United States Patent

[11] **3,568,605**

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[54] **SUSPENDED MONORAIL SYSTEM**
25 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** **104/95,**
105/30, 105/73, 105/153, 105/154, 105/156, 105/329, 105/397, 296/31

[51] **Int. Cl.** **B61b 3/02,**
B61c 13/04, B61d 17/04

[50] **Field of Search** ..... 104/93, 94; 105/146, 147, 148, 149, 150, 155; 296/31 (P); 104/95; 105/30, 73, 154, 153, 156, 329, 397

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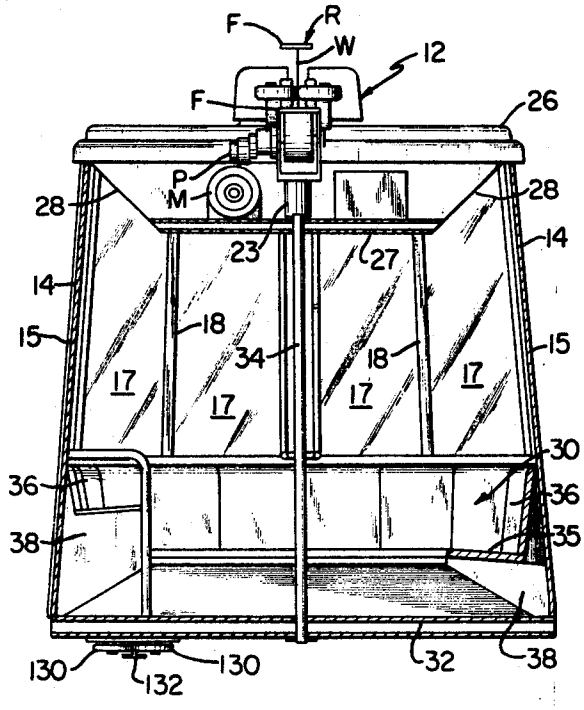
ABSTRACT: In a monorail system a lightweight vehicle is designed for suspension from an overhead rail by drive units extending upwardly from a longitudinal beam which defines the main support for the entire vehicle structure, and the drive units are characterized in particular by having drive wheels pivotally mounted to swing upwardly under running engagement with the rail from a line normal to the running surface of the rail, to increase the urging and pressure of the drive wheel against the running surface.



Patented March 9, 1971 **3,568,605**

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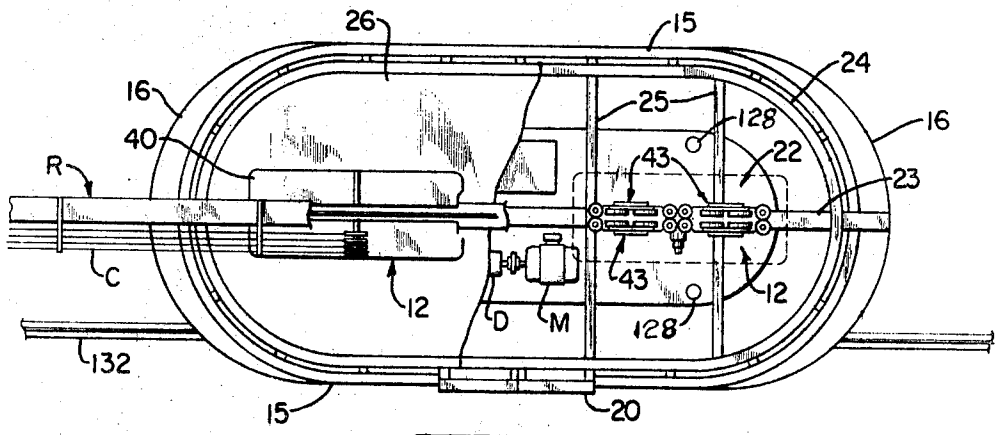

FIG. 1

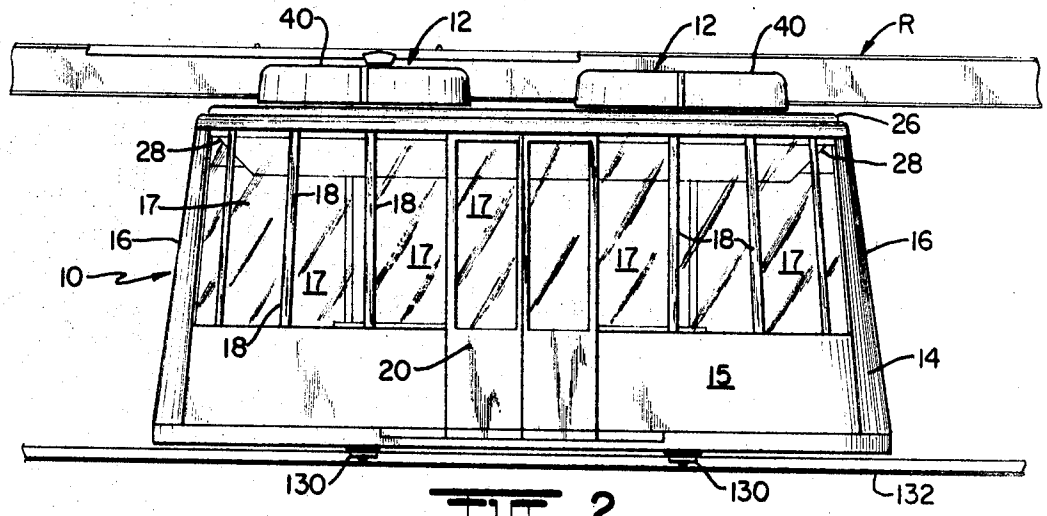

FIG. 2

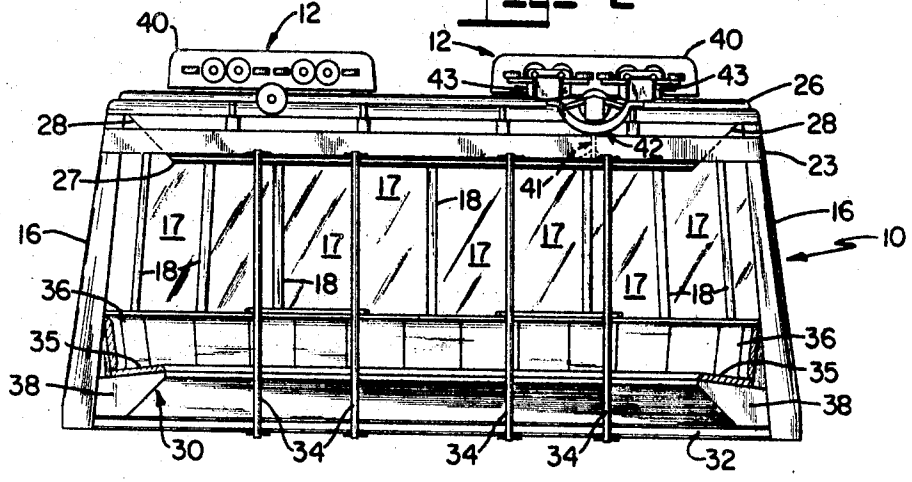

FIG. 3

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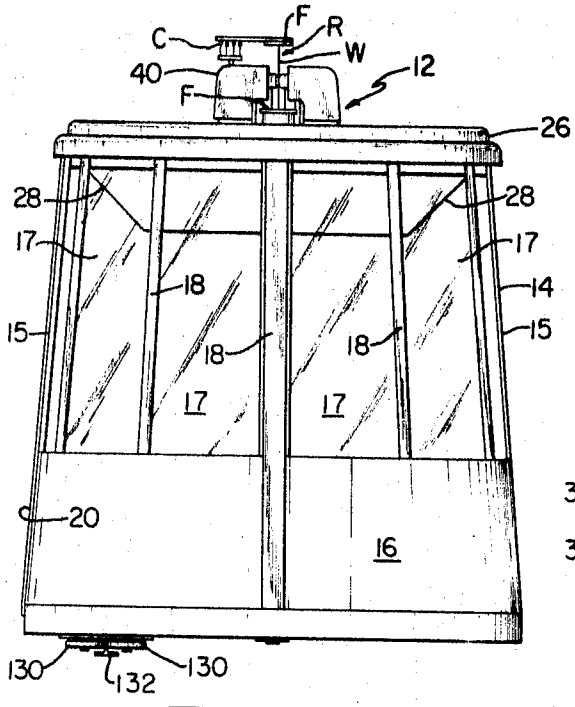

FIG. 4

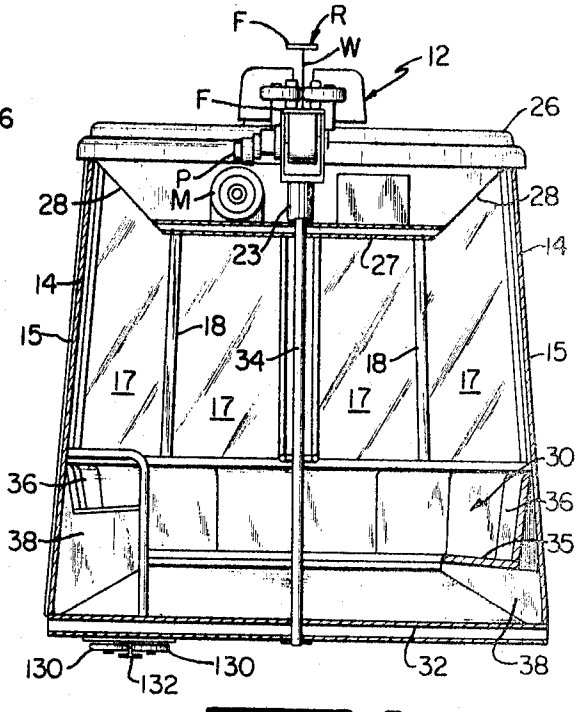

FIG. 5

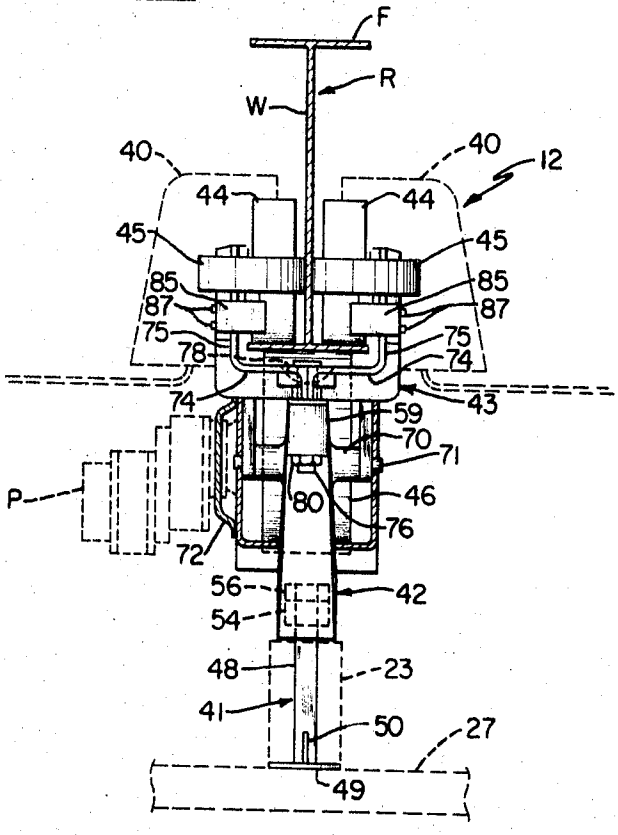

FIG. 8

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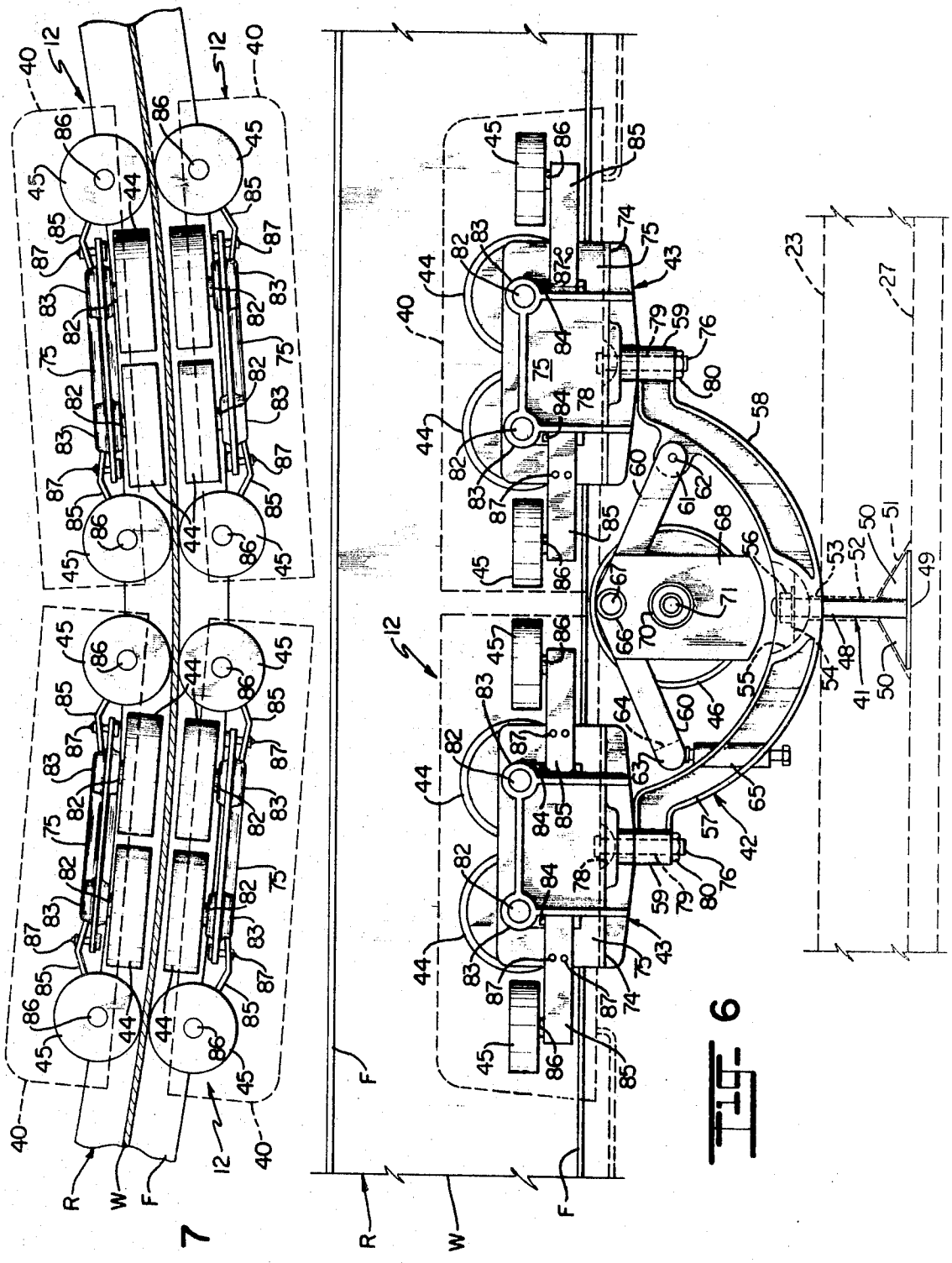

FIG. 7

FIG. 6

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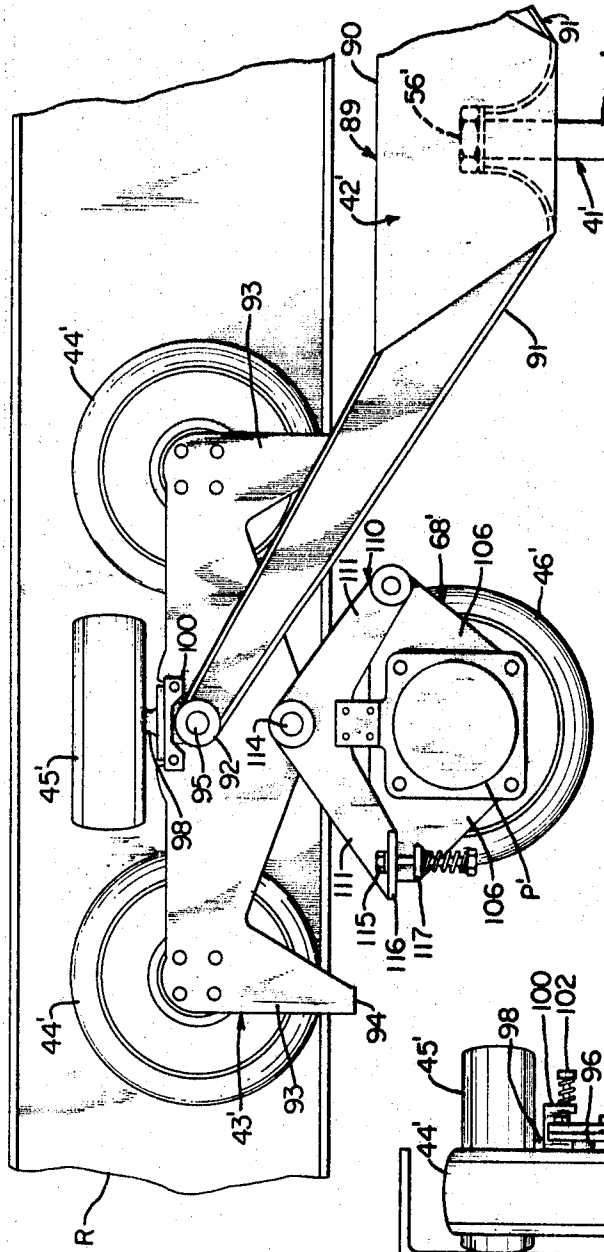

FIG. 9

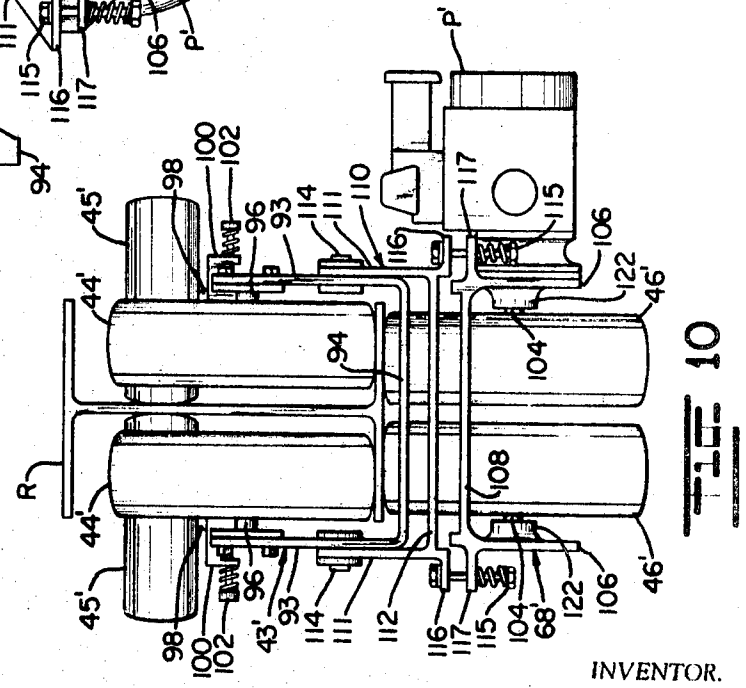

FIG. 10

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SUSPENDED MONORAIL SYSTEM

The present invention relates to novel and improved monorail carrier systems and apparatus, and more particularly relates to a novel and improved vehicle and drive units therefor, the drive units being adaptable to suspend and to drive the vehicle along an overhead monorail.

Various types of monorail systems have been devised for transporting passengers and cargo, but in the past their use and acceptance has been somewhat limited, primarily due to their relatively high cost of construction, maintenance and operation. Customarily, the vehicle is suspended from an overhead rail by means of drive units selectively engageable with the rail, and particular difficulties have been encountered in devising a drive unit capable of reversibly driving the vehicle in a positive, dependable manner while affording maximum stability and comfort at relatively high speeds.

It is therefore an object of the present invention to provide for a novel and improved monorail system of lightweight, sturdy construction being adapted for high speed travel along an overhead rail and which is capable of transporting relatively heavy loads of cargo or passengers at high rates of speed safely and economically with maximum comfort and stability.

It is another object of the present invention to provide for a novel and improved means of suspension of a lightweight monorail vehicle from an overhead rail together with improved forms of drive units capable of maintaining a constant positive drive over extended track lengths notwithstanding variations in conditions on the track or changes in load.

It is a further object of the present invention to provide in a monorail system for a drive assembly capable of driving and advancing relatively heavy loads at high rates of speed with comparatively low power requirements, is further capable of negotiating sharp turns without introducing bending or twisting stresses with complete articulation between the vehicle and drive system as well as between the component parts of the drive system, and in general assures greater flexibility while maintaining firm frictional engagement between the driving members and the running surfaces of the rail.

It is a still further object of the present invention to provide novel and improved forms of drive assemblies for monorail systems in which the drive assemblies may employ either solid or inflatable rubber or rubberlike tire members which will effect maximum frictional engagement with the running surface of the rail together with increased stability and flexibility in negotiating sharp turns or inclines while eliminating the need for flanged wheel assemblies.

In accordance with the present invention, a lightweight monorail vehicle may be constructed almost entirely of fiberglass or other lightweight materials which are combined into a unitary structure and suspended from an overhead rail through a single beam member traversing the upper control section in the vehicle. Overhead drive units extend upwardly from the longitudinal beam member for suspension from an overhead rail with the necessary source of motive power and control for the drive units being housed in the upper control section so as to afford maximum space in the vehicle for passengers or cargo.

Preferred and alternate forms of drive units are characterized by having load wheels which sustain the weight of the vehicle by riding along the upper surfaces of the lower horizontal flange portions of the rail, guide wheels associated with the load wheels and engageable with the vertical section of the rail to minimize lateral displacement of the drive units with respect to the rail, and one or more lower frictional drive wheels being pivotally mounted about an axis above the axis of rotation and directly beneath the undersurface of the lower horizontal flange portion of the rail. The drive wheels are biased upwardly against the undersurface of the rail and when rotatively driven about their axes of rotation are free to be urged by running engagement with the rail from a line normal to the undersurface angularly in an upward direction about their pivotal axes to increase the pressure of the wheels against the undersurface of the rail and afford most positive advancement along the rail. The preferred form of invention is characterized by providing complete articulation between the load wheels, guide wheels and drive wheels where the wheels are composed of solid rubber or rubberlike tires; or in the alternate form of invention inflatable tires may be utilized in place of solid tires to provide an extremely flexible, stable drive while avoiding the need for articulation between different sections of the drive units.

The above and other objects, advantages and features of the present invention will become more readily appreciated and understood from a consideration of preferred and alternate forms of the present invention when taken together with the accompanying drawings, in which:

FIG. 1 is a top plan view with portions broken away to illustrate the interior detail of the upper control section of a monorail vehicle.

FIG. 2 is a side elevational view of the monorail vehicle and track of FIG. 1.

FIG. 3 is a sectional view of the monorail vehicle and track of FIGS. 1 and 2 showing the interior of the drive units and vehicle.

FIG. 4 is an end view of the monorail vehicle.

FIG. 5 is an end view partially in section illustrating the interior of the vehicle as shown in FIG. 4.

FIG. 6 is an enlarged view in detail of a preferred form of drive unit.

FIG. 7 is a top plan view in detail of the preferred form of drive unit shown in FIG. 6.

FIG. 8 is an end view partially in section of the preferred form of drive unit.

FIG. 9 is a fragmentary side view of an alternate form of drive unit; and

FIG. 10 is an end view of the alternate form of drive unit shown in FIG. 9.

Referring to the drawings, there is shown in FIGS. 1 to 5 a monorail system broadly comprised of a passenger vehicle 10 suspended by upper drive units 12 from an overhead track or rail R. Typically the rail may be *I*-shaped or inverted *T*-shaped in cross section to provide a lower horizontal flange F and a vertical web section W extending upwardly from the midsection of the flange. In the preferred form, the vehicle is a passenger car constructed with an outer lightweight fiberglass shell 14 of generally oval-shaped configuration having downwardly divergent sides 15 and curved end sections 16 with plexiglass windows 17 interrupted by vertical moldings 18 and a side door or other closure portion 20.

The shell is suspended from an upper rigid framework 22 consisting of a main support member in the form of a solid longitudinal beam 23, generally rectangular in cross section, which traverses the entire length of the upper section of the vehicle. A generally circular or oval beam 24 circumscribes the upper peripheral edge of the shell, and transverse beams or tie bars 25 interconnect the longitudinal beam 23 and outer beam 24 in order to transmit the load or weight of the vehicle from the outside into the central beam member. The upper section of the vehicle is covered by removable access panels 26 which, together with a lower horizontal panel 27 secured to the underside of the beam 23 and divergent sidewalls 28, forms a hollow interior space, and which space serves as a control section above the rigid framework to house the necessary equipment and accessories for operating the vehicle and drive units in a manner to be described.

As illustrated in FIGS. 3 and 5, seats 30 are built into the lower wall of the shell and rest upon a horizontal floor section 32, and vertical hand rails 34 are mounted for extension between the floor section and upper section of the vehicle. Here the seats 32 have seat and backrest cushions 35 and 36 mounted in wooden frame 38 built into the wall of the shell directly beneath the window sections.

The vehicle is suspended from the rail R by a pair of upper drive units 12 that are disposed in longitudinally spaced relation between opposite ends of the vehicle to uniformly distribute the load, and each drive unit is suitably enclosed within

a streamlined fiberglass fairing 40. Broadly, each drive unit supports the vehicle through a hanger 41 depending downwardly from a yoke 42 for mounting in the longitudinal beam 23. The yoke in turn transmits the load of the vehicle into load brackets 43, each load bracket being operative to support pairs of load wheels 44 on opposite sides of the monorail R to ride along the upper surface of the lower horizontal flange portions. Guide wheels 45 are located fore and aft of each pair of load wheels to yieldingly engage the vertical flange section of the rail, and a lower frictional drive wheel 46 is pivotally mounted about an axis above its axis of rotation and directly beneath the undersurface of the lower horizontal flange so as to urge itself upwardly to increase the pressure of engagement against the flange surface in driving the vehicle in either direction of rotation.

Considering in more detail the construction and arrangement of each of the drive units 12 of the preferred form of invention, the hanger 41 has a rod 48 terminating at its lower end in a circular base plate 49, and upwardly and inwardly inclined flanges 50 on diametrically opposite sides of the rod form conical bearing surfaces disposed within a generally cup-shaped, correspondingly inclined recess 51 in the underside of the beam. The rod extends through a bore 52 communicating with the recess 51 on the beam and upwardly through an aligned bore 53 in the yoke 42. The upper terminal end of the hanger has a bearing member 54 provided with a downwardly facing, hemispherical bearing surface adapted for disposition within a complementary recess 55 within the yoke 42, and a nut and washer assembly 56 serves to retain the bearing 54 on the end of the rod 48. The hanger may be assembled to suspend the vehicle form the drive units by inserting the rod upwardly through the aligned bores 52 and 53 in the beam and yoke members and by positioning the bearing member 54 on the upper end of the rod and tightening the same by means of the nut 56. In assembled relation the drive unit is therefore free to undergo a limited amount of rotation and tilting both with respect to the yoke and to the vehicle.

In the preferred form, the yoke 42 is of generally semicircular or arcuate configuration and has oppositely directed arm portions 57 and 58 curving upwardly from the lower, intermediate bearing portion for the hanger and terminating in horizontally directed end portions having hollow bosses 59 for connection to each of the load brackets 43. The yoke also carries a drive wheel support assembly which is defined by a pair of pivot links 60 mounted in spaced parallel relation on opposite sides of the yoke, each link being formed by an inverted V-shaped arm pivoted at one end 61 to opposite ends of a common pivot shaft 62. The opposite ends 63 of the links 60 are interconnected by an element 64 which rests upon a spring-loaded plunger 65 mounted on one side of the yoke opposite to that of the pivot shaft 62. In this relation the pivot link arms form opposite sides of a common U-shaped member so that the closed end 64 of the member rests against the spring-loaded plunger in the yoke and the free ends are pivotally attached to the pivot shaft on the opposite arm portions 58 of the yoke, the plunger serving primarily as a wear-compensating device for the drive wheel 46. In turn, the midpoint or apex of each pivot link arm 60 is provided with a bore 66 for lateral insertion of a common pivot pin 67, the latter supporting the upper free ends of a generally U-shaped drive wheel support bracket 68. Opposite sides of the bracket 68 may be suitably provided with aligned ball bearing races 70 for journaled support of opposite ends of a drive shaft 71 of the drive wheel 46.

As best seen from FIG. 8, one end of the drive shaft 71 is rotatively engaged by a variable displacement, hydraulic drive motor represented at P which is supported by an attaching plate 72 to one side of the drive bracket in outer spaced relation to the end of the shaft 71. As the driving force is applied to the drive wheel in either direction of rotation the effect will be to urge the drive wheel to swing from a line or reference plane through the axis of the drive shaft 71 and of the pivot pin 67 perpendicular to the running surface of the rail angularly in an upward direction and in the direction of advancement to increase the pressure and resultant traction of the drive wheel against the running surface.

Each of the load brackets 43 is similarly in the form of a U-shaped member having interconnected lower closed end portions 74 extending horizontally in spaced relation beneath the undersurface of the rail and upwardly extending sides 75 in laterally spaced relation to opposite sides of the rail. A bolt member 76 has an upper enlarged bearing portion 78 provided with a downwardly facing, spherical bearing surface which rests in a correspondingly shaped recess formed between the adjoining closed end portions of the bracket 43, the bolt 79 continuing downwardly through the boss 59 with a suitable nut and washer assembly 80 threaded on the lower end of the bolt 76. A pair of load wheels 44 are arranged in longitudinally spaced relation to one another on opposite sides of the vertical section of the rail and each wheel has a stub shaft 82 journaled for rotation in a bearing 83, there being a pair of bearings 83 adjacent to the upper surface in each side 75 of the load bracket 43. In addition, guide wheels 45 are mounted in horizontal spaced relation forwardly and rearwardly of the sides 77 of the load brackets for rolling engagement with the vertical section of the rail. Each guide wheel is mounted by means of a horizontal guide arm 85 of generally arcuate configuration which has its inner end secured by a pin 84 directly beneath one of the bearings 83 on the side of the load bracket, and its outer end is provided with a vertical bore to receive a vertical shaft 86 for the guide wheel. The guide arm is mounted to bias the guide wheel inwardly against the vertical section of the rail, and a spacer bolt 87 interconnects the intermediate portion of each guide arm 85 and the side of the bracket.

As shown in FIGS. 6 to 8, the load wheels 44, the guide wheels 45 and the drive wheels 46 are each formed of a solid or semipneumatic tire which may be suitably composed of a rubber or rubberlike material to provide maximum frictional engagement with the running surfaces of the rail; or, each of the tires may be composed of inner metallic hubs covered with a tread surface composed of a rubber or rubberlike material. In the relationship described, the load wheels are compressed against the horizontal flange portion of the rail by the load of the vehicle with the guide wheels urged into engagement with the vertical section of the rail; and the drive wheels are caused to be urged upwardly against the undersurface of the lower flange portion intermediately between the fore and aft load wheel assemblies of each drive unit. It will be noted that the load wheels, guide wheels and drive wheels are provided with flat or rimless running surfaces and obviate the use of flanged wheels or guide rims to stabilize the drive units on the rail. Furthermore, the drive units are completely articulated both with respect to one another and with respect to the vehicle and further the load wheels fore and aft of each drive wheel are similarly articulated with respect to the yoke and hanger so that each drive unit is free to follow a curved or inclined path of travel independently of the other drive unit while remaining in firm engagement with the rail or track.

A modified form of drive assembly is shown in FIGS. 9 and 10 and comprises the same essential combination of elements as in the preferred form including a yoke 42′ and a downwardly depending hanger 41′. The yoke transmits the load of the vehicle through load brackets 43′ at opposite ends of the yoke, the load brackets supporting pairs of fore and aft load wheels 44′ on opposite sides of the vertical section of the rail; and guide wheels 45′ are mounted on the load bracket intermediately between each pair of load wheels. Further, in the modified form, a pair of drive wheels 46′ are suspended by a support bracket 68′ from each of the load brackets 43′ at opposite ends of the yoke so as to provide a pair of drive wheels working in cooperation with each of the load wheel assemblies, as opposed to the single drive wheel for each drive unit in the preferred form of invention, in order to achieve greater driving and braking power. The modified form of invention is particularly adapted to permit utilization of inflatable tires for

the drive wheels, load wheels and guide wheels so that if a tire should fail the necessary load and driving force can be sustained by the other tires until the vehicle reaches a convenient stopping point for repair. At the same time, use of inflatable tires permits high speed driving with greater deflection and avoids the need for articulated joints between the frame and tires, and will also compensate more for uneveness in the rail or changes in direction.

In the modified form of drive unit the yoke 42' has an intermediate portion 89 in the form of a generally rectangular housing provided with an upwardly convergent hollow receptacle 90 for insertion of the upper end of the hanger rod 48', the latter being suspended from the yoke by a nut and washer assembly 56'. A pair of arm portions 91 each formed of a channel beam member extend upwardly and outwardly in spaced relation to one another from opposite sides of the portion 89, and each pair of arms terminate in free end portions pivotally attached to opposite sides of each load bracket 43'. In turn, each load bracket 43' is defined by a rigid frame, generally U-shaped in cross section having opposite vertical sides 93 interconnected by horizontal closed end portions 94 extending transversely of and in spaced relation beneath the undersurface of the rail. Each end of an arm portion 91 is attached to the midsection of the bracket by extension of a suitable connecting pin 95 through a transverse opening in the end portion 92.

The load wheels 44' are journaled for rotation about a shaft member 96 extending inwardly from the upper front and rear corners on each side of the bracket. In turn a single guide wheel 45' is journaled on a shaft 98 extending upwardly from a supporting block 100 mounted intermediately of the upper edge of each side 93, and the block is biased inwardly by pairs of spring-loaded pin members 102 inserted through the outer edge of the block into engagement with the side of the bracket.

A pair of drive wheels 46' are supported in side-by-side relation beneath each load wheel assembly on a common drive shaft 104 between opposite sides of the drive wheel support bracket 68'. The bracket 68' has downwardly directed triangular sides 106 interconnected by transversely extending webs 108 located at opposite edges of the sides forwardly and rearwardly of the drive wheel. Further, the wheel-supporting bracket 68' is suspended from opposite sides of the upper load bracket by a pivotal bracket 110 having opposite sides 111 of inverted V-shaped configuration interconnected by transversely extending web portions 112. Each of the sides 111 has its apex pivotally secured to one side 93 of the load bracket by a suitable pivot pin 114, a lower end of each side 111 being pivotally attached to an end of the bracket 68' and the opposite lower end being secured to the opposite end of the bracket 68' by a spring-loaded bolt member 115 extending through spaced parallel connecting flanges 116 and 117 on the bracket portions. A variable displacement hydraulic drive motor P' is attached to one side 106 of the bracket 68' to drivingly engage the shaft 104, the latter being supported in bearings 122 in the sides 106 of the bracket, and if desired a mechanical brake, not shown, may be attached to the bracket 68' for engagement with the opposite end of the drive shaft 104 so as to permit emergency braking for sudden stops.

The specific manner and means for mounting each of the drive assemblies fore and aft of the vehicle corresponds to that described and shown in the preferred form of FIGS. 6 to 8 and is therefore not illustrated for the modified form. A particular feature of the modified form of invention is that the U-shaped, oppositely directed bracket members for the load wheels and drive wheels enables use of inflatable tires safely at high speeds, since if one of the load or drive wheel tires should fail the load is automatically transferred by its bracket to the other tire or tires.

In each form of invention, the motor P or P' for the drive assemblies may be energized and controlled in operation by a conventional hydraulic control system mounted in the upper control section, as partially shown in FIG. 1. Thus a source of hydraulic fluid under pressure is represented at S, and a drive pump D is suitably driven by an electric motor M. In a conventional manner, electrical collectors C may be mounted on the top of the bus to generate electricity for the electrical motor M as well as for lights 128 and other electrical accessories in the vehicle.

In the forms of invention set forth herein, the guide wheels will cooperate in resisting lateral displacement of the load wheels. However where it is necessary to negotiate relatively sharp turns or curves at relatively high speeds, additional stability is afforded through the use of guide wheels or rollers 130 projecting downwardly from the vehicle for engagement with a lower guide rail 132. As shown, the guide wheels 130 are journaled on supporting shafts projecting downwardly from attachment to the floor section of the vehicle, and the wheels being disposed to engage the vertical sections of the rail to prevent swaying or tipping of the bus under high speeds of travel. Moreover, the emergency brake may be or may not be employed in either form of drive unit, since the variable displacement motor is self-locking when not energized and the brake may be employed merely as an emergency brake for sudden stops.

The monorail apparatus of the present invention can support relatively heavy passenger or freight loads while traveling at high rates of speed. For the purpose of illustration, the bus as described and shown in the preferred form is designed to accommodate 50 passengers and has an unladen weight of 5,300 lbs. and, for instance, in utilizing a 15 horsepower drive motor, the drive units are capable of attaining speeds on the order of 10 to 12 miles per hour. In this connection, efficiency is greatly increased in each form of invention by utilizing drive wheels which of their own urging will advance or swing upwardly into firm frictional engagement with the undersurface of the monorail equally in either direction of travel. For higher speeds of travel on the order of 70 to 80 miles per hour, a 100 horsepower drive motor may be utilized in association with the inflatable tire drive unit of the modified form. Initial contact between the drive wheels and the rail is established by the wear compensating, spring-loaded plunger elements as described, an additional function of the plungers being to urge the drive wheels against the rails in braking the bus.

From the foregoing, it will be evident that among other features the monorail apparatus of the present invention incorporates a positive reversible drive which is capable of maintaining a constant driving pressure against the running surface of the rail in either direction over extended track lengths notwithstanding variations and conditions on the track, changes in load or tire pressure while being capable of transporting relatively heavy loads at high speeds both safely and economically.

It is therefore to be understood that various modifications and changes may be made in the specific construction and arrangement of elements comprising the preferred and modified forms of drive assemblies either when used in association with the monorail system described or in other monorail systems without departing from the spirit of the present invention.

I claim:

1. Monorail apparatus adapted for suspension from an overhead monorail comprising:

a vehicle having an upper framework extending the substantial length of the upper section of the vehicle; and

at least one drive wheel assembly mounted on said vehicle and engageable with the overhead monorail, each drive wheel assembly including a drive wheel and drive motor therefor, suspension means to suspend said vehicle from the rail for advancement therealong with the drive wheel and drive motor pivotally supported centrally within a space provided between the suspension means and underside of the rail, and means associated with the suspension means biasing said drive wheel into contact with the rail, and a hanger extending upwardly from said framework for connection at its upper end to said suspension means whereby said drive wheel assembly is freely and independently tiltable and rotatable with respect to said vehicle.

2. Monorail apparatus according to claim 1, each hanger defined by an elongated rod and including bearing members at upper and lower ends having bearing surfaces in facing relation to one another, each of the bearing surfaces seated in complementary recesses in said suspension means and said framework, respectively.

3. Monorail apparatus according to claim 1, said upper framework consisting of a longitudinal beam extending centrally of the upper section of said vehicle, transverse supporting ribs extending horizontally from opposite sides of said beam at longitudinally spaced intervals, and an outer peripheral beam in surrounding relation to said ribs.

4. Monorail apparatus according to claim 3, further including an upper drive unit control section housed within said vehicle and supported on said upper framework.

5. Monorail apparatus according to claim 1, said vehicle having an outer lightweight shell formed of side and end panels of fiber glass construction diverging downwardly from connection with said upper supporting framework, and a floor section at the bottom of said side and end panels.

6. Monorail apparatus according to claim 5, further including a longitudinally extending guide rail disposed in spaced relation beneath the vehicle, and guide wheels depending downwardly from the floor section of said vehicle for engagement with said guide rail as said vehicle is advanced along the overhead monorail.

7. Monorail apparatus according to claim 1, wherein said drive unit is engageable with a rail having a lower horizontal flange portion, each drive unit including load-supporting wheels carried on said drive unit supporting frame for engagement with the upper surface of said flange, and at least one drive wheel including a drive motor carried by said suspension means for engagement with the bottom surface of said flange portion, said drive wheel pivotal about an axis vertically spaced above the drive wheel axis of rotation to undergo upward swinging movement about its pivotal axis in response to rotation of said drive wheel for rolling advancement along the bottom surface of said flange.

8. Monorail apparatus according to claim 7, wherein said suspension means includes;

a yoke having upwardly directed arm portions;

a load wheel supporting bracket at the upper end of each arm portion, said load wheel supporting bracket being of generally U-shaped configuration with opposite sides extending upwardly along opposite sides of the horizontal flange to carry pairs of inflatable tire load-supporting wheels in longitudinally spaced relation to one another for rolling engagement with opposite sides of the upper surface of the flange,

a drive wheel supporting bracket of generally U-shaped configuration having opposite sides extending downwardly from said pivotal connection to opposite sides of each of said load-supporting brackets; and

a pair of inflatable tire drive wheels pivotally suspended centrally beneath said load-supporting wheels on each of said load-supporting brackets.

9. Monorail apparatus according to claim 8, each of said drive wheel supporting brackets including resilient means biasing said drive wheel upwardly against the bottom surface of the horizontal flange portion.

10. In an overhead monorail carrier system having a rail provided with a horizontal flange portion, a drive unit comprising:

load-supporting wheels extending upwardly from said supporting frame for rolling engagement with the upper surface of the horizontal flange portion;

a drive wheel supporting frame beneath the horizontal flange portion;

a rotatable drive wheel assembly including a drive wheel, said supporting frame including pivot means pivotally supporting said drive wheel to engage the bottom surface of the flange about a pivotal axis spaced above the drive wheel is at rest through the drive wheel axis of rotation and normal to the bottom surface of the flanged portion whereby to cause said drive wheel to undergo upward swinging movement about its pivotal axis in response to rotation of said drive wheel; and

drive means operable to rotate said drive wheel for rolling advancement along the bottom surface of said flange portion.

11. A drive unit according to claim 10 wherein said drive wheel is pivotal in either direction away from the reference plane.

12. A drive unit according to claim 11, said load-supporting wheels being flangeless, and said drive unit further including guide wheels carried by said supporting frame for rotation about a vertical axis and including means to yieldingly urge said guide wheels into engagement with a vertical surface portion on the monorail.

13. A drive unit according to claim 10, said pivot means pivotal about a pivot link which pivotally connects to said supporting frame, said drive wheel pivotally connected to said pivot link in spaced relation to the pivotal connection of said pivot link to said supporting frame, and means biasing said link arm and drive wheel upwardly to urge said drive wheel against the bottom surface of said flange portion.

14. A drive unit according to claim 10, wherein two sets of load-supporting wheels are disposed in fore and aft relation on said supporting frame, each set of load-supporting wheels including a pair of wheels longitudinally spaced on opposite sides of a vertical section of the monorail, and said drive wheel being centered beneath said for and fore and aft load-supporting wheels between said supporting frame and horizontal flange portion.

15. A drive unit according to claim 13 being further characterized by having a pair of drive wheels including a drive motor carried by said supporting frame, each of said drive wheels defined by an inflatable tire centrally located beneath each set of load-supporting wheels.

16. In a drive unit for a monorail carrier system and the like, said drive unit having a supporting frame with load-supporting wheels on said frame for rolling engagement with an inner surface of a horizontal flange on the monorail together with lateral stabilizing means associated with said load-supporting wheels, the improvement comprising:

a rotatable traction drive wheel assembly pivotally supported independently of said load-supporting wheels for engagement with a surface of the horizontal flange on the side opposite to said load-supporting wheels, said drive wheel assembly including pivot means pivotally supporting said drive wheel about a pivotal axis spaced above the drive wheel axis of rotation and in a reference plane when said drive wheel is at rest through the drive wheel axis of rotation and normal to the bottom surface of the flanged portion whereby to cause said drive wheel to undergo upward swinging movement away from the reference plane against the surface of the flange as it is caused to advance in either direction of travel along the rail.

17. In a drive unit according to claim 16, said drive wheel pivotal about an axis relatively near the surface of engagement of said drive wheel with the flange and away from its axis of rotation.

18. In a drive unit according to claim 17, said pivot means defined by a generally U-shaped drive wheel support bracket having opposed sides and spaced web portions interconnecting said sides, and said drive wheel being defined by a pair of inflatable tires mounted between the sides of said bracket for rotation on a common axis of rotation.

19. In a drive unit according to claim 17, further including a pivot link on said support frame and said drive wheel bracket pivotally connected to said pivot link to support said drive wheel for pivotal movement with said pivot link while being pivotal independently of said pivot link.

20. In a monorail system for suspension of a vehicle from an overhead monorail, the monorail characterized by having a lower horizontal flange portion and a vertical web section extending upwardly from and along the midsection of the flange

portion, a pair of drive units spaced longitudinally of the vehicle and extending upwardly therefrom for engagement with the monorail, each of said drive units comprising:

a suspension member suspended from the vehicle, a yoke secured to the upper end of said suspension member, said yoke being of generally arcuate configuration to define oppositely directed arm portions curving upwardly and outwardly from said suspension member to provide a space between the yoke and the monorail;

load wheel-supporting brackets of generally U-shaped configuration each swiveled to the upper ends of said arm portions and having opposite sides extending upwardly in spaced relation to opposite sides of the horizontal flange portion of the monorail, load-supporting wheels carried by opposite sides of each of said load-wheel-support brackets for rolling engagement with the upper surface of the lower horizontal flange portion of the monorail, guide wheels carried on opposite sides of each of said brackets for rotation about axes perpendicular to the axes of rotation of said load-supporting wheels, and means yieldingly urging said guide wheels against the vertical section of the monorail for rolling engagement therealong;

a drive wheel in the space provided between the yoke and monorail and a motor drivingly connected to the drive wheel; and

a drive wheel-supporting bracket including means pivotally supporting said drive wheel about a pivotal axis spaced above the drive wheel axis of rotation and in a reference plane when said drive wheel is at rest through the drive wheel axis of rotation and normal to the bottom surface of the flanged portion whereby to cause said drive wheel to undergo upward swinging movement about its pivotal axis in response to rotation of said drive wheel, and means on said drive wheel-supporting bracket biasing said drive wheel into tractional engagement with the bottom surface of the horizontal flange.

21. In a monorail system according to claim **20**, said drive wheel-supporting bracket further including a pivot link extending between said arm portions of said yoke member, said pivot link pivotally connected at one end to one of said arm portions and means on the other arm portion biasing the opposite end of said pivot link upwardly, said drive wheel-supporting bracket depending downwardly from pivotal connection intermediately between opposite ends of said pivot link, said drive wheel carried for rotation by said support bracket about an axis of rotation spaced beneath the pivotal connection of said bracket to said pivot link and biased upwardly from said pivot link into tractional engagement with the bottom surface of the horizontal flange.

22. In a monorail system according to claim **21**, the point of pivotal connection between said drive wheel support bracket and said pivot link being below the bottom surface of the horizontal flange portion on the monorail.

23. In a monorail system according to claim **21**, the pivotal connection between said drive wheel support bracket and said pivot link being in spaced relation above the bottom surface of the horizontal flange portion on the monorail.

24. In a monorail system according to claim **21** in which said guide wheels are positioned forwardly and rearwardly of opposite sides of said bracket for rolling engagement with the vertical section of the monorail fore and aft of said load-supporting wheels.

25. In a monorail system according to claim **20**, wherein said load supporting wheels are each in the form of an inflatable tire, and there being a pair of drive wheel-supporting brackets each including a pivot link pivotally connected to one of said load wheel-supporting brackets with said drive wheel-supporting bracket depending downwardly from pivotal connection at one end of said pivot link, and means at the opposite end of said pivot link biasing said drive wheel-supporting bracket upwardly, said drive wheel defined by a pair of inflatable tires carried for rotation by each of said drive wheel-supporting brackets about an axis of rotation spaced beneath the pivotal connection of said bracket to said pivot link and biased upwardly by said pivot link into tractional engagement with the bottom surface of the horizontal flange.