

July 29, 1969

W. D. HOLDEN

3,457,876

SUSPENDED RAILWAY SYSTEM

Filed July 20, 1966

6 Sheets-Sheet 1

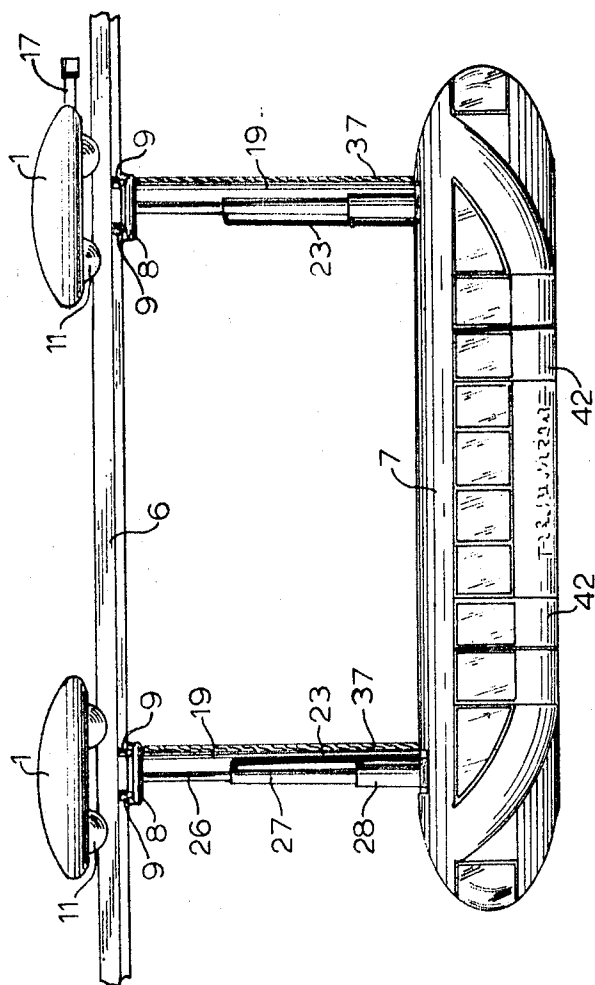


FIG. 1

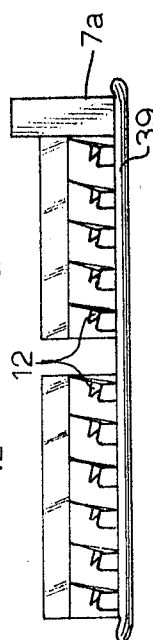


FIG 1A

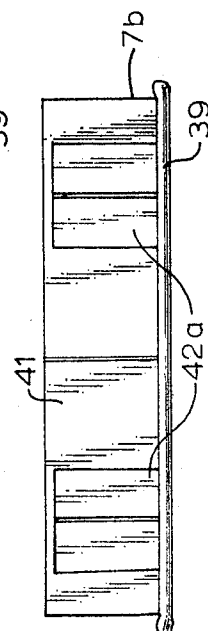


FIG 2

INVENTOR.

William D Holden

July 29, 1969

W. D. HOLDEN
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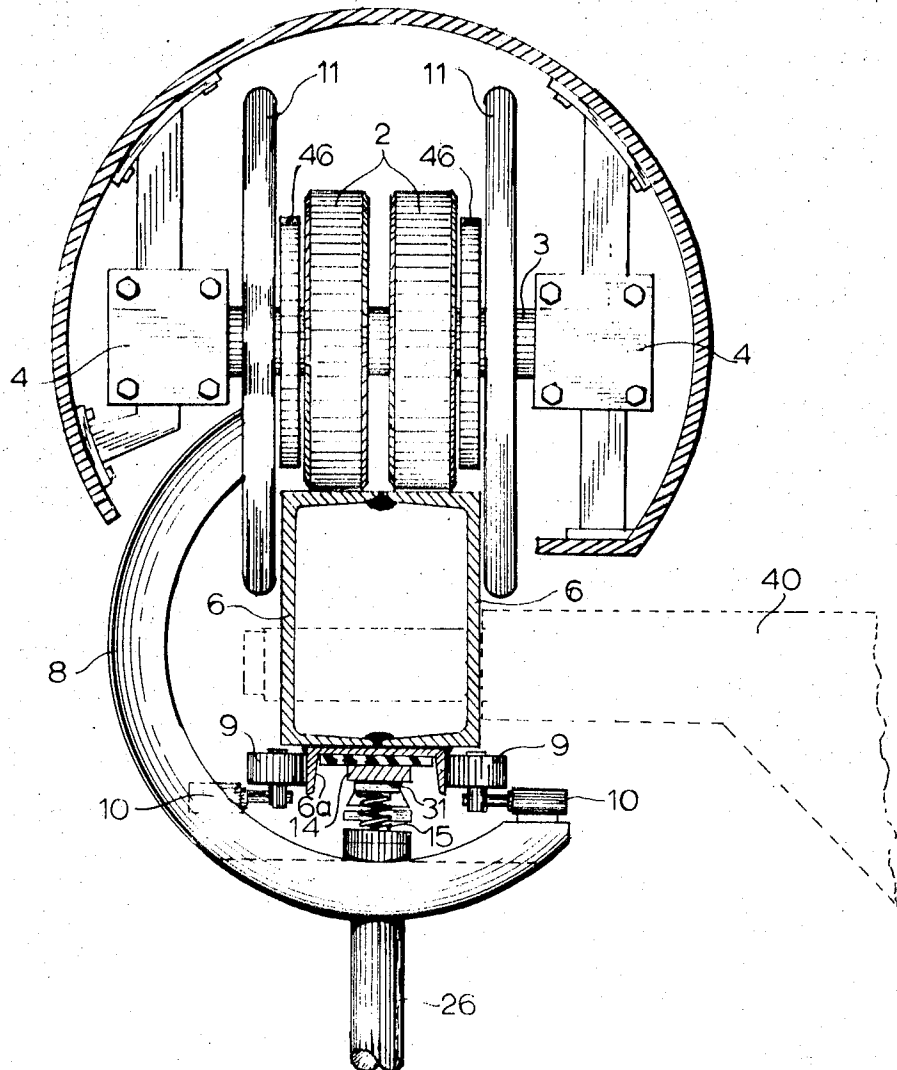


FIG 3

INVENTOR.

William D Holden

July 29, 1969

W. D. HOLDEN

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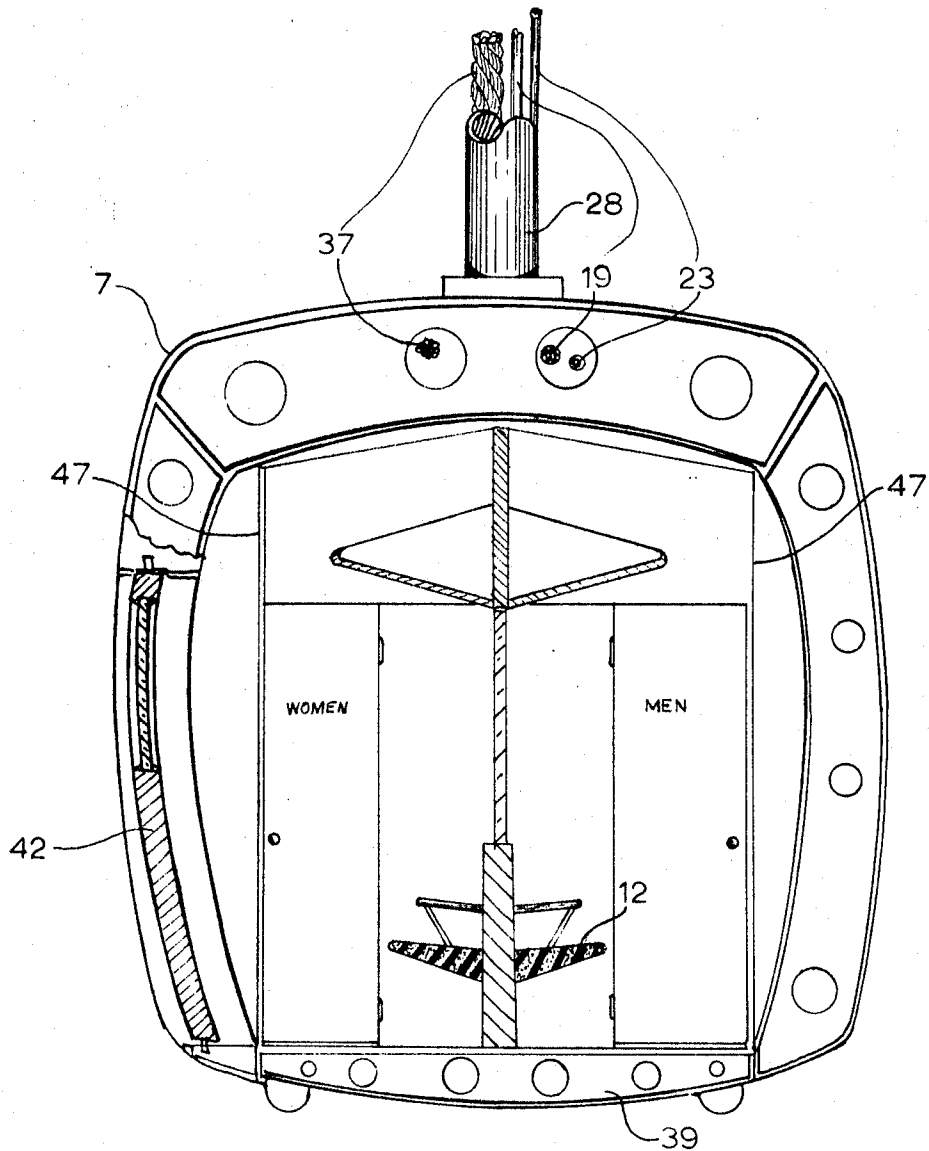


FIG 4

INVENTOR.

William D Holden

July 29, 1969

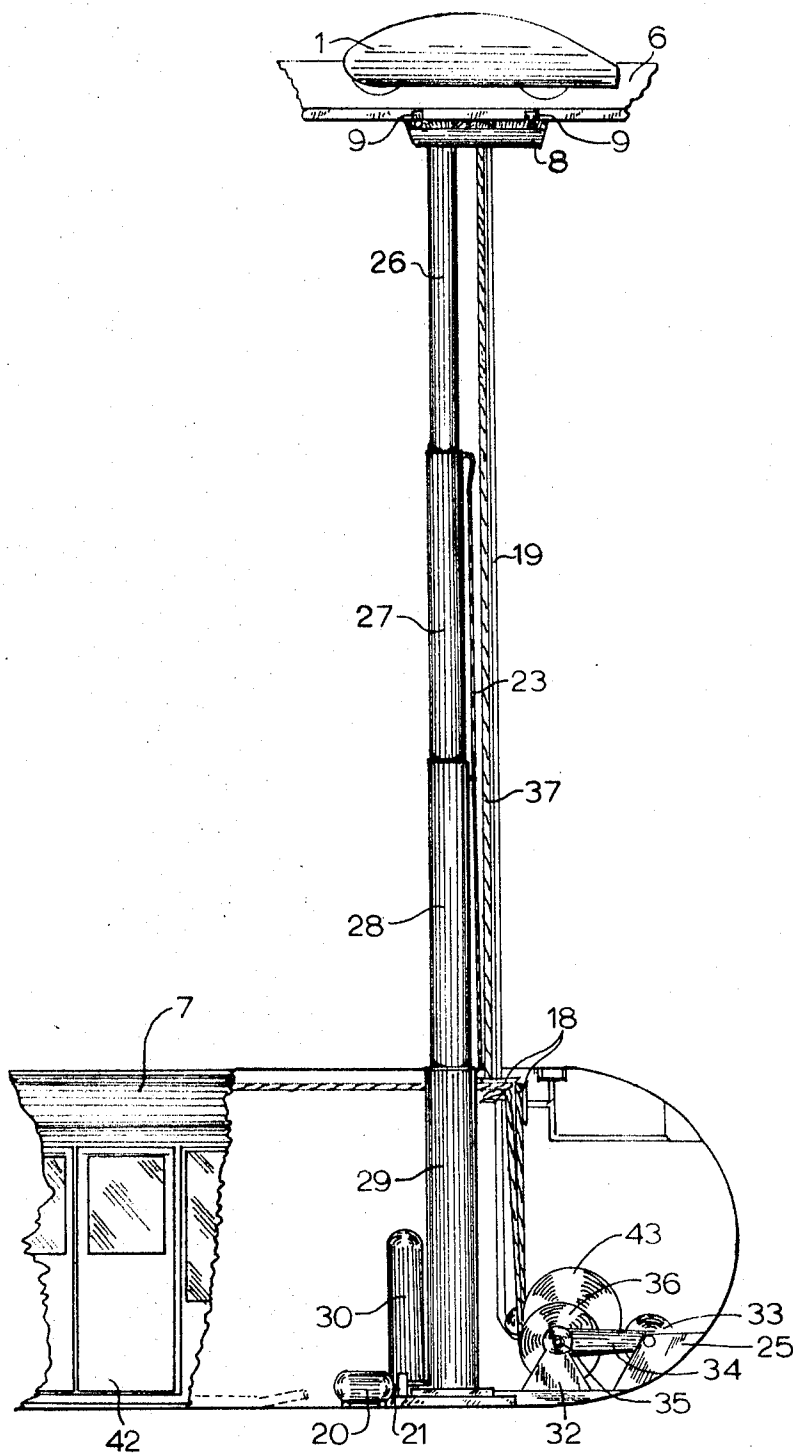
W. D. HOLDEN

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INVENTOR.

William D Holden

FIG 5

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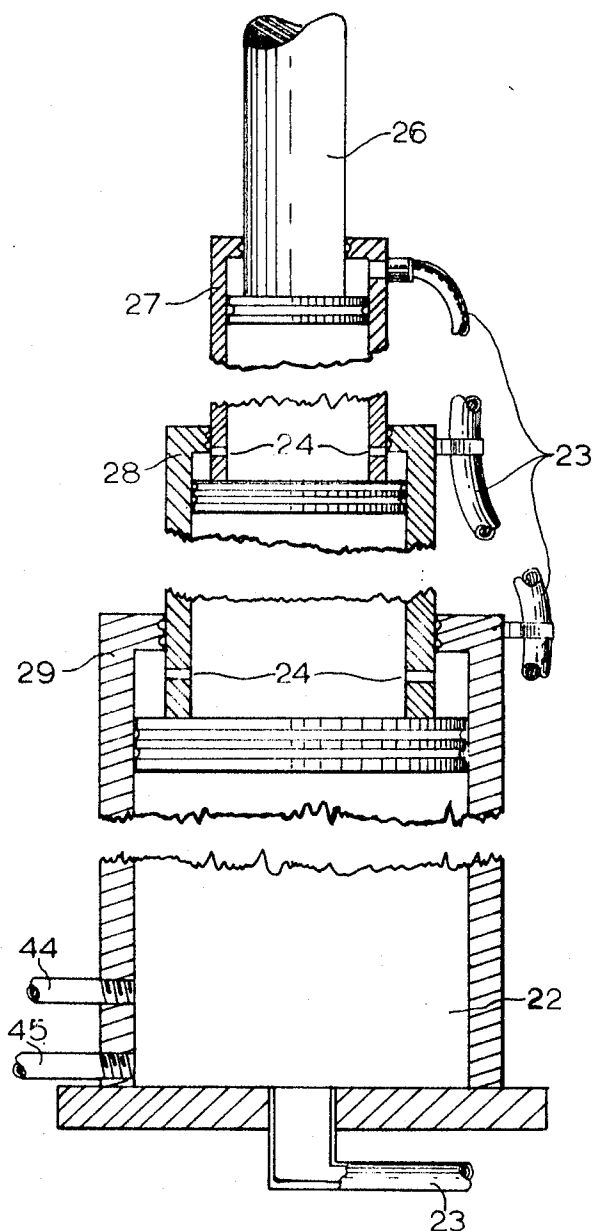


FIG 6

INVENTOR.

William D Holden

July 29, 1969

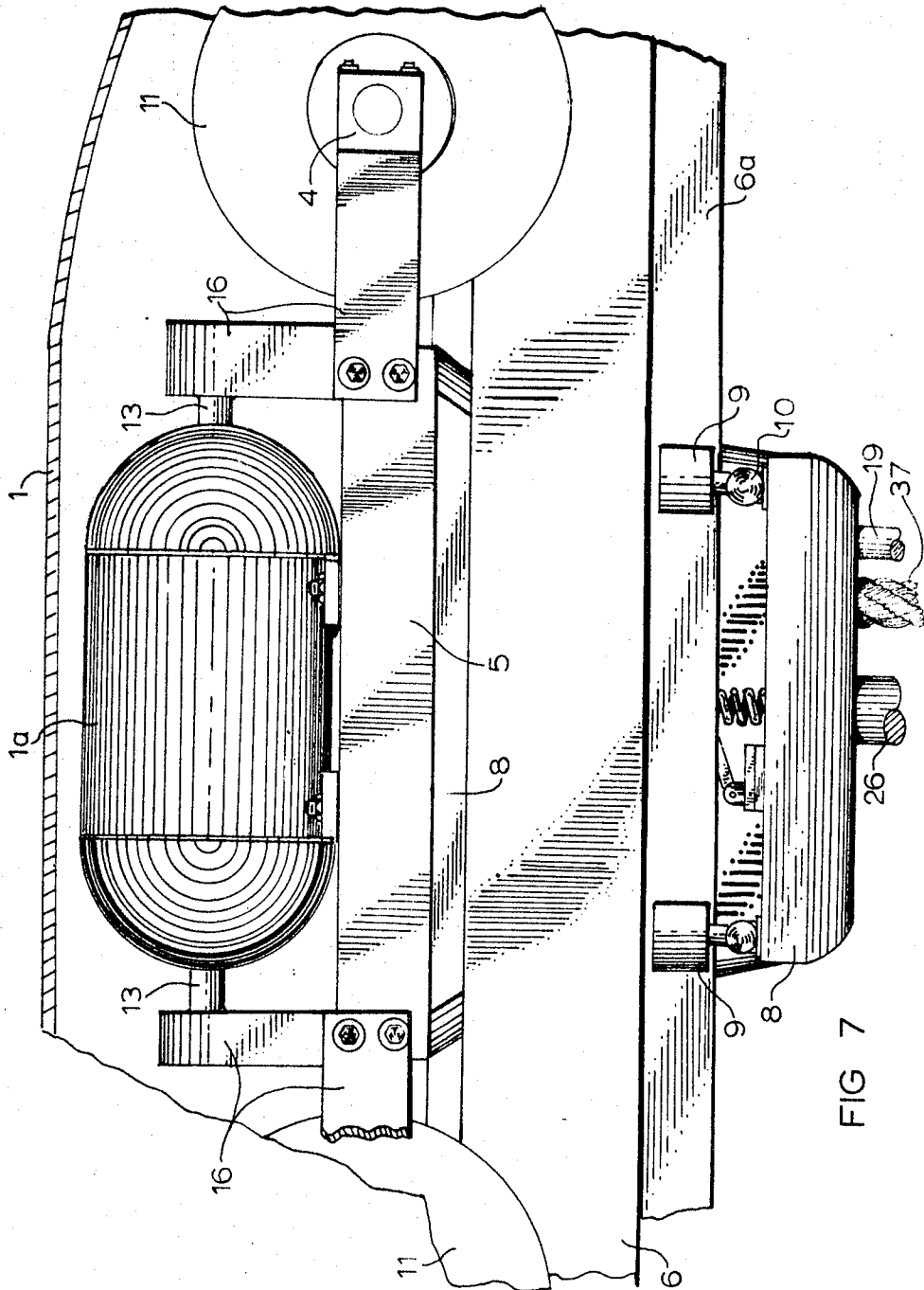
W. D. HOLDEN

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INVENTOR.

William D Holden

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3,457,876

SUSPENDED RAILWAY SYSTEM
William Darwin Holden, 607 Kent Ave.,
Teaneck, N.J. 07666

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10 Claims

ABSTRACT OF THE DISCLOSURE

A suspended railway system in which the car is suspended below the rail or rails and in which the cars may be raised and lowered between a moving position when the cars are normally in an upper position and a contents loading and unloading position when the cars are normally in a lowered position. The cars are lowered and raised by means of at least one telescoping hydraulic cylinder in which the piston is fixed to an upper reference point adjacent to the rail or rails and the outer cylinders are movable with respect thereto.

This invention is one that relates to the monorail type conveyance but more specifically to the type where the coaches are suspended beneath the support rails or rail structure. I prefer to call suspended railway systems of the invention "televated" systems. The word elevated is arrived at by the function and mainstay of the invention. The invention relies on telescoping cylinders for the vertical elevating of the coach or unit. Thus, by combining the kind of cylinders (telescoping) and the function of said cylinders the word elevated becomes apparent.

A number of monorail systems have been devised and manufactured, but all of them to date have such limiting factors as the use of costly elevated stations, sloping rails, and the limitation of specific units or coaches for specific purposes or jobs. These added devices have proven to be very costly and sometimes impractical for a mass transit system, therefore, it is believed that a simple multipurpose vehicle is needed and until now this type of vehicle has not been invented.

The AirOtrain, which derives its name from its airplane and train-like functional qualities, would qualify as a simple multipurpose vehicle, in that it is able to break with the traditional stationary level of mobility, by adjusting its vertical level to any given point between the supporting overhead rail or rails and the ground level. Thus the AirOtrain's elevated system, which includes a vertical moving coach, with a removable bottom, and its associated suspension, is able to facilitate a rapid change from a passenger unit to one of freight. Another unique feature of the AirOtrain elevated system is its ability to extend itself to any level between the overhead support rail or rails, in order to conduct business with all known types of transportation at their level of operation; while at the same time maintaining horizontal mobility without interfering with the air or surface field of operation.

The AirOtrain (monorail) type public conveyance would certainly prove invaluable, in that it could operate in a well defined air space which is readily available even in the most congested areas of our country. This air space exists in an almost inexhaustible supply throughout most of the nation and ranges in altitude from 0' to 70' depending on its location. The utilization of this already

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available supply of air space could be accomplished without interrupting any known transportation system and this includes vehicles of aviation as well, since most airplanes regardless of size fly at much higher altitudes.

The AirOtrain, because of its interchangeability of purpose would also overcome the rush hour dilemma experienced by the mass transit systems of today. (This dilemma being the need of additional equipment and crews during the rush hours only.) The AirOtrain could be used to carry passengers during the rush hours and freight during the other hours of operation by simply removing and interchanging the bottom sections. Thus, both the crew and unit could be used more efficiently during the whole period of operation.

It is an object of this invention to provide the AirOtrain monorail coaches with the elevated system which will allow the cars to be vertically raised or lowered to any predetermined level between the overhead support rail and the ground.

It is also an object of this invention to provide two unique power sources (in the elevated system) to operate in conjunction with each other or in the case of an emergency to operate independently. However, it should be noted here that both power sources are dependent on the telescopic cylinders for vertical guidance which at the same time prevents them from being stranded in mid-air because of power failure.

It is further the object of this invention to provide for a unique quick transformation of a passenger conveyance into one of freight, utilizing the same unit. This being accomplished by the interchanging of the floor-platforms through the use of the vertical movement of the coach produced by the elevated system.

A further object of this present invention is to provide a design of the coach so as to allow each individual unit to operate independently of each other, either on a horizontal or vertical plane with the supporting rail. This is brought about by coupling the units or coaches at the power units located above the support rail and by the design of the coaches themselves.

It is further the object of this invention to provide a novel arrangement of the motor, and drive wheels, in conjunction with their associated support rail or rails.

The above objects along with others will be brought out by the structural illustrations in the accompanying drawings along with the subsequent description:

FIGURE 1 is a side elevational view of a suspended railway of the invention with the coach in a lowered position;

FIGURE 1A is a side elevational view of a removable unit for carrying passengers, positioned directly below its place in the coach or car of FIGURE 1;

FIGURE 2 is a side elevational view of a removable unit for carrying freight, positioned directly below its place in the coach or car of FIGURE 1;

FIGURE 3 is an enlarged, transverse view, partly in section, of the hanger unit used in the invention showing the flanged discs, spacers, pneumatic rubber drive wheels and track;

FIGURE 4 is an enlarged, transverse sectional view of the passenger carrying section of FIGURE 1;

FIGURE 5 is an enlarged, side elevational view of a portion of the car showing one of the telescoping hydraulic cylinders together with the associated operative elements;

FIGURE 6 is a further enlarged, vertical sectional view of the telescoping hydraulic cylinder of the invention; and

FIGURE 7 is an enlarged, side elevational view of the hanger system and power unit of the invention.

The illustrated assemblies shown in FIGURES 1 through 7 relate to design and improvements in the mono-rail coach or unit, support rail and its associated hanger system. These assemblies serve to provide for increased safety along with other features deemed necessary for an economical modern day transit system.

Operation of the system is as follows:

When the motors 1a contained in the power units 1 are energized or motivated the axles 3 of all drive wheels 2 are put into motion by the associated drive shafts 13 and power unit gear boxes 16 and 4. As the power units 1 and trucks 5 roll upon the support rail 6 the load supporting drive wheels 2 are retained in rolling engagement with the supporting rail 6 by the weight of the power units 1 and the weight of the coach 7. The coach 7 is suspended beneath the support rail 6 by the support arm 8 which maintains a perfect balance between the coach 7 and the power units 1 through a common center of gravity. The rolling movement of the coach in relationship to its longitudinal axis of the support rail 6 is checked by the guide wheels 9 and its associated hydraulic damper cylinders 10. The guide wheels 9 not only arrest the lateral sway or rolling movement of the coach but also keeps the drive load carrying wheels centered on the support rail 6. As an added safety feature all drive wheels 2 have flanged discs 11 that could act as guides in an emergency.

Located at the bottom of the support arm 8 is the sliding contact 31 along with its associated pressure spring 15 which maintains contact with the hot line 14 deriving the necessary electrical energy. (Note that the hot line 14 is protected by the two lower flanges of the guide rail 6a.) A complete circuit is maintained in the following manner: First the sliding contact 31 receives its electrical energy from the insulated suspended hot line 14 contained in the interior section of the guide rail 6a. From the sliding contact 31 the electrical energy is transmitted to the motors 1a through an insulated cable (not shown) in the support arm 8. The ground or return flow of energy is carried to the support rail 6 through a contact (not shown).

The vertical upward movement operation of the telelevated system is put into operation upon receiving electrical impulses from the pilot control panel (not shown) which activates the hydraulic pump 20. This pump in turn forces the hydraulic fluid from the primary reservoir 22 and the auxiliary reservoir 30 into the pressure line 23 passing into the primary telescoping cylinder 27, filling it and causing the cylinder 27 to rise up on the stationary piston 26 until it has reached its maximum movement at which time an escape valve 24 is opened into the second cylinder 28 through the wall of the primary cylinder 27. When cylinder 28 is filled and has moved up the outside of cylinder 27 to its maximum, another escape valve 24 is opened allowing the fluid to move under pressure into cylinder 29. The above procedure is perpetuated to any number of cylinders being used in the telelevated system. As can be seen in FIG. 6, the cylinder 29 becomes the primary reservoir 22 as the AirOtrain begins its descent with any excess hydraulic fluid being forced into the auxiliary reservoir 30 through the opened bypass valve 44. If any more hydraulic fluid is needed after the primary reservoir 22 is depleted during ascent then the auxiliary reservoir 30 will furnish it through the bypass valve 45.

The flexible pressure line 23 could be eliminated along with its spring loaded take-up drum 43 by assembling the reservoirs, and pumps in the power units 1 and running a non-flexible pressure line through the support arm 8 into the center of the stationary piston 26 with openings

in the top of the piston itself. (This method is not shown in drawings because it should be self-evident by the foregoing explanation.)

The downward movement of the AirOtrain is achieved by the pull of gravity on the coach 7 forcing the hydraulic fluid in a reverse direction of the filling procedure. The hydraulic fluid passes first from the largest volume cylinder 29 into cylinder 28 through the escape valves 24 at the same rate of flow that cylinder 28 loses its fluid to cylinder 27 which in turn gives up its fluid to the flexible pressure line 23 which carries the fluid back to the primary reservoir 22 and its auxiliary reservoir 30. The coach rate of descent is controlled by control valves (not shown) and without the use of any form of power. Power may also be used to lower the coach. Thus, the elevating devices prevent the coach 7 from being stranded in mid-air.

The cable system is operated from the pilot control panel (not shown) by the use of electrical energy derived from the sliding contact 31 located in the support arm 8. (This source of energy could also come from batteries or an internal combustion engine.) The electrical source of energy enters the cable take-up motor 33, located on its support 25, by the way of the power control cables 19 which in turn activates the take-up drive shaft 34 and gear box 35 which rotates the spring loaded pick-up drums 36 and 43 on their support 32, pulling taut the vertical lift cables 37, the hydraulic line 23 and the electrical control cables 19 on their pulley systems 18 causing the coach or unit 7 to rise to any given level between the ground and the support rail 6. When the cable telelevated system is operating independently of the hydraulic telelevated system the telescopic stationary piston 26 and the piston cylinders 27, 28, and 29 act as guides for the AirOtrain barring any lateral or rolling movement of the coach.

As can be seen by the foregoing detailed description of operation, both the hydraulic and the electrical cable source power systems are dependent on the telescoping cylinders. These two power systems can be operated jointly whenever an extra heavy load is being lifted. Either one of the above power systems could be used separately and as a primary source of power in the AirOtrain. The reason both of these power systems are shown in the drawings are to enlighten one as to the feasibility of these two systems being used jointly along with the fact that both depend on the telescopic cylinders.

It should be noted that coach or unit 7 as shown in FIG. 1 has its retractable coupler 17 located in the power unit 1 which allows each attached unit or coach to operate independently while in vertical or horizontal movement with said support rail 6. The mechanical-electrical control coupler 17 allows the lead coach to control the attached coaches or units upon connection. The advantage of the above being that only those cars taking on freight or passengers or discharging same are involved in a vertical movement, leaving the rest of the coaches or units in a stationary position.

As can be seen in FIGURES 1A and 2 the coach or unit has a removable bottom 39 which allows it to convert from a passenger conveyance 7a to one of freight 7b in a matter of minutes. The passenger section 7a is made up of seats 12 along with rest rooms (rest rooms are optional) which are located on the removable floor-platform 39. The freight section 7b is made up of a contour freight container 41, with sliding side doors 42a (corresponding to the doors 42 contained in the coach) which also is located on a removable floor-platform 39. The contour freight container 41 protects the inside of the coach 7 from being damaged by freight and at the same time shows the loading crews the limitations of the freight size. The contour freight container is inserted over the freight in two sections and latched in the middle. The side doors 42 and 42a give the AirOtrain the advantage of loading or unloading partial shipments at different locations, along

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with taking on whole shipments through the bottom and depositing same in like manner.

In FIGURE 3 a transverse section of the hanger system is shown using a box-shaped support rail 6. This employs two pieces of welded channel steel to form the top with another piece of channel steel being attached to the base forming the two lower flanges of configured inverted "U." This lower portion of track becomes the guide rail 6a and the hot line's protective cover. The drive wheels 2 are dual semipneumatic rubber tyred wheels. Spacers 46, located between drive wheels and flanges 11 can be used as drive wheels if the semipneumatic tyres should become deflated. When the spacers 46 become the drive wheels then the flanged discs 11 automatically serve as guides.

The coach, as can be seen, is suspended from the support rail 6 by the power units 1 and the support arms 8 which are generally "C" shaped. The support arms 8 are constructed identically so as to hang the coach both front and rear by the hydraulic cylinders. Said hydraulic cylinders are mounted to the coach bottom sections located at opposite ends of coach 7.

FIGURE 4 shows the transverse view of the floorplatform in relationship to its position in the coach, along with its accompanying passenger section 7a. Also shown by lines 47 is the outer dimensions of the contour freight container 41 and its relative position to the interior walls of said coach 7. Note, that the freight container's sides do not come in contact with the interior walls of the said coach, but rather lock in at the bottom and at the ceilings attaching points of the coach. This feature keeps the interior walls of said coach free from scarification, while at the same time allowing folding seats (not shown) to be located in the interior wall well out of the way of the freight container 41.

This invention may be embodied in other specific forms without departing from the essence of essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the invention being indicated by the appended claims rather than by the foregoing descriptions and all modifications which come under or within the meaning and range of equivalency of these claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is hereby presented:

1. A suspended type railway conveyance comprising:
 - an elevated rail;
 - a truck supporting a car for movement along the elevated rail;
 - at least one telescoping cylinder connected between the truck and the car;
 - the telescoping cylinder comprising an inner stationary piston which is attached to the truck in fixed vertical relationship therewith, an outer casing which is attached to the car, surrounding the inner piston and spaced therefrom, a source of fluid, and means for introducing and removing fluid into and from the space between the inner stationary piston and the outer casing such that in one condition, the car is raised toward the elevated rail and in the other condition, the car is lowered away from the elevated rail.
2. The suspended railway of claim 1 wherein the car is raised when fluid is introduced into the said space and lowered when fluid is removed from the said space.
3. The suspended railway of claim 2 wherein the telescoping cylinder comprises a plurality of nested outer casings, each said outer casing being spaced from the next adjacent outer casing and means for introducing fluid into and removing fluid from the spaces between the successive outer casings, the fluid being introduced first into the space between the inner piston and the outer casing adjacent thereto and successively into each of such spaces between the various adjacent outer cas-

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ings toward the space between the outermost of the outer casings and the outer casing adjacent thereto to thereby raise the car, the fluid being removed first from the space between the outermost casing and the outer casing adjacent thereto and successively out of each of such spaces between the various outer casings toward the space between the inner piston and the outer casing adjacent thereto to thereby lower the car.

4. The suspended railway of claim 3 wherein there are two such telescoping cylinders, one at each end of the car, to thereby enable the car to be maintained level horizontally at any vertical level between the uppermost and the lowermost positions.

5. The suspended railway of claim 2 including at least one vertical cable running between the elevated rail and the car, at least one take-up drum and means for winding the cable onto and off the take-up drum to thereby assist in the raising and lowering of the car.

6. The suspended railway of claim 5 wherein the telescoping cylinder comprises a plurality of nested outer casings, each said outer casing being spaced from the next adjacent outer casing and means for introducing fluid into and removing fluid from the spaces between the successive outer casings, the fluid being introduced first into the space between the inner piston and the outer casing adjacent thereto and successively into each of such spaces between the various adjacent outer casings toward the space between the outermost of the outer casings and the outer casing adjacent thereto to thereby raise the car, the fluid being removed first from the space between the outermost casing and the outer casing adjacent thereto and successively out of each of such spaces between the various outer casings toward the space between the inner piston and the outer casing adjacent thereto to thereby lower the car.

7. The suspended railway of claim 6 wherein there are two such vertical cables, one at each end of the car and two such telescoping cylinders, one at each end of the car, to thereby enable the car to be maintained level horizontally at any vertical level between the uppermost and the lowermost positions.

8. The suspended railway of claim 2 wherein there are two such telescoping cylinders, one at each end of the car to thereby enable the car to be maintained level horizontally at an vertical level between the uppermost and the lowermost positions.

9. The suspended railway of claim 2 wherein the elevated rail is of a generally box-shaped configuration and including:

- a plurality of drive wheels connected to the car and means for moving the plurality of drive wheels;
- the plurality of drive wheels engaging the top portion of the elevated rail;
- a plurality of flanged, steel discs adjacent a vertical portion of the elevated rail, there being one alongside each drive wheel;
- a plurality of spacers, there being one such spacer between each drive wheel and flanged steel disc to keep the same separated;
- a plurality of guide wheels engaging a vertical portion of the elevated rail to maintain the drive wheels centered on the elevated rail and to reduce lateral sway of the car;
- a "C" shaped support arm or hanger connecting the telescoping cylinder to the means for moving the plurality of drive wheels, the guide wheels being on the "C" shaped support arm.

10. The suspended railway of claim 2 wherein the car comprises:

- an outer housing;
- a bottom section removably affixed to the outer housing and interchangeable with other similar bottom sections;
- the bottom sections being formed such that various interior appointments are carried thereby to permit

adapting the car to transport passengers or various types of cargo.

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5 ARTHUR L. LA POINT, Primary Examiner
HOWARD BELTRAN, Assistant Examiner

U.S. Cl. X.R.

104—122; 105—148, 150, 238, 329, 366; 180—89;
187—17, 20; 212—10; 244—140