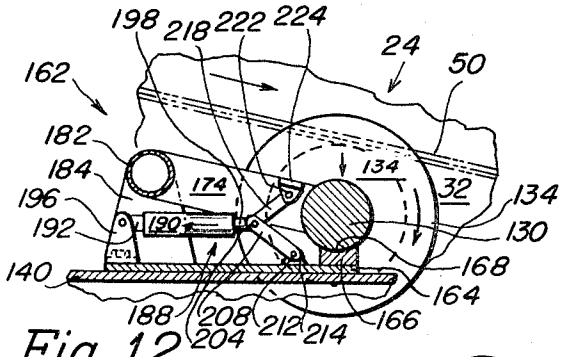


Fig. 12

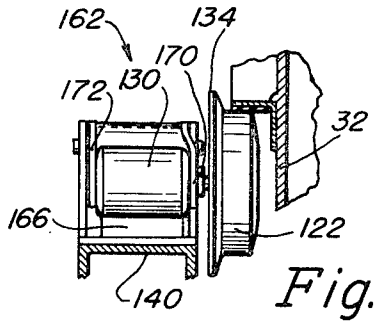


Fig. 13

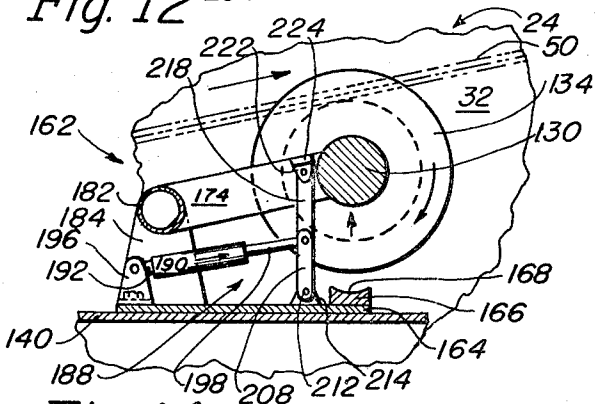


Fig. 14

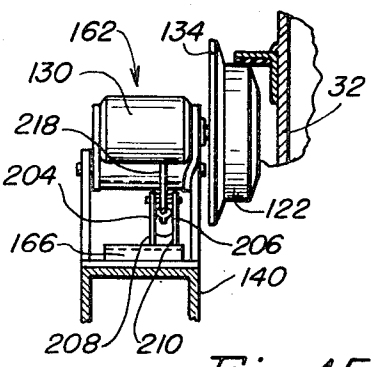


Fig. 15

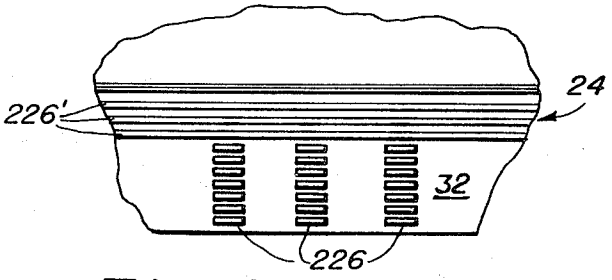


Fig. 16

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JACK HICKMAN
BY Bruce & McCoy
ATTORNEYS

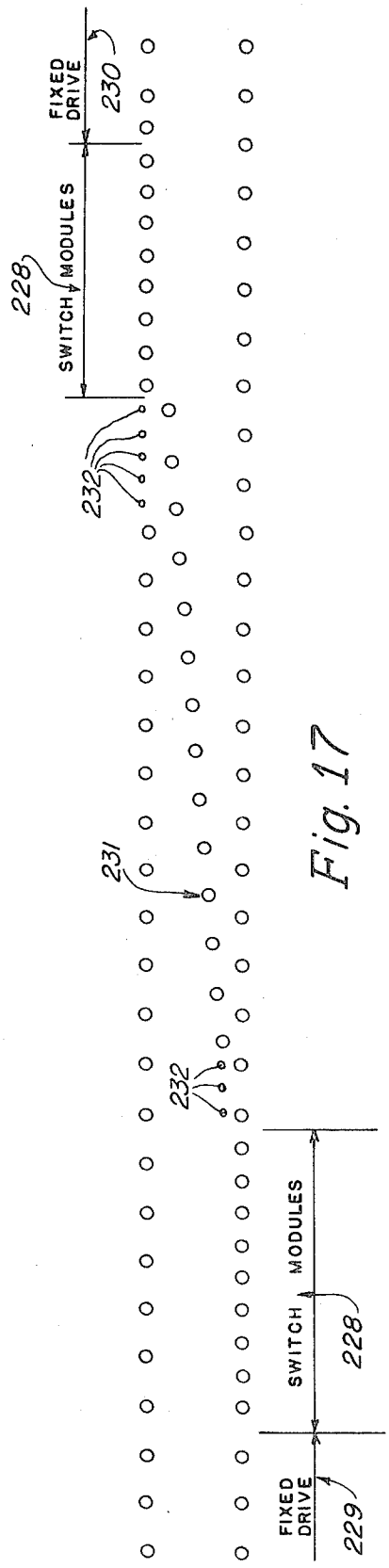


Fig. 17

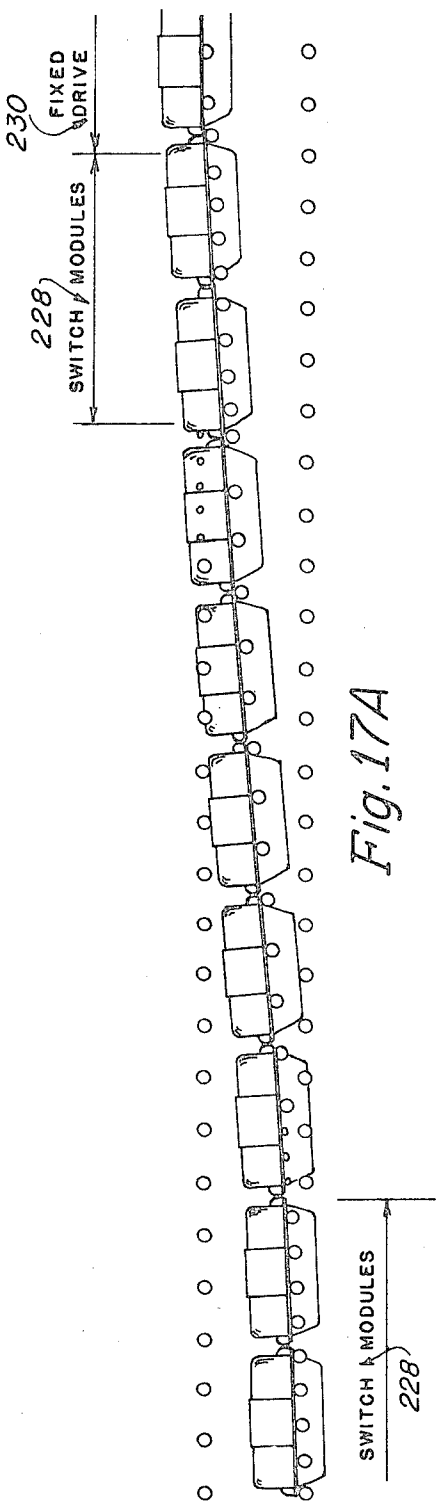


Fig. 17A

INVENTOR
JACK HICKMAN
BY Bruce & McCoy
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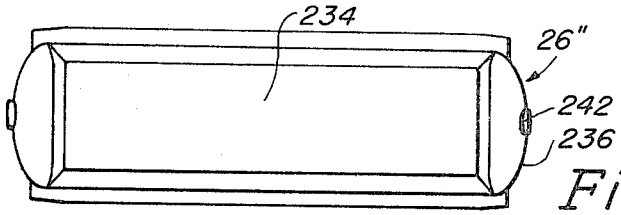


Fig.18A

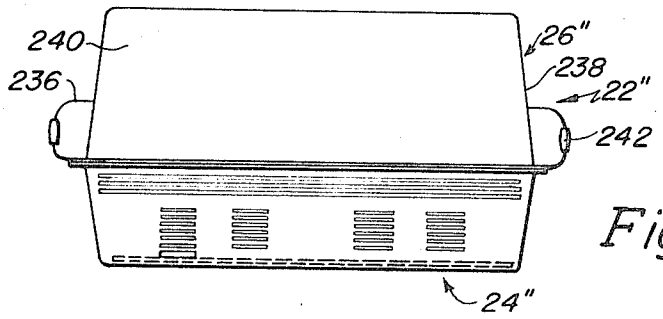


Fig. 18

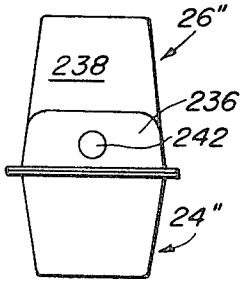


Fig.18B

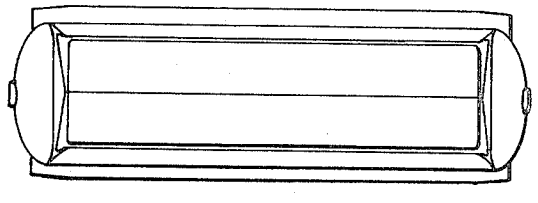


Fig.19A

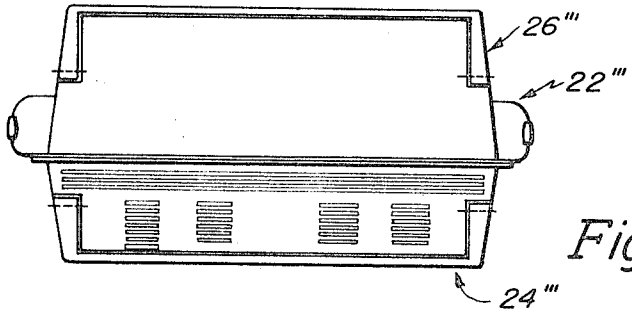


Fig.19

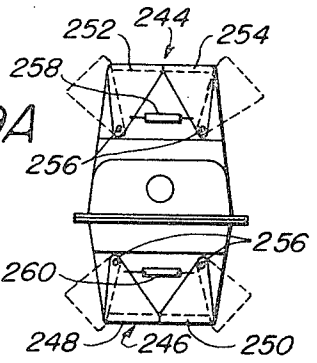


Fig.19B

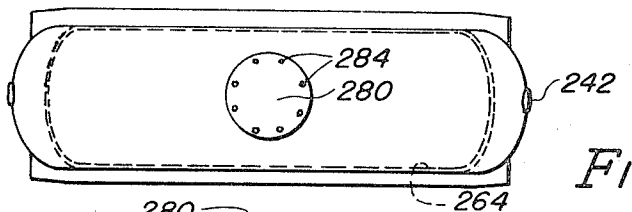


Fig.20A

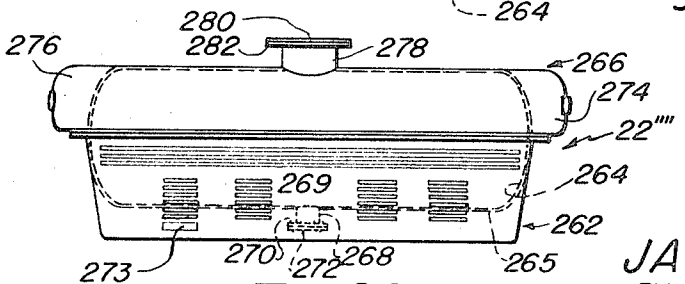


Fig.20

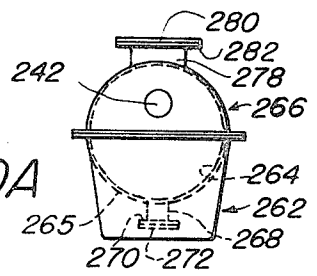


Fig.20B

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JACK HICKMAN
BY Bruce & McCoy
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TRANSPORTATION SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to transportation systems. More specifically, the invention relates to a land transportation system, designed for the movement of either people or freight.

It has been conventional, in the prior art, to utilize land transportation systems, which include vehicles for the transporting of people or freight. Thus, there have been commonly employed for such transportation purposes, the railroad train, utilizing a steam locomotive, or a Diesel locomotive; and traveling along a set of railroad tracks. Also employed for such land transportation purposes has been the motor vehicle, utilizing a gasoline engine, or a Diesel engine; and traveling along a system of highways.

The known land transportation systems have presented numerous disadvantages with respect to their use. Thus, as one such disadvantage, all present systems utilize vehicles carrying on-board propulsion devices which add considerable weight to the vehicles. Furthermore, the vehicles of these systems usually carry wheels, brakes, articulating suspensions, and various other devices for steering or guiding the vehicles. These items are all subject to mechanical failure and all add additional, undesired weight to the vehicle.

Other disadvantages include the fact that present systems usually carry heavy loads (passenger or freight) at relatively infrequent or peak intervals. Supporting roadbeds must be relatively massive as well as expensive to handle these heavy loads. The wheel/roadbed adhesion of vehicles traveling over the present systems vary widely with environment. Therefore, wind, sand, rain, ice, snow or other elements can radically change the adhesion thereby causing accidents or mishaps affecting large numbers of people and vehicles. This may result in the loss of time, the expenditure of large sums of money, and in many cases serious injury or even death. Moreover, the present systems are usually run on very tight schedules which may be easily disrupted or modified by outside circumstances, such as accidents, etc. A passenger missing one of the schedule runs of the present systems, or delayed in transit will materially increase the time required to reach his destination.

As has become more evident in recent years, present systems expose passengers to overcrowding and the possibility of danger or harm from fellow passengers. Such encounters have proved to be critical on occasion and present systems offer no plausible solution to this serious problem.

The known vehicles for land transportation purposes have presented still further disadvantages. Such disadvantages has inhered in the fact that the known vehicles have usually required constant human attention, with resultant inflexibility in respect of both routing and scheduling operations.

Furthermore, the known vehicles for land transportation purposes contribute greatly to the growing problems of air and noise pollution by emissions from the engines driving these vehicles.

The present land transportation systems offer little opportunity for overcoming the above-listed disadvantages. Most proposed changes involve little more than reducing the tolerances in roadbed and wheel dimensions and the elimination of grade crossings with computer scheduling.

SUMMARY OF THE INVENTION

The present invention provides a transportation system, which system employs a vehicle having two opposite side walls, the side walls being formed with two outwardly-projecting drive rails, respectively, each of the drive rails having an underside adapted for frictional engagement by drive wheels for the advancement of the vehicle. The transportation system of the invention also employs a plurality of rotatable drive wheels, adapted, when rotated, to provide frictional engagement of the undersides of both of the drive rails, for advancement of the vehicle. The transportation system of the invention further provides electrically-operated means for rotating the drive wheels.

The transportation system of the present invention, in its employment, serves to overcome the above-discussed disadvantages existing in the prior art, with respect to the known land transportation systems. The transportation system of the invention provides for the land transportation of people or freight without the attendant air and noise pollution problems associated with known land transportation systems. At the same time, the transportation system of the invention is of comparatively low cost with respect to its production, its operation, and its maintenance. In addition, the transportation system of the invention, in its utilization, provides a high degree of safety. Furthermore, the transportation system of the invention is automatically operated and offers the advantage of good flexibility, with respect to both the routing and the scheduling of the vehicles employed.

BRIEF DESCRIPTION OF THE DRAWINGS

The advantages of the present invention will become apparent to one skilled in the art, from the following description, when read in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a portion of a land transportation system, constructed in accordance with the invention;

FIG. 2 is an end-elevational view of a vehicle employed in the transportation system of FIG. 1;

FIG. 3 is a side-elevational view of the vehicle of FIG. 2, one of the sliding door portions thereof being shown, diagrammatically, in an open position;

FIG. 4 is a side-elevational view of a portion of a transportation system constructed in accordance with the invention, being partly broken away and employing a vehicle of modified construction;

FIG. 5 is a cross-sectional view, taken along the lines 5—5 of FIG. 4;

FIG. 6 is a top plan view of the transportation system of FIGS. 4 and 5;

FIG. 7 is an enlarged end-elevational view of a drive wheel and associated motor housing, employed in the transportation system of the invention, a support beam for such drive wheel and housing being shown in cross-section;

FIG. 8 is a side-elevational view of the drive wheel, housing, and support beam of FIG. 7, being partly broken away;

FIG. 9 is a diagrammatic view, illustrating one employment of a switching system wherein adjacent pairs of switches are operable in vertical directions for

switching individual vehicles traveling at moderate rates of speed in converging or diverging directions from one level to another, in the transportation system of the invention;

FIG. 10 is a view similar to FIG. 9, but illustrating another employment of the switching system shown;

FIG. 11 is a top plan view of a switch mechanism employed in the switching system of FIGS. 9 and 10, a support beam therefor being shown, broken away;

FIG. 12 is a cross-sectional view, taken along the lines 12—12 of FIG. 11, a portion of a vehicle in switching position being shown in side elevation;

FIG. 13 is an end-elevational view of the switch mechanism of FIGS. 11 and 12, a portion of the support beam for such mechanism being shown in cross-section, and a portion of the vehicle in switching position also being shown in cross-section;

FIG. 14 is a view similar to FIG. 12, but illustrating a changed position of the switch mechanism;

FIG. 15 is a view similar to FIG. 13, but illustrating the switching mechanism in the position of FIG. 14;

FIG. 16 is an enlarged fragmentary side elevation of a wall portion of a vehicle employed in the transportation system of the invention.;

FIG. 17 is a diagrammatic view illustrating employment of a switching system for high speed trains of ten or more coupled cars, wherein all the switch modules are operated simultaneously as a group to form the high speed switch configuration while the train is some distance away;

FIG. 17A shows the switching system of FIG. 17 with the high speed train being switched;

FIG. 18 is a side view of a vehicle employed in the transportation system for hauling miscellaneous freight;

FIG. 18A is a top view of the vehicle of FIG. 18;

FIG. 18B is an end view of the vehicle of FIG. 18;

FIG. 19 is a side view of a vehicle employed for hauling bulk materials;

FIG. 19A is a top view of the vehicle of FIG. 19;

FIG. 19B is an end view of the vehicle of FIG. 19;

FIG. 20 is a side view of a vehicle employed for hauling liquids;

FIG. 20A is a top view of the vehicle of FIG. 20; and

FIG. 20B is an end view of the vehicle of FIG. 20.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, and particularly to FIG. 1, there is shown a portion of a transportation system 20, designed in accordance with the invention. The system 20 includes a vehicle 22, having a base section 24 and a superstructure 26.

The base section 24 is constructed of a rigid material, such as e.g., a metal, or reinforced fiberglass. The base section 24 provides a bottom wall 28; opposite side walls 30, 32; and opposite end walls 34, 36 (See also FIGS. 2 and 3). The base section 24 is open at the top 38 thereof.

When the vehicle is to be used for freight only the basic shell including the base and superstructure are used. However, when the vehicle is to be used for passengers, two chairs 40, 42, each preferably capable of holding a single passenger, are provided on the bottom wall 28 of the base section 24. Similarly mounted within the base section 24 is a step 44, for use by passengers in entering or exiting the vehicle.

The base section 24 further includes an outwardly-projecting collar or flange 46 mounted thereon. The collar 46 is secured to the base section 24, being preferably constructed of steel; and surrounds the open top 38. The collar 46 provides two oppositely-positioned drive rails 48, 50, which project from the side walls 30, 32, respectively. The collar 46 further provides a pair of guard rails 52, 54, which project from the end walls 34, 36, respectively.

The drive rails 48, 50 are each in the form of a flat plate, being of the same predetermined size. The drive rails 48, 50 lie in a common plane, which extends substantially parallel to the bottom wall 28 of the base section 24. Each of the drive rails 48, 50 extends for substantially the full length of the base section 24.

If desired, a covering, formed of plasticized rubber, is secured by means of a conventional adhesive, to each of the respective undersides 56, 58 of the drive rails 48, 50.

The superstructure 26 is formed of two portions 64, 66. In the preferred embodiment shown, the portion 64 is made fixed and the portion 66 mounted relatively slidable thereto. The fixed portion 64 is secured to the base section 24, in conventional manner, for the closure of the open top 38, adjacent the end wall 34. The slidable portion 66 of the superstructure 26 is mounted on the base section 24, in conventional manner, for sliding movement between the position thereof shown in FIG. 1; and the position thereof shown diagrammatically in FIG. 3. The fixed portion 64 is constructed of an end wall 68; opposite side wall portions 70, 72; and a top wall portion 74. Secured in conventional manner to the wall portion 70, 72 and 74 is a window 76. The slidable portion 66 similarly provides an end wall 78; opposite side wall portions 80 and 82; a top wall portion 84; and a window 86.

The vehicle employed in the system of the invention may be of modified structure. Thus, for example, a vehicle 22', capable of carrying several passengers may be employed (see FIG. 4). The vehicle 22' is constructed of a base section 24', being of comparatively great length; and a comparatively long superstructure 26'.

The base section 24' is formed of a bottom wall 28'; opposite side walls 30' and 32'; and opposite end walls 34', 36'. (See FIG. 5.) The base section 24' is open at the top 38' thereof. Integral with the base section 24' is a collar 46', providing two oppositely-positioned guide rails 48', 50'; and two oppositely-positioned guard rails 52', 54'. (See also FIG. 6.) The width of the collar 46' is equal to the width of the collar 46.

The superstructure 26' is formed of a centrally located portion 88, which is slidably mounted on the base section 24'; a rearward end portion 90, fixedly secured to the base section 24'; and a forward end portion 92, fixedly secured to the base section 24'.

The end portion 90 is formed of an end wall 94; opposite side walls 96, 98; and a top wall 100. The side walls 96, 98 are provided with two windows 102 (one being seen), respectively.

The central portion 88 is formed of opposite side walls 104, 106; and a top wall 108 which are capable of riding over the end portions. The side walls 104, 106 are provided with two windows 110 (one being seen), respectively.

The end portion 92 is formed of an end wall 112; opposite side walls 114, 116; and a top wall 118. The side

walls 114, 116 are provided with two windows 120 (one being seen), respectively.

The base section 24' may be further provided with a bumper or cushioning means 121 at either or both ends thereof to protect the vehicle 22' if it comes into contact with a further vehicle or an obstruction. Coupling means, as for example, magnetic couplers 123 may be provided within the bumper means. This coupling means allows a plurality of cars to be attached together for transportation of large quantities of cars, goods or people at high speeds and is especially useful for carrying same between distant points.

The transportation system 20 provides means for the automatic advancement of a vehicle or a plurality of vehicles. Such advancement means include a plurality of rotatable drive wheels 122. As seen most clearly in FIG. 6, the drive wheels 122 are arranged in two parallel series 124, 126. The arrangement of the two series 124, 126 is such that a succession of pairs of drive wheels 122, having substantially coaxial positions, is provided. The drive wheels 122 of each such pair are spaced apart a sufficient distance for the reception therebetween of the vehicle 22, or the vehicle 22'; and for the engagement, respectively of the undersides 56, 58 of the drive rails 48, 50; or of the undersides 56', 58' of the drive rails 48', 50'. The pairs of drive wheels 122 are so spaced apart, that a plurality of drive wheels 122 simultaneously engage each of the drive rails undersides 56, 58; or drive rails undersides 56', 58'. Thus, in the embodiments shown, such simultaneous engagement by four drive wheels 122 is provided for the vehicle 22; and such simultaneous engagement by five drive wheels 122 is provided for the vehicle 22'.

Each of the drive wheels 122 is of cylindrical form (see also FIG. 7 and FIG. 8). Each drive wheel 122 is constructed of a comparatively rigid material, such as, e.g., cast iron or steel. If deemed necessary, the circumferential surface 128 thereof, may be provided with a covering of plasticized rubber.

An electric motor (not shown), being of synchronous type, and being mounted in a cylindrical housing 130, is provided for the rotation of each of the drive wheels 122. A suitable control system (not shown) is provided, for the automatic operation of such motors.

Mounted on each of the drive wheels 122, and at the rearward face 132 thereof, is a guide member 134. Each of the guide members 134 is in the form of a vertically extending circular plate or flange.

The two guide members 134 associated with each pair of oppositely-positioned drive wheels 122 are positioned apart a distance slightly greater than the width of the collar 46, or the collar 46'.

The transportation system 20 includes means for support of the two parallel series 124, 126 of drive wheels 122 in respective positions of elevation from the ground. Such support means include a plurality of transversely-extending I-beams 136. Mounted on the I-beams 136 are two sets of longitudinally-extending support girders 138, 140. Mounted in conventional manner on the two sets of support girders 138, 140 are two sets of longitudinally-extending shield members 142, 144.

Each of the motor housings 130 is supported on a mounting member 146, providing a curved support surface 148, and being bolted to one of the support girders 138, 140. A collar 150, mounted on each housing 130, serves, at the opposite end portions 152, 154 thereof, to secure the housing 130 to respectively associated mounting member 146. Each of the shield members 142, 144 serves to shield a plurality of the motor housings 130.

The transportation system 20 includes a switching station 156 (see FIG. 9). At the switching station 156, the vehicle 22, or the vehicle 22', can be automatically directed from a fixed drive area of a particular level 158, to a fixed drive area 160, for transfer to a lower level. A similar switching station 156' is provided (see FIG. 10), for direction from a fixed drive area 158', to a fixed drive area 160', for transfer to a higher level.

The switching stations 156 or 156' are especially useful for switching single vehicles traveling at moderate rates of speed in converging or diverging directions from one level to another.

A plurality of switch modules operable as pairs in a vertical direction, such as the switch module 162 illustrated in FIGS. 11–15, may be employed. The switch module 162 provides a mounting plate 164, which is bolted to a girder 140; and a support pad 166, secured in conventional manner to the mounting plate 164. The top surface 168 of the support pad 166 is provided with a concave curvature. The pad 166 is designed, at the top surface 168, to support one of the motor housings 130, and in the manner shown in FIG. 12.

The motor housing 130, at the module 162, is supported between the respective inner end portions 170, 172 of a pair of positioning levers 174, 176. The respective outer end portions 178, 180 of the levers 174, 176 are secured to a cylinder 182. The cylinder 182 is pivotably mounted on a pair of vertically-extending support plates 184, 186, which are secured to the mounting plate 164.

The angular position of the levers 174, 176 is adjusted, by means of an adjustment mechanism 188. The mechanism 188 includes a hydraulically, or pneumatically, operated control cylinder 190. The cylinder 190 is pivotably mounted at the outer end 192 thereof, between two support plates 194, 196, secured to the mounting plate 164. In its operation, the control cylinder 190 serves to reciprocate a rod 198 which at its outer end supports a mounting element 200 of U-shaped cross-section. The element 200 bears a pivot pin 202.

Pivotably secured to the pivot pin 202 are the respective inner ends 204, 206 of two positioning bars 208, 210. The bars 208, 210, at their respective outer ends 212 (one being seen), are pivotably mounted on a support member 214, secured to the mounting plate 164, adjacent the support pad 166.

Also pivotably secured to the pivot pin 202, and intermediate the bars 208, 210 is the inner end 216 of a positioning bar 218. The bar 218, at its outer end 220, is pivotably secured to a support member 222, mounted on a connector bar 224, which inter-connects the levers 174, 176.

The control cylinder 190, in the operation thereof, serves to reciprocate the rod 198, for consequent movement of the bars 208, 120, and 218, to move the levers 174, 176, as between the two vertical position thereof shown in FIGS. 12 and 14, respectively. The associated motor housing 130 is consequently raised or lowered, for adjustment of the level of the associated drive wheel 122 to thereby allow a car to be switched. Electronic devices (not shown) preclude interference

between approaching vehicles coming in either direction.

Referring to FIG. **16**, there are shown a plurality of brush strips **226**, which are mounted on the side wall **32** of the base section **24** of the vehicle **22**. These brush strips may be of different lengths and are preferably arranged as shown, i.e., the top three strips **226'** are solid and arranged so as to extend the entire length of the car and may, if considered to be suitable, extend the full length on both sides of the base section. The lower strips, as shown, are preferably broken and may also be placed on both sides of the base section. The brush strips may be made from brass or copper for receiving electrical signals as part of the control system employed for the operation of the vehicle **22**. Or, these strips may be fabricated from light strips for utilization with photoelectric devices.

In the operation of the transportation system **20** for advancement of the vehicle **22**, the latter is supported, at each of the drive rails **48, 50** by four drive wheels **122**. When the control system is put into operation to rotate the drive wheels **122**, the vehicle **22** is caused to advance. The vehicle **22** is thus advanced along the course defined by the two parallel series **124, 126** of the drive wheels **122**. At the same time, the guide members **134**, by contacting the outermost edges of the guide rails **48, 50** serve to maintain the vehicle **22** centered on such course.

When the vehicle **22** reaches a switching station **156**, or a switching station **156'**, the associated switch modules **162** may be automatically operated, preferably in pairs, for transferral of the vehicle **22** to an upper or lower vertical level.

Referring now to FIGS. **17** and **17A**, there is shown in diagrammatic form the employment of a further switching system to be used with high speed trains having a plurality of coupled cars **22**, preferably ten or more. As shown, all switch modules in switching station **228** are operated simultaneously as a group to form the high speed switch configuration while the train is some distance away.

At the switching station **228**, the train of ten or more vehicles **22**, held together by magnetic couplings, is automatically directed from a fixed drive level **229** to a further fixed drive area or level **230**.

A plurality of separate switch modules, such as the switch modules **162**, are combined into the switching station **228**, whereby all of the modules **162** are operated simultaneously, as a group, to switch the train of cars **22** onto a connecting spur **231**.

In order that a high speed train traveling in either direction along the fixed drive areas **229** and **230** may continue along the drive level or be switched, the connecting spur **231** is provided, at one end thereof, with a plurality of reduced diameter drive wheels **232** adjacent one of the fixed drive levels, while the other of the fixed drive levels is provided with a further plurality of reduced diameter drive wheels **232** after the switching station located thereon. In the preferred embodiment shown in FIGS. **17** and **17A**, the reduced diameter drive wheels **232** are provided at the end of the spur adjacent the fixed drive level **229** to allow clearance for a train continuing along the level **229** and to insure smooth transition of a train when switched. The upper fixed drive level **230** is provided with a further plurality of reduced diameter drive wheels **232** after the switching station **228** to insure passage of a train along the level **230** or a smooth transition to or from the spur **231**.

FIGS. **18, 18A** and **18B** show a preferred embodiment of a vehicle **22''** for hauling miscellaneous freight. The vehicle **22''** is constructed of a base section **24''**, and a superstructure **26''**. The base section **24''** is similar in construction with the base section **24** and **24'** of the vehicles **22** and **22'**, while the superstructure **26''** differs slightly from the superstructure **26** and **26'**, and is preferably of one piece construction having a recessed top **234** having bumpers **236** extending across the ends **238, 240** thereof. The bumpers are provided with coupling means, such as the magnetic couplings **242** shown, for attachment to further vehicles.

FIGS. **19, 19A** and **19B** show a vehicle **22'''** which is a further modification of the vehicle of FIG. **18**, employed for hauling bulk materials. The base section **24'''** and the superstructure **26'''** are similar to the base section and superstructure shown in FIGS. **18, 18A** and **18B**, except that the top of the superstructure **26'''** and the bottom of the base section **24'''** are provided with a pair of hopper doors **244, 246** for loading and unloading bulk materials. As shown more clearly in FIG. **19B**, each of the separate doors **248, 250, 252, 254** is rotatably attached to its respective section by hinge pins **256**. Each of the pair of hopper doors **244, 246** is separately operable by means of separate hydraulic cylinders **258, 260** attached thereto. When operated, by any suitable means (not shown), the hydraulic cylinders **258, 260** swing the doors **248, 250, 252, 254** to the open position shown in phantom line, for loading or unloading the vehicle.

A further modified vehicle **22''''** for hauling gases and liquids, is shown in FIGS. **20, 20A** and **20B**. The vehicle **22''''** is provided with a base section **262** supporting a pressure vessel **264** on a wall **265** secured therein. A superstructure **266** is provided over the top of the pressure vessel **264**. The pressure vessel is provided with bottom and top filling sections with only the bottom section **268** being shown in phantom lines.

The bottom filling section **268** extends through a hole **269** formed in the bottom of the supporting wall **265** and is provided with a flange **270** secured thereto in any suitable manner, such as by welding. The flange **270** has a removable cover plate **272** sealingly attached thereto to prevent the leakage of any gas or liquid held within the pressure vessel.

The base section **262** is preferably formed with an opening in the bottom portion thereof, whereby a hose or other unloading means may be connected to the flange **270** of the pressure vessel for unloading. A ground strip **273** is provided on the base section **262** for safety.

The superstructure **266** is provided with integral bumper means **274, 276** formed at both ends thereof. Each of the bumpers holds a magnetic coupling means **242** for connection to a further vehicle. A circular flanged portion **278** is secured to the superstructure **266** and surrounds the top filling section (not shown) to enable the pressure vessel to be filled with a gas or liquid. A cover plate **280** is removably secured to a flange **282** secured to the circular portion **278**, by means, for example, of bolts passing through holes **284** formed in the cover plate and flange, to enable the filling part to be sealed.

One of the major advantages of the transportation system of the present invention lies in the fact that the electric propulsion motors employed to advance the vehicles are stationary and do not travel with the vehicles. Furthermore, the wheels, brakes, suspension devices, and guidance system are also stationary and do not travel with the vehicle. This brings about a substantial reduction in the weight and complication of the vehicle thereby minimizing the cost of the vehicle and reducing the energy required to drive the vehicle.

The small size, light weight, and high travel frequency of the vehicles of the present invention provide the same total (gross) capacity as existing systems and accomplishes the same task with much lighter roadbeds, bridges, and other related structures.

The instant arrangement of stationary drive wheels, coacting with drive rails secured to the vehicle of the invention offers maximum protection from adverse environmental conditions. With this arrangement adhesion coefficients will remain uniform during adverse conditions.

The system of the invention will transport small numbers of passengers at frequent intervals. The vehicles may be dispatched automatically as space becomes available and there are no schedules to miss. Travel time between two stations should be predictably constant regardless of load density conditions. Furthermore, passengers may have a private car and uninvited encounters with other passengers in transit will not occur.

The system of the invention emits no pollutants, is extremely quiet and offers unlimited opportunities for expansion and development into fully automated freight and passenger distribution systems. Freight may be moved automatically at off-peak hours for a substantial reduction of urban truck traffic and vehicles of the invention are readily adapted for container type distribution systems. The vehicles of the invention could be used as containers, for instant and automatic distribution, while thefts in transit will be thwarted by automatic control of the system. The comfort, safety, and economics of the passenger are more assured by utilization of the present invention than by any known form of land transportation. Furthermore, the opportunity to further increase this assurance is present. The system can be easily installed so as to operate above or below ground at less cost, greater capacity, and more convenience than any known system.

Although the invention has been described with respect to a particular embodiment thereof, it will be understood that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. A transportation system comprising

a vehicle having two opposite side walls, each of said side walls being formed with outwardly-projecting drive rails disposed longitudinally at the same elevation thereon and having a pair of parallel flat lower surfaces, each of said drive rails having an underside adapted for frictional engagement by drive wheels for the support and advancement of said vehicle,

a plurality of rotatable drive wheels aligned in a pair of rows close enough spaced so that at least a plurality of drive wheels are always in contact with the drive rails of said vehicle to form a track, said wheels adapted to provide frictional and supporting engagement of the undersides of both of said drive rails, for advancement of said vehicle when rotated, said drive wheels including flanges at the rear or outermost edges thereof forming a plurality of guide members adapted to engage and contain the outermost edges of said drive rails if a vehicle moves from the center of the track, and

electrically-operated means for rotating said drive wheels.

2. A transportation system in accordance with claim 1, said vehicle being of a base section and a superstructure, said drive rails being substantially horizontal and coplanar and secured to said base section and extending substantially the full length thereof.

3. A transportation system in accordance with claim 2, said base section comprising a bottom and a fixed side portion, said bottom portion being removable from fixed side portion, said removable bottom portion serving as a pallet for transfer of freight to and from the fixed portion, said removable bottom portion becoming an integral part of the fixed portion when the vehicle is in transit.

4. A transportation system in accordance with claim 2, wherein the bottom portion of said base section and the top portion of said superstructure are equipped with power operated doors for loading and discharge of bulk materials.

5. A transportation system in accordance with claim 2, wherein said base section includes a pressure vessel.

6. A transportation system in accordance with claim 2, a portion of said superstructure being movable with respect to said base section, said movable portion serving as a door for said vehicle.

7. A transportation system in accordance with claim 6, said base section being equipped with at least one seat for a passenger and a step to assist in entering or leaving the vehicle.

8. A transportation system in accordance with claim 1, a series of pairs of said drive wheels being provided, the drive wheels of each pair having substantially coaxial positions.

9. A transportation system in accordance with claim 1, said rotating means including a synchronously operated drive motor for each drive wheel.

10. A transportation system in accordance with claim 1, switch means being provided for transferring said vehicle from a fixed drive area of a particular vertical elevation to a fixed drive area of a different vertical elevation.

11. The transportation system of claim 10 wherein said switch means includes a further plurality of rotatable drive wheels disposed in a similar track relationship but vertically disposed with respect to said previous plurality of drive wheels forming a ramped track, and a switch module for raising and lowering one or more drive wheels in synchronous series to advance said vehicle smoothly onto and off of said ramped track.

12. A transportation system in accordance with claim 1, wherein said vehicle includes at least one bumper with a coupling means mounted in said bumper.

13. A transportation system in accordance with claim 1, a plurality of signal strips being cooperative with electrically-operated means for controlling advancement of said vehicle.

14. A transportation system, comprising a vehicle constructed of a base section and a superstructure, a flat, plate-like collar being integral with the uppermost portion of said base section and extending substantially parallel to a bottom wall of said vehicle, said collar providing two laterally-projecting drive rails, the underside of each of said drive rails being provided with a covering adapted for frictional engagement by drive wheels for the advancement of said vehicle, a series of pairs of rotatable drive wheels being provided, the drive wheels of each pair having substantially co-axial positions and being adapted to frictionally engage said drive rail undersides, respectively, a plurality of guide members of circular shape being mounted adjacent said drive wheels, respectively, said guide members being adapted to contact the respective outermost edges of said drive rails for maintenance of said vehicle on a predetermined course, a synchronously-operated drive motor being provided for rotating each of said drive wheels, switch means being provided for change of elevation of said course, a plurality of signal strips being mounted on a side wall portion of said vehicle and being cooperative with electrically-operated means for controlling advancement of said vehicle.

15. A transportation system in accordance with claim 14, wherein at least ten vehicles are coupled together to form a train and said switch means is capable of changing the elevations of the course of said train.

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