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(54) **DUAL-PIVOT STEERING SYSTEM AND METHOD**

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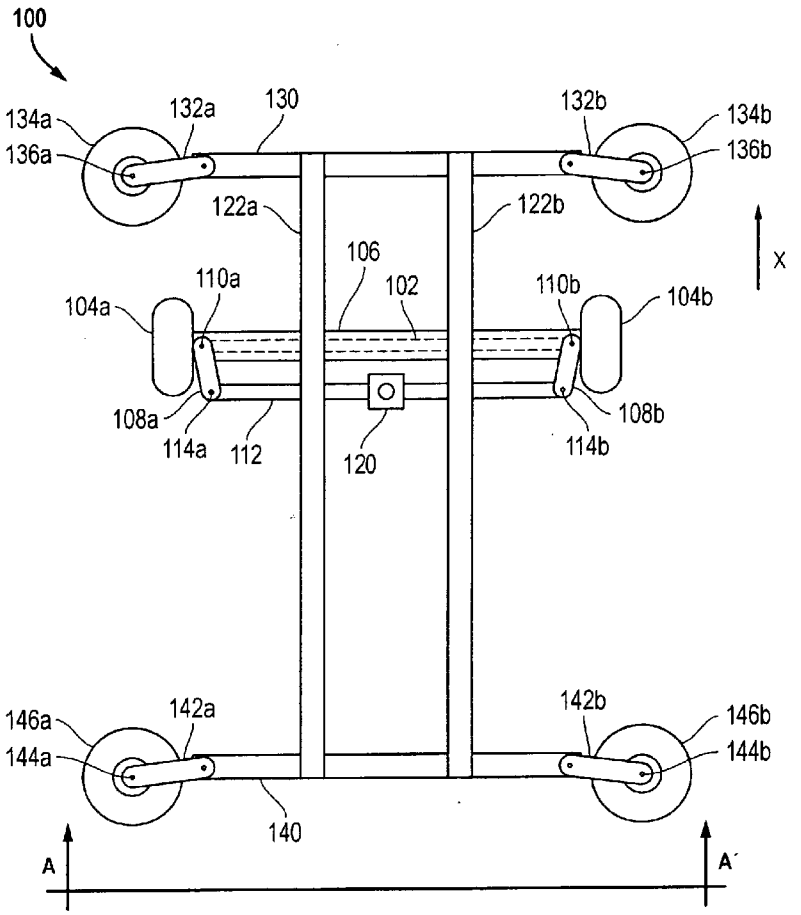
(57) **ABSTRACT**

A system for guided travel over a surface between parallel guide rails includes a first frame including at least one rotatable element for travel over the surface; a first pin connected to the first frame, for rotation of the first frame thereon; a second frame including at least one rotatable element for travel over the surface; a second pin connected to the second frame, for rotation of the second frame thereon; and a base connected to the first pin and the second pin. The first frame and the second frame each include guide wheels for tracking along the respective guide rails and between them. The base can provide transit for people or products.



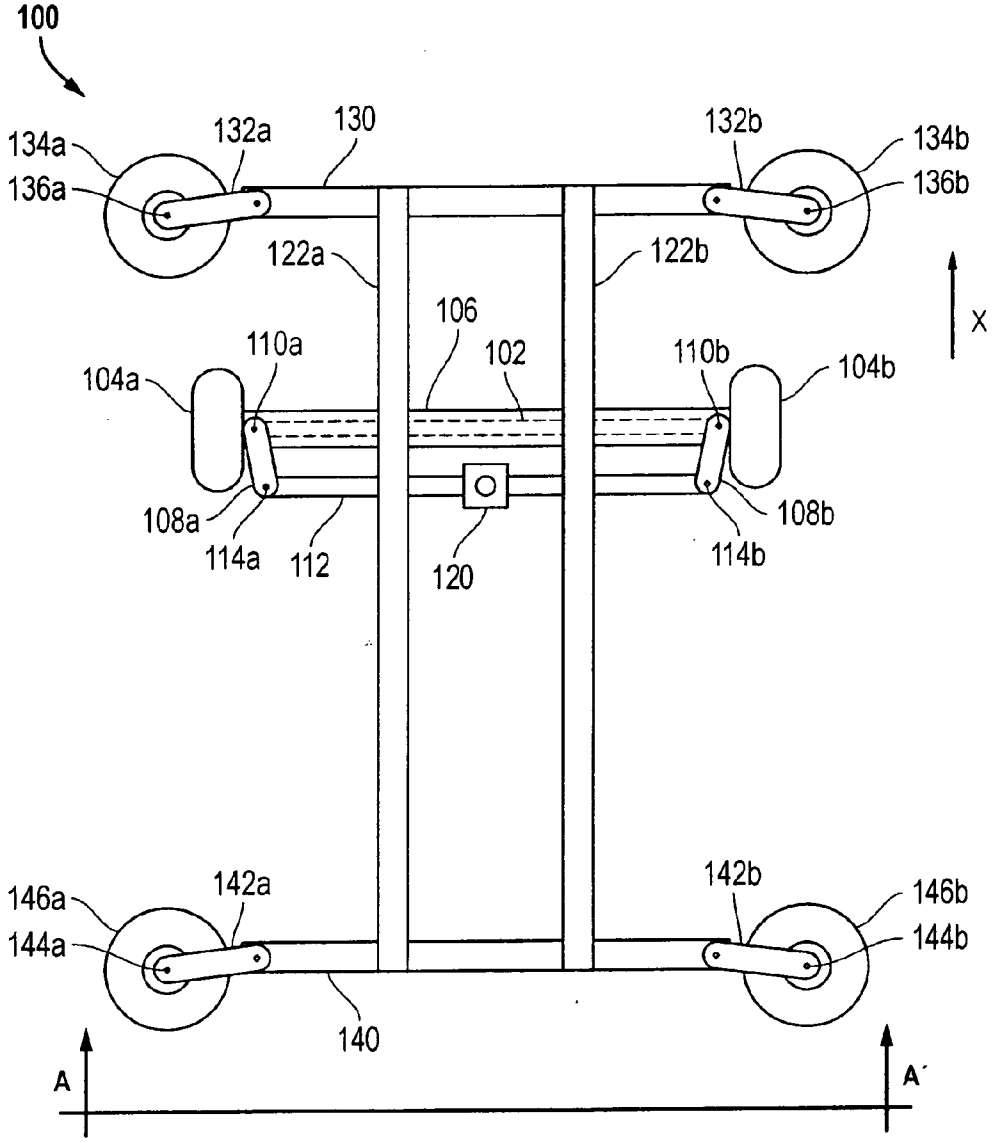

100
134a
132a
130
132b
134b
136a
136b
122a
122b
X
106
102
110a
110b
104a
104b
108a
108b
114a
112
120
114b
146a
142a
142b
146b
144a
144b
140
A
A'

FIG. 1

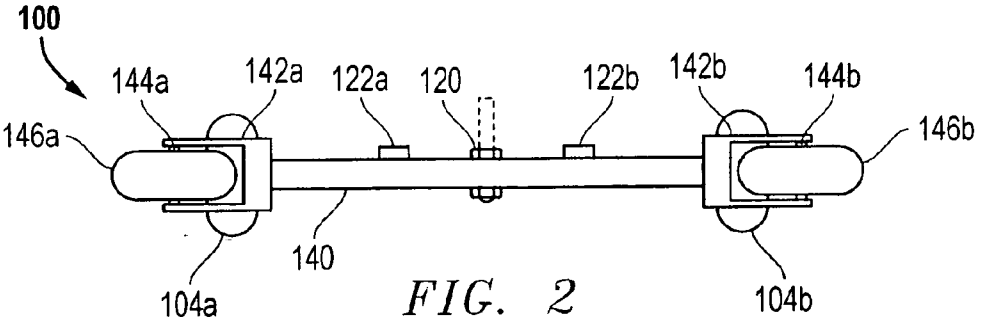

100
144a
142a
122a
120
122b
142b
144b
146a
146b
140
104a
104b

FIG. 2

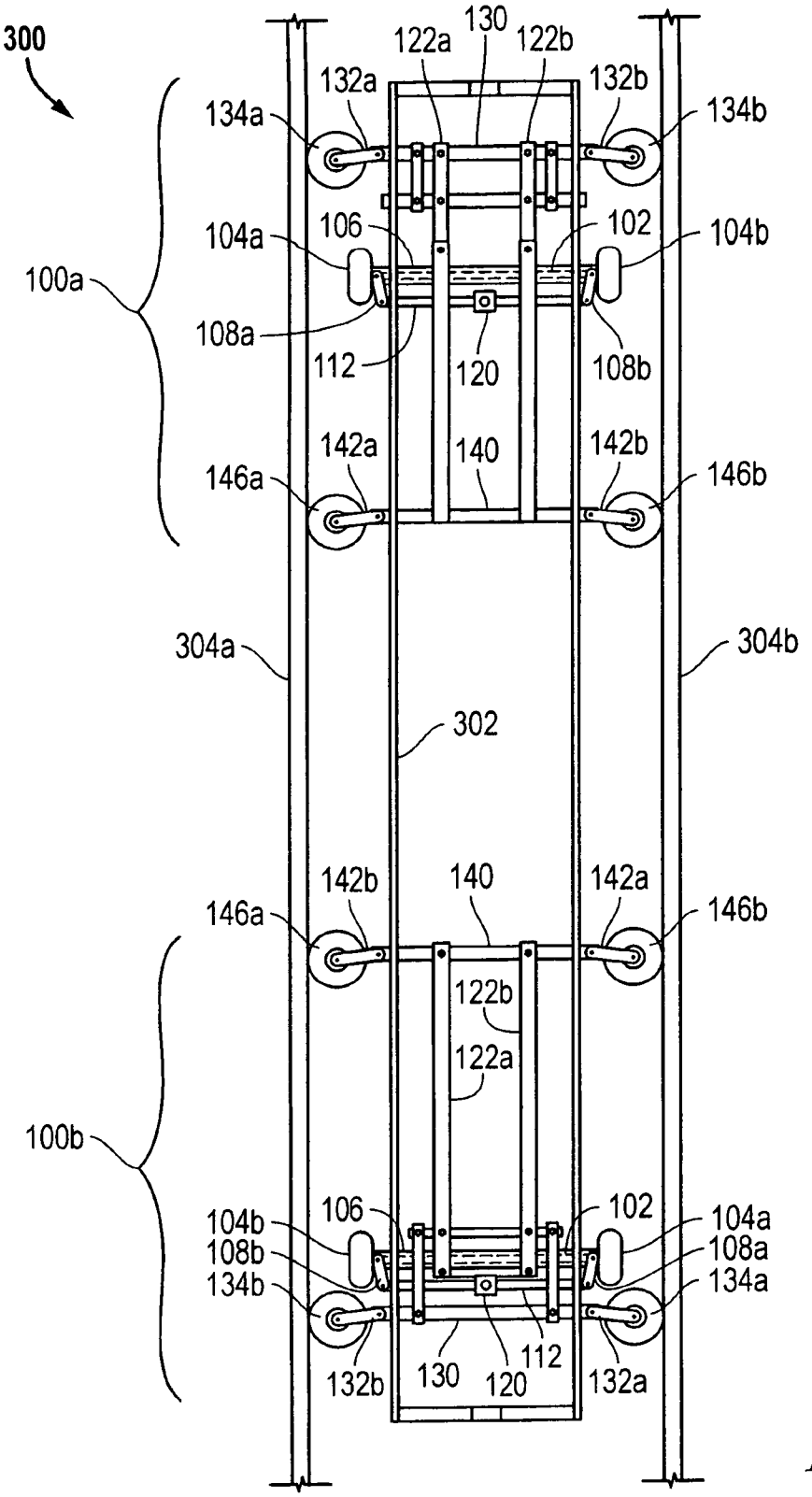

300
130
122a
122b
132a
132b
134a
134b
106
102
104a
104b
100a
108a
108b
112
120
142a
140
142b
146a
146b
304a
304b
302
100b

FIG. 3

DUAL-PIVOT STEERING SYSTEM AND METHOD

BACKGROUND OF THE INVENTION

[0001] The present invention generally relates to transport vehicles and, more particularly, relates to guided mass transit vehicles having dual-pivot steering mechanisms.

[0002] Mass transit trains and other guided transit vehicles, such as subways and the like, operate in certain large cities and metropolitan areas in the U.S. and throughout the world. Additional locations would, no doubt, be benefited by mass transport services. Costs are quite substantial to acquire land, build tracks and infrastructure, and operate transport vehicles. Thus, many locations forego, or do not have the ability and resources required to implement and provide, transit services.

[0003] Prior mass transit systems have typically been built in underground tunnels (e.g., as subways), as overhead railways, or as street-operated buses. Each of these systems is problematic because of expense. Moreover, each of the systems has certain requirements and peculiarities for construction and operations that make it physically and technically impractical, if not impossible in many cases.

[0004] Additionally, although most locations have railway and surface street facilities and access in place, the prior transit systems have only been capable of limited cross-use of the facilities and access. For example, buses use city streets, however, the buses must typically conform to traffic flows of regular car and vehicle traffic. Few, if any, buses operate in designated lanes and transit space. The buses can be unwieldy and, in any event, further clog the normal vehicular traffic. As another example, trains use rail systems. These rail systems typically are limited to certain portions of cities or areas; therefore, the rails can not themselves provide general transit system access. Additionally, as to tunnel and overhead transit systems, the transit vehicles typically operate only in dedicated lines or space. However, these systems require special and costly infrastructure because of the dedicated usage, including land and space availability concerns.

[0005] It would be a significant improvement in the art and technology to provide systems and methods for mass transit that make best use of existing facilities and systems otherwise used for other purposes. Additionally, it would be an improvement to provide such systems and methods operable among and between the conventional facilities and systems. Moreover, it would be a significant improvement in the art and technology to limit costs, infrastructure, space usage, and other normal requirements for erection and operation of mass transit systems. The present invention provides numerous advantages and improvements, including, for example, limited costs, use of existing infrastructures, minimization of land and space dedication and requirements, and other advantages. The present invention further operates consistently, smoothly, and in superior respects to the conventional systems.

SUMMARY OF THE INVENTION

[0006] An embodiment of the invention is a system for guided travel over a surface between parallel guide rails. The system includes a first frame including at least one rotatable element for travel over the surface, a first pin connected to the first frame, for rotation of the first frame thereon, a second frame including at least one rotatable element for travel over the surface, a second pin connected to the second frame, for rotation of the second frame thereon, and a base connected to the first pin and the second pin

[0007] Another embodiment of the invention is a transport system for travel over a surface. The system includes a wheel for travel on the surface, a frame on which the wheel is rotatingly fixed, a guide fixed to the surface, and a roller, rotatingly fixed to the frame, for travel in close proximity to and along the guide.

[0008] Yet another embodiment of the invention is a method of transit of a vehicle. The method includes providing a first guided wheel, providing a second guided wheel, and pivoting the first guided wheel and the second guided wheel with respect to the vehicle.

[0009] Another embodiment of the invention is a method of transit. The method includes providing a frame having a first pin and a second pin longitudinally displaced, providing a first guide, pivotally connected to the first pin, and providing a second guide pivotally connected to the second pin.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention is illustrated by way of example and not limitation in the accompanying figures, in which like references indicate similar elements, and in which:

[0011] **FIG. 1** illustrates a top view of a pivot steering mechanism for a transit system, according to certain embodiments of the invention;

[0012] **FIG. 2** illustrates an end view, along line A-A' of **FIG. 1**, of the pivot steering mechanism for a transit system, according to certain embodiments of the invention; and

[0013] **FIG. 3** illustrates a top view of a transit vehicle foundation, including dual ones of the pivot steering mechanism for a transit system, according to certain embodiments of the invention.

DETAILED DESCRIPTION

[0014] Referring to **FIG. 1**, a pivot steering mechanism **100** includes an axle **102** and two wheels **104***a*, **104***b*. The wheels **104***a*, **104***b* are rotatingly fixed at respective ends of the axle **102**. The axle **102** is maintained within an axle housing **106**. The axle housing **106** includes a central, longitudinal void for holding the axle **102** in a freely rotating manner within the void. Although the axle housing **106** is shown as a single element in **FIG. 1**, the axle housing **106** is and can include any device for affixing the axle **102** in rotational relationship to any structures fixed to the axle housing **106**.

[0015] The axle housing **106** is pivotally fixed to struts **108***a*, **108***b* at or near respective ends of the axle housing, close to the respective wheels **104***a*, **104***b*. The struts **108***a*, **108***b* pivot with the axle housing **106** at the pivot points **110***a*, **110***b*, respectively. The struts **108***a*, **108***b* have another end not fixed via the pivot points **110***a*, **110***b* to the axle housing **106**.

[0016] Each other end of each of the struts **108***a*, **108***b* is fixed at respective ends of a guide bar **112**. The struts **108***a*,

108*b* pivot at the pivot points **114***a*, **114***b*, respectively, in relation to the guide bar **112**. The guide bar **112** is fixed or incorporated with a center point pivot **120**. The center point pivot **120** is a centrum for rotational movement of the entire combination of the wheels **104***a*, **104***b*, axle **102**, axle housing **106**, struts **108***a*, **108***b*, and guide bar **112** thereabout. The guide bar **112** is fixed to the center point pivot **120** at a midway location of the length of the guide bar **112**. The guide bar **112** is, thus, rotates around the point pivot **120** such that each half of the guide bar **112** is a spoke about the center point pivot **120**. The wheels **104***a*, **104***b*, axle **102**, axle housing **106**, and struts **108***a*, on the other hand, are maintained in relative relation about the pivot points **110***a*, **110***b* and **114***a*, **114***b* and are circularly rotatable around the center point pivot **120** always some length away from the location of the center point pivot **120**.

[**0017**] In operations, the guide bar **112** rotates around its midway at the center point pivot **120**. The struts **108***a*, **108***b*, in cooperation with the axle housing **106** and the axle **102** contained within the axle housing **106**, causes the axle **102** to remain substantially perpendicular to the direction of travel of arrow X. This operation causes the wheels **104***a*, **104***b* to roll on the axle **102** in substantially parallel direction to the arrow X of travel of the mechanism **100**.

[**0018**] Continuing to refer to **FIG. 1**, the axle housing **106** is fixedly connected to parallel bars **122***a*, **122***b*. The parallel bars **122***a*, **122***b* are fixed in perpendicular relation to the axle housing **106**. The parallel bars **122***a*, **122***b* extend along either side of the center point pivot **120**. As the axle housing **106** moves rotationally around the center point pivot **120**, the parallel bars **122***a*, **122***b* likewise rotate around the center point pivot **120** and maintain the perpendicular relation to the axle housing **106** and the parallel relation of the bars **122***a*, **122***b* across opposing sides to the center point pivot **120**.

[**0019**] The parallel bars **122***a*, **122***b* are substantially the same length, and extend sufficiently laterally beyond the wheels **104***a*, **104***b*. At an end of the parallel bars **122***a*, **122***b*, extending beyond the axle housing **106** on a same side of the center point pivot **120**, a front frame **130** is fixed to the parallel bars **122***a*, **122***b*. The front frame **130** is connected to guide wheel housings **132***a*, **132***b*, at each end of the front frame **130**. The guide wheel housings **132***a*, **132***b* fixed with the front frame **130** extend at least beyond a width of the wheels **104***a*, **104***b* in relation to the center point pivot **120**.

[**0020**] The guide wheel housings **132***a*, **132***b* each support a respective guide wheel **134***a*, **134***b* rotatingly affixed thereto. Each guide wheel **134***a*, **134***b* is a substantially round wheel centered and mounted with a vertical (outward from the page) rotational axis **136***a*, **136***b*. The guide wheels **134***a*, **134***b* each rotate around the respective rotational axis **136***a*, **136***b*. Whereas the wheels **104***a*, **104***b* travel along a surface, such as the ground, the guide wheels **134***a*, **134***b* can travel along a guide (hereafter further detailed) perpendicularly to the surface on which the wheels **104***a*, **104***b* travel.

[**0021**] At another end of the parallel bars **122***a*, **122***b*, a rear frame **140** is fixed perpendicular to the parallel bars **122***a*, **122***b*. The rear frame **140** is attached at its ends with respective guide wheel housings **142***a*, **142***b*. Like the guide wheel housings **134***a*, **134***b*, the guide wheel housings **142***a*, **142***b* are each affixed with a rotation axis **144***a*, **144***b*, rising vertically (i.e., upward in the page of **FIG. 1**). Each respective rotation axis **144***a*, **144***b* is fixed with a guide wheel **146***a*, **146***b* that rotates on the rotation axis **144***a*. Like the guide wheels **134***a*, **134***b*, the guide wheels **146***a*, **146***b* can travel along a guide perpendicularly to the surface on which the wheels **104***a*, **104***b* travel.

[**0022**] Referring to **FIG. 2**, a rear view along line A-A' of **FIG. 1** shows the mechanism **100** and relative orientation of the wheels **104***a*, **104***b* and the guide wheels **146***a*, **146***b*. Although not shown in detail in the Figures, a front view of the mechanism **100** would also show a substantially similar relative orientation of the wheels **104***a*, **104***b* and the guide wheels **134***a*, **134***b*. The rear frame **140** is substantially horizontal with a surface on which the wheels **104***a*, **104***b* can roll. The parallel bars **122***a*, **122***b*, and the respective guide wheel housings **142***a*, **142***b* fixed to the rear frame **140**, each rotate around the center point pivot **120** for the mechanism **100**.

[**0023**] Referring to **FIG. 3**, a transit vehicle **300** includes two opposingly configured pivot steering mechanisms **100***a*, **100***b*. Each pivot steering mechanism **100***a*, **100***b* is fixed at its center point pivot **120** to a vehicle base **302**. The vehicle base **302** is a chassis or other foundation atop which can be fixed a vehicle housing (not shown in figure), such as a passenger compartment. The vehicle base **302** extends a length beyond each mechanism **100***a*, **100***b*. Each mechanism **100***a*, **100***b* is located under the vehicle base **302**, and the vehicle base **302** (and any vehicle housing fixed to it) is fixed with each mechanism **100***a*, **100***b* via the respective center point pivot **120**.

[**0024**] Respective and parallel extending guides **304***a,b* form a guided path in which the entire structure of the transit vehicle **300** can travel. The guides **304***a,b* extend upward from a travel surface on which the wheels **104***a,b* of each mechanism **100***a*, **100***b* can travel. For example, if the wheels **104***a*, **104***b* travel along a relatively horizontal ground surface, the guides **304***a,b* are rails extending along the surface and forming an upwardly projecting side. The adjacent and upwardly projecting sides of the guides **304***a,b* serve to retain the respective guide wheels **134***a*, **134***b* and **146***a*, **146***b* of each of the mechanisms **100***a*, **100***b* between the guides **304***a,b*.

[**0025**] In operation, the center point pivot **120** of each mechanism **100***a,b* is retained in approximately a center of the travel path formed by the guide rails **304***a,b*. If and when the guide rails **304***a,b* vary from exact straight extension, the mechanisms **100***a, b* are maintained between the guide rails **304***a,b*. Nonetheless, the vehicle base **302** need not be bendable or otherwise jointed in order to continue in the path formed between the guide rails **304***a,b*. Moreover, the respective guide wheels **134***a*, **134***b* and **146***a*, **146***b* of each mechanism **100***a*, **100***b* can continue along the guide rails **304***a*, **304***b* of the path, because each mechanism **100***a*, **100***b* is able to rotate laterally in relation to the vehicle base **302**, via the respective center pivot point **120**.

[**0026**] Furthermore as to operation, the entire transit vehicle **300** is automatically steered and guided in an appropriate path by the guide rails **304***a*, **304***b* forming the travel path. The wheels **104***a*, **104***b* of each mechanism **100***a,b* are aligned to rotatingly travel along the appropriate path, because the wheels **104***a*, **104***b* are automatically aligned therein in travel, as the guide wheels **134***a,b* and

146*a,b* travel within and along the guide rails **304***a,b*. The double pivot arrangement of the vehicle **300** permits travel along any path by the vehicle, corresponding to the appropriate and desired path formed via the guide rails **304***a,b*.

[**0027**] The steering provided by the foregoing will permit travel of the vehicle **300** along most any desired path, including along conventional mass transit roads and the like. Moreover, the vehicle **300** is not restricted to travel on any railway or other particular surface. The wheels **140***a,b* of the vehicle **300** can be regular tires or other round wheels. If the vehicle **300** is incorporated with a manual or other steering assemblage, the vehicle can travel along as so steered. In such instance, the guide rails **304***a,b* would not be limiting. Moreover, the vehicle **300** can be equipped with a drive train and engine or motor. In such instance, the vehicle **300** can automatically travel as driven, either along a path formed by guide rails **304***a,b* or along any other path provided there is some other steering assemblage or path. In any event, the vehicle **300** is not limited to operations of travel via or within guide rails **304***a,b* or any other particular path. On the other hand, the dual mechanism **100***a,b* arrangement and center point pivot **120** thereof, allows any type of vehicle base **302** (and vehicle housing) to effectively travel within a guide rail **304***a,b* path.

[**0028**] For other examples and alternatives, the Exhibit A hereto and incorporated herein includes additional features and concepts. All such examples and alternatives, together with the features and concepts, are included herein and in the invention.

[**0029**] In the foregoing specification, the invention has been described with reference to specific embodiments. However, one of ordinary skill in the art appreciates that various modifications and changes can be made without departing from the scope of the present invention as set forth in the claims below. Accordingly, the specification and figures are to be regarded in an illustrative rather than a restrictive sense, and all such modifications are intended to be included within the scope of the present invention.

[**0030**] Benefits, other advantages, and solutions to problems have been described above with regard to specific embodiments. However, the benefits, advantages, solutions to problems and any element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential feature or element of any or all the claims. As used herein, the terms "comprises, "comprising," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus.

What is claimed is:

1. A system for guided travel over a surface between parallel guide rails, comprising:

a first frame including at least one rotatable element for travel over the surface;

a first pin connected to the first frame, for rotation of the first frame thereon;

a second frame including at least one rotatable element for travel over the surface;

a second pin connected to the second frame, for rotation of the second frame thereon; and

a base connected to the first pin and the second pin.

2. The system of claim 1, wherein the first frame and the second frame each travel retained between the guide rails.

3. The system of claim 1, wherein the guide rails are substantially perpendicular to the surface.

4. The system of claim 3, wherein the first frame and the second frame each travel retained between the guide rails.

5. The system of claim 4, further comprising a guide wheel for tracking along the guide rail, wherein the guide wheel is rotatingly attached to the first frame or the second frame.

6. A transport system for travel over a surface, comprising:

a wheel for travel on the surface;

a frame on which the wheel is rotatingly fixed;

a guide fixed to the surface; and

a roller, rotatingly fixed to the frame, for travel in close proximity to and along the guide.

7. The transport system of claim 6, further comprising:

a second wheel for travel on the surface, rotatingly affixed to the frame.

8. The transport system of claim 7, further comprising:

a second guide fixed to the surface in substantially parallel relationship to the first guide; and

a second roller, rotatingly fixed to the frame for travel in close proximity to and along the second guide.

9. The system of claim 8, wherein the first roller and the second roller travel between the first and second guide rails.

10. The system of claim 9, further comprising a second frame, wherein the second frame includes a first and second roller, each rotatingly fixed to the second frame and traveling along respective ones of the first and second guide rails.

11. The system of claim 10, further comprising:

a vehicle structure, connected independently to each of the first frame and the second frame.

12. The system of claim 11, further comprising:

a first pin fixedly connected to the vehicle structure, and pivotally affixed to the first frame.

13. The system **12**, further comprising:

a second pin fixedly connected to the vehicle structure, and pivotally affixed to the second frame.

14. The system of claim 13, wherein the first pin and the second pin are centrally locatable between the first and second guides during transit.

15. A method of transit of a vehicle, comprising the steps of:

providing a first guided wheel;

providing a second guided wheel; and

pivoting the first guided wheel and the second guided wheel with respect to the vehicle.

16. The method of claim 15, wherein the first guided wheel and the second guided wheel travel along substantially parallel to a guide.

17. A method of transit, comprising the steps of:

providing a frame having a first pin and a second pin longitudinally displaced;

providing a first guide, pivotally connected to the first pin; and

providing a second guide pivotally connected to the second pin.

18. The method of claim 17, further comprising the steps of:

providing a first wheel rotatingly connected to the first guide; and

providing a second wheel rotatingly connected to the second guide.

19. The method of claim 18, wherein the first wheel and the second wheel travel across a surface during transit.

20. The method of claim 19, wherein the first wheel and the second wheel are retained between longitudinally parallel guides along a desired path of the transit; and wherein the first wheel and the second wheel each travel between the guides during transit.

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