



US 20060060106A1

(19) **United States**(12) **Patent Application Publication****Ueda**(10) **Pub. No.: US 2006/0060106 A1**(43) **Pub. Date: Mar. 23, 2006**(54) **STACKER CRANE****Publication Classification**(75) **Inventor: Yuichi Ueda, Kasugai-shi (JP)**(51) **Int. Cl.**
B61B 13/04 (2006.01)(52) **U.S. Cl.** **105/144**

Correspondence Address:
THE WEBB LAW FIRM, P.C.
700 KOPPERS BUILDING
436 SEVENTH AVENUE
PITTSBURGH, PA 15219 (US)

(57) **ABSTRACT**

It is an object to provide a stacker crane that is configured to move on a single rail provided along one or more racks, and that includes: a first wheel that moves on the rail; a vehicle frame supported by the first wheel; a first motor that is supported by the vehicle frame such that the first motor is disposed on a right side of the first wheel, and that is capable of driving the first wheel; and a second motor that is supported by the vehicle frame such that the second wheel is disposed on a left side of the first wheel, and that is capable of driving the first wheel.

(73) **Assignee: DAIFUKU CO., LTD., Osaka (JP)**(21) **Appl. No.: 11/213,616**(22) **Filed: Aug. 26, 2005**(30) **Foreign Application Priority Data**

Sep. 9, 2004 (JP) PAT. 2004-262334

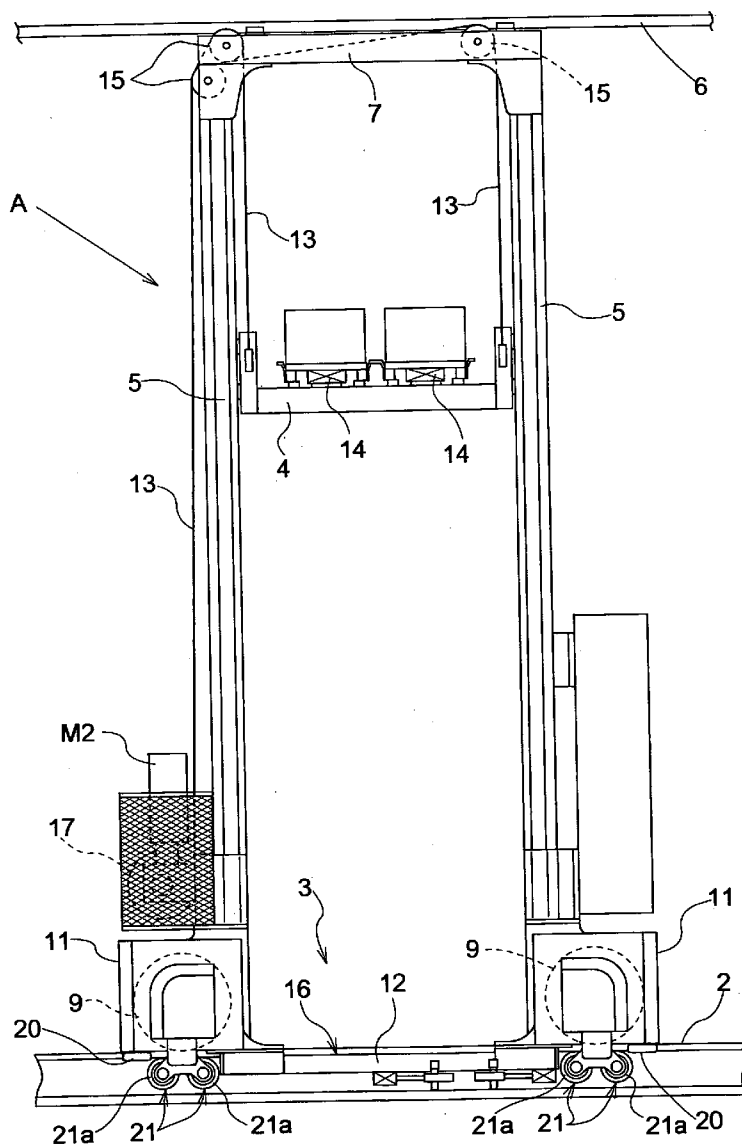
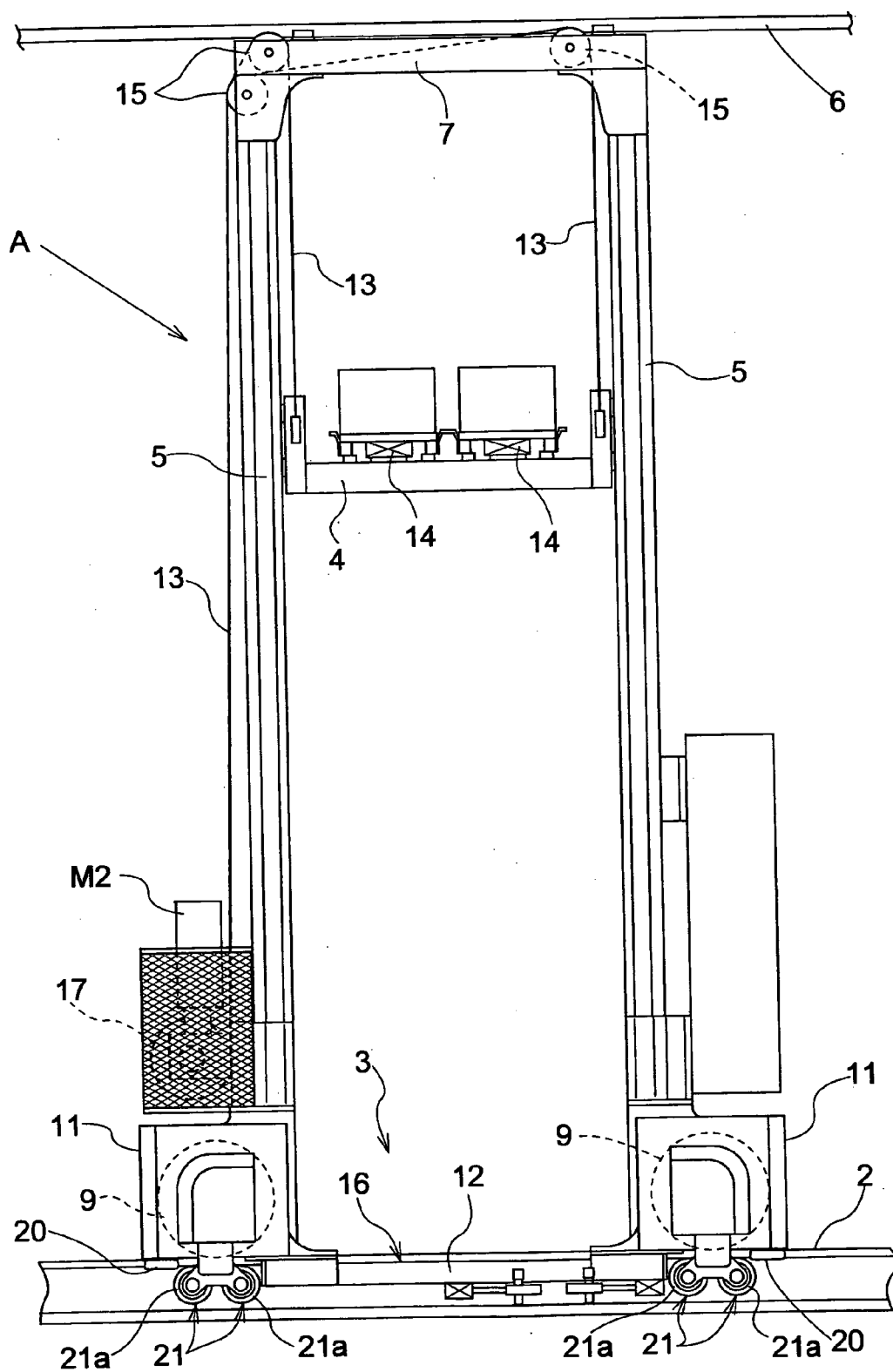


FIG. 1



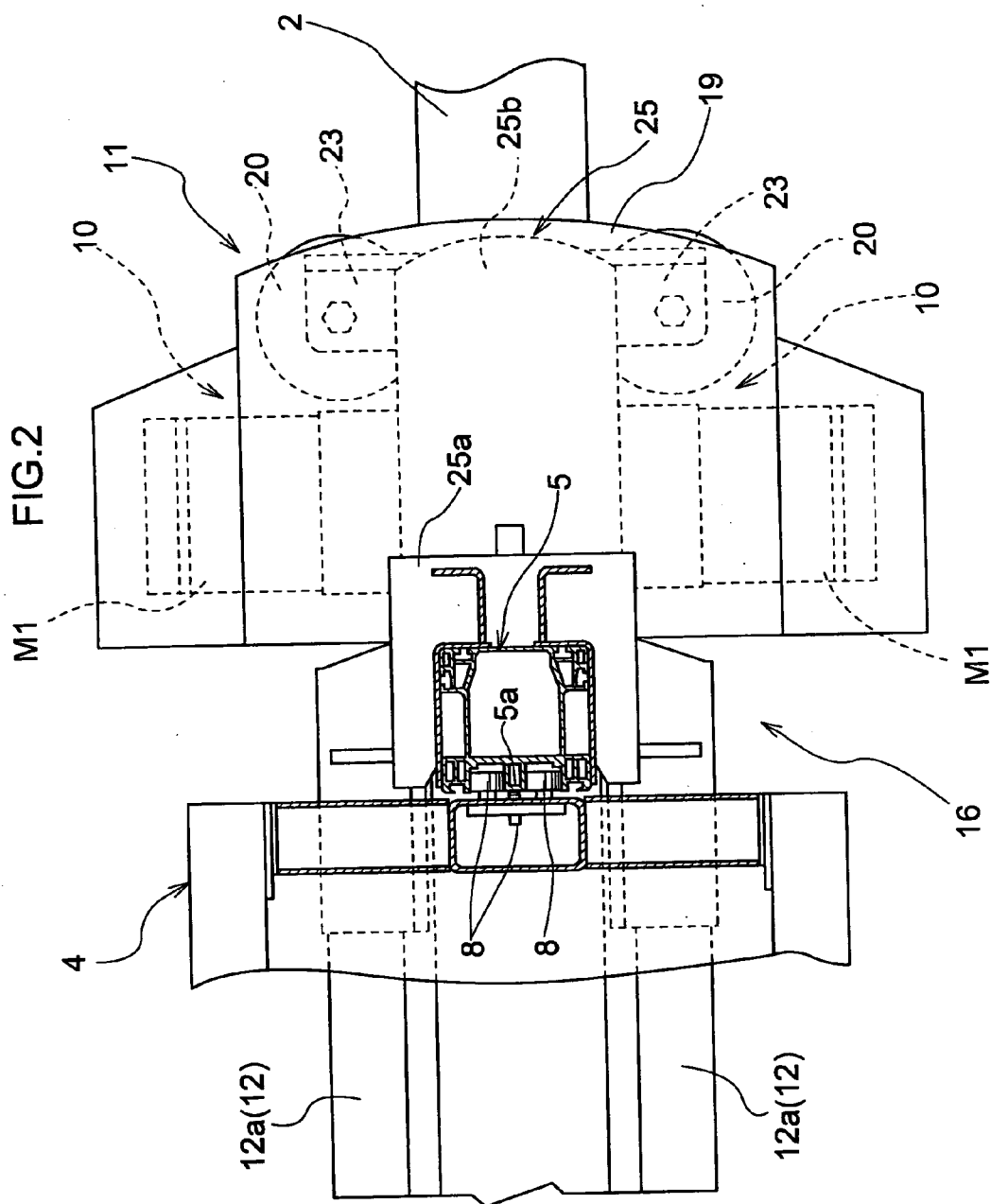


FIG.3

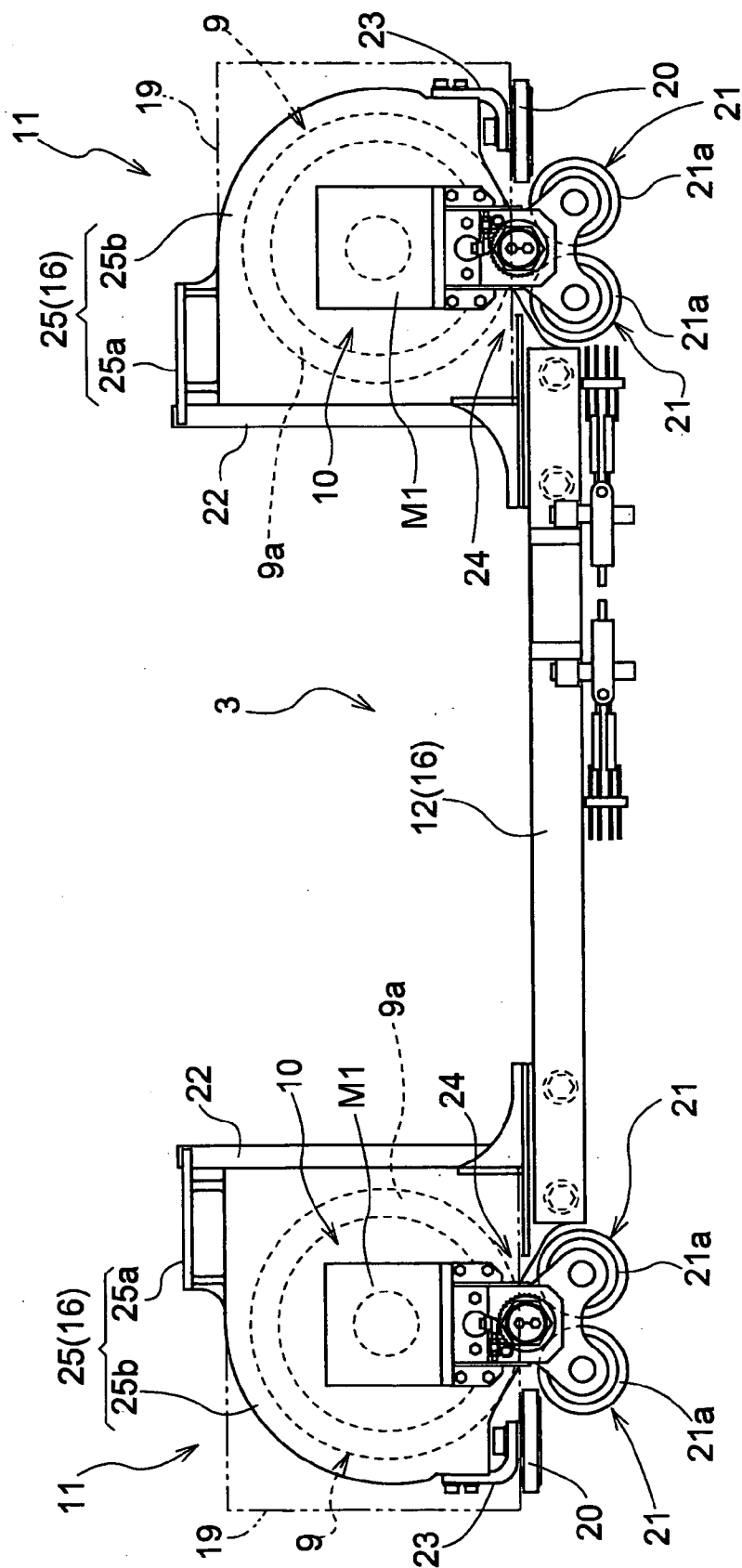


FIG.4

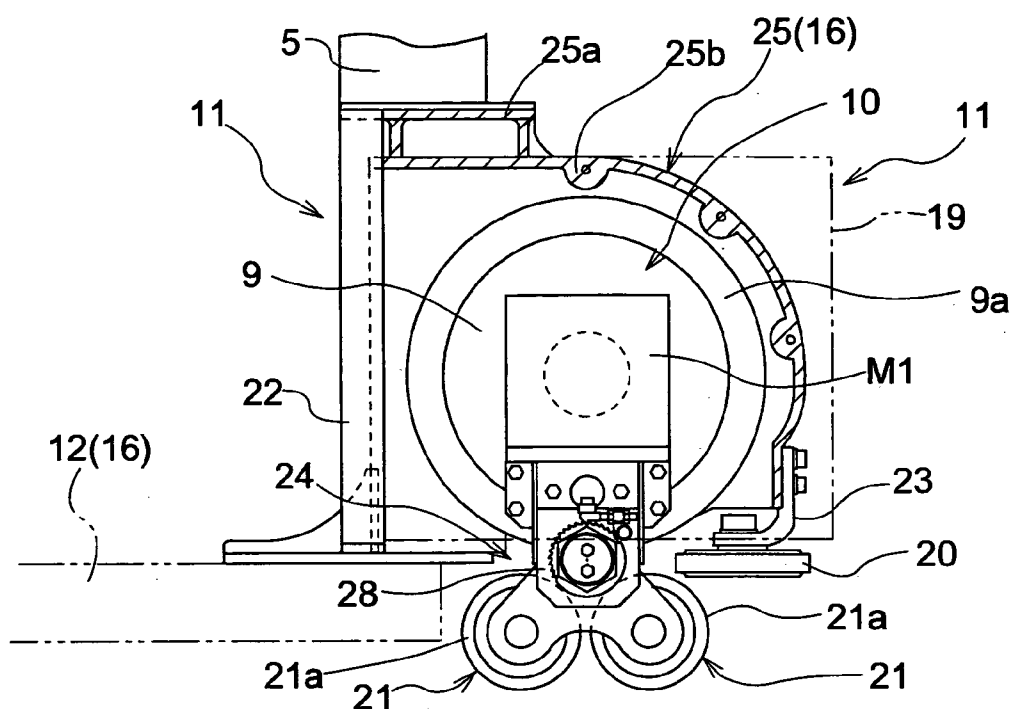


FIG.5

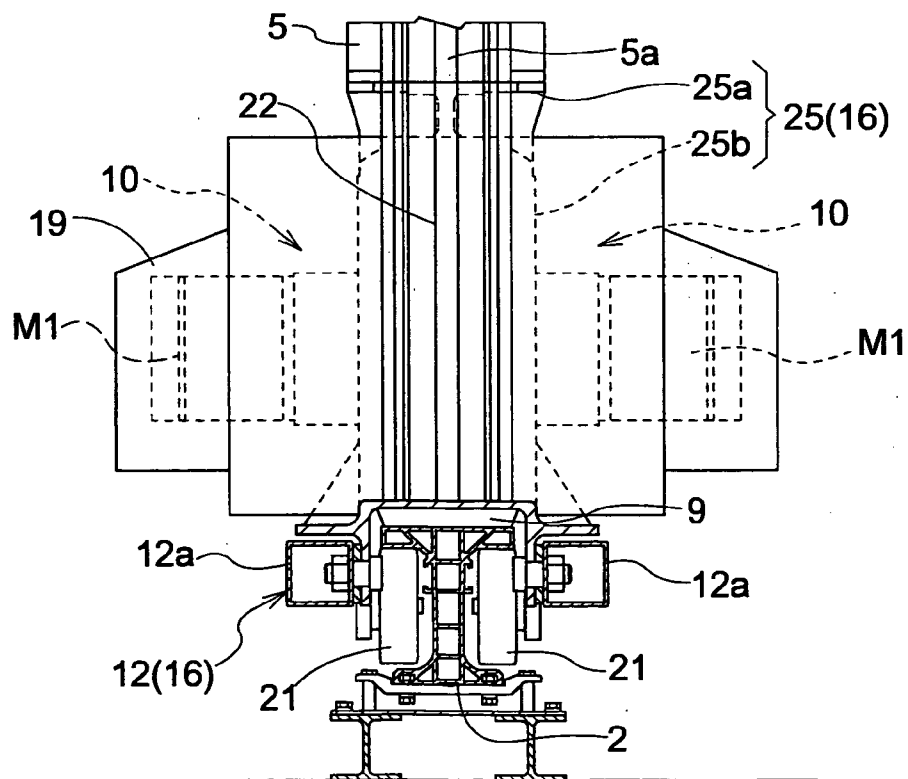


FIG.6

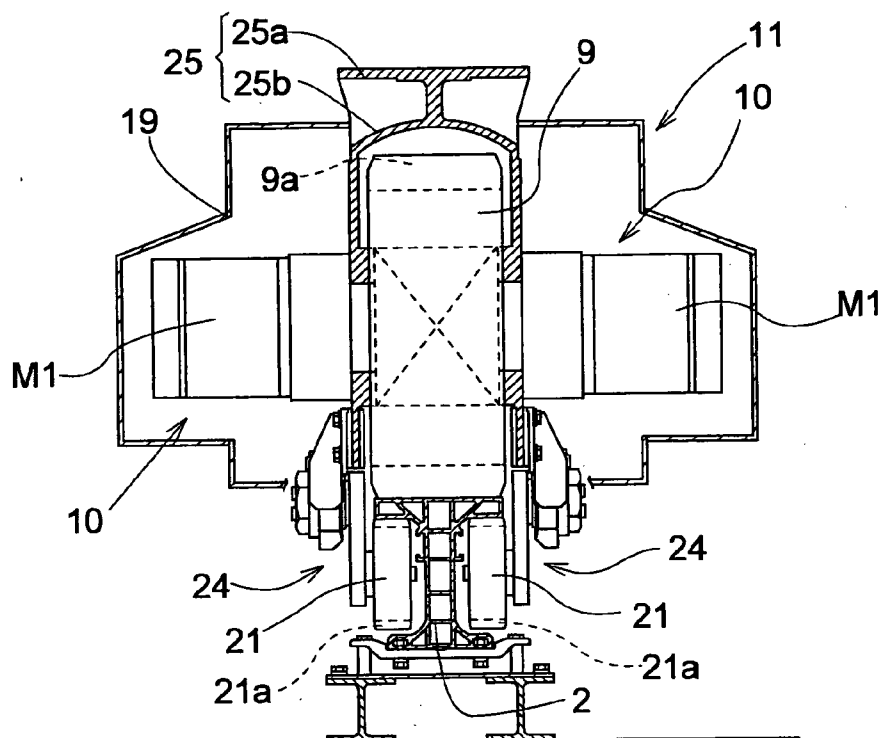


FIG.7

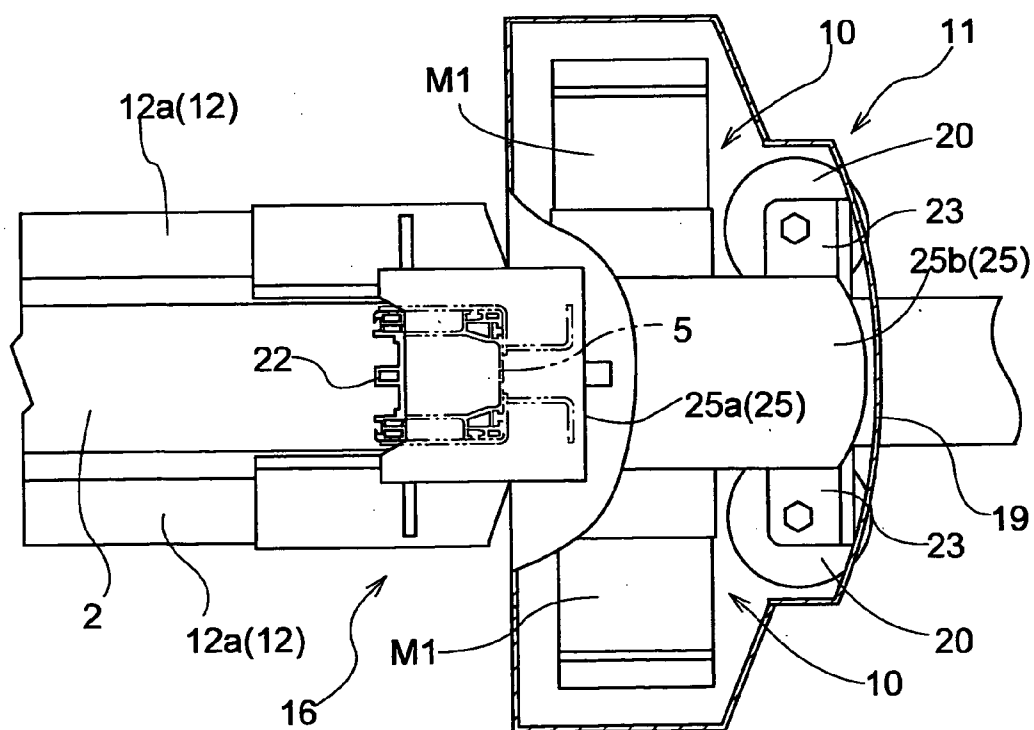


FIG.8

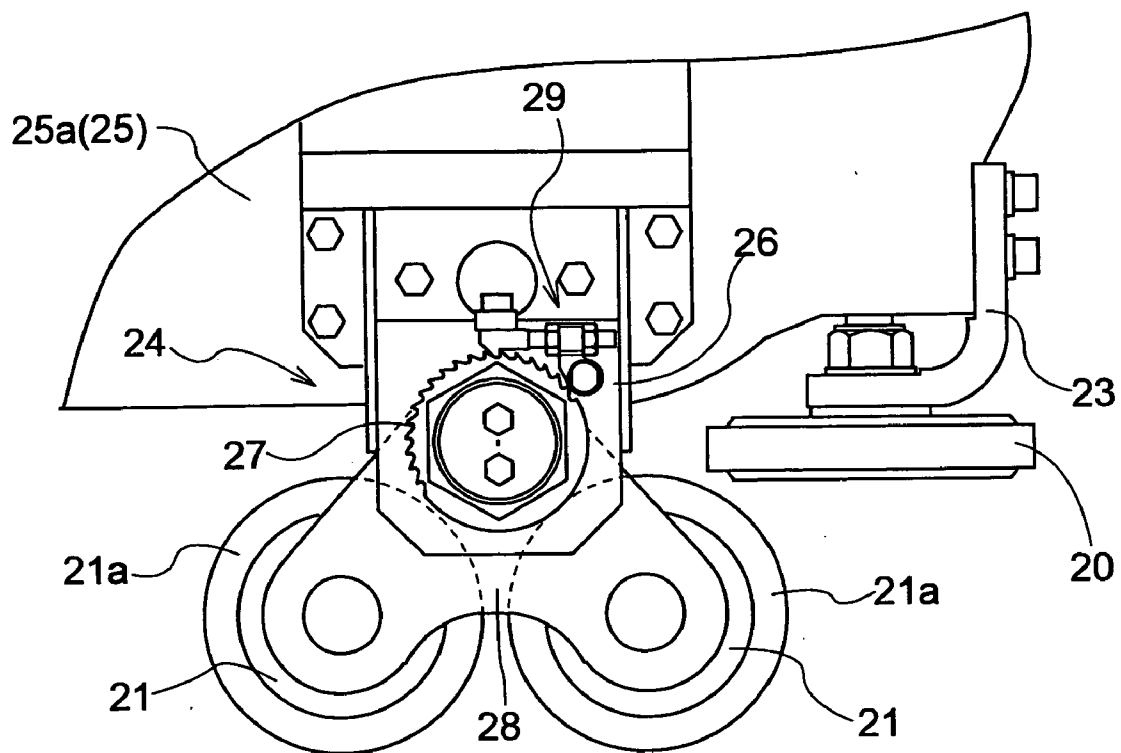
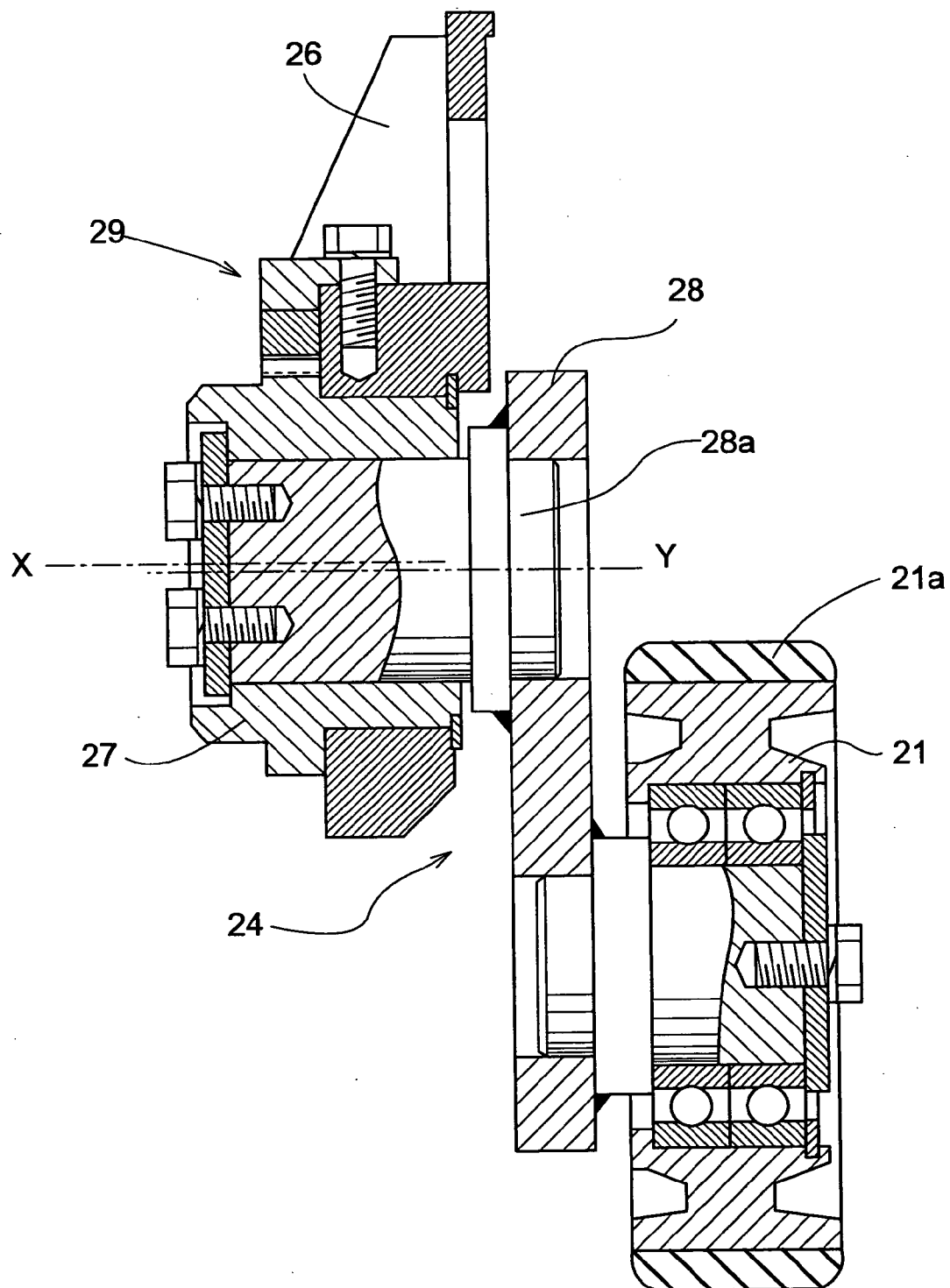


FIG.9



STACKER CRANE

BACKGROUND OF THE INVENTION

[0001] The present invention relates to stacker cranes.

[0002] Stacker cranes are provided with a travel motor that rotatively drives travel wheels, moving the stacker crane along a travel rail in order to transport articles. Conventionally, the travel wheels are rotatably supported at the left center and right center of the vehicle frame, and the travel motor is supported on the vehicle frame on only one side of the travel wheels. With this configuration, one travel motor is employed to rotatively drive one travel wheel (see JP 2002-046809A, for example).

[0003] In the conventional configuration described above, the travel motors are supported on the vehicle frame positioned on one side portion of the travel wheels, and therefore the weight of the travel motors was concentrated on one side portion of the travel wheels on the vehicle frame. There thus was room for improvement in terms of the lateral balance of the weight of the stacker crane.

SUMMARY OF THE INVENTION

[0004] The present invention was arrived at in view of the above circumstances, and it is an object thereof to provide a stacker crane with improved lateral weight balance.

[0005] A stacker crane according to the invention is configured so as to move on a single rail provided along racks, and includes:

[0006] a first wheel that moves on the rail;

[0007] a vehicle frame supported by the first wheel;

[0008] a first motor that is supported by the vehicle frame such that the first motor is disposed on a right side of the first wheel, and that is capable of driving the first wheel; and

[0009] a second motor that is supported by the vehicle frame such that the second wheel is disposed on a left side of the first wheel, and that is capable of driving the first wheel.

[0010] Since the motors are arranged on both sides of the wheel, it is possible to provide a stacker crane that has better balance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a lateral view of a stacker crane.

[0012] FIG. 2 is a cross-sectional view of a support post.

[0013] FIG. 3 is a lateral view of a travel vehicle.

[0014] FIG. 4 is a lateral view of a travel drive unit.

[0015] FIG. 5 is a front view of the travel drive unit.

[0016] FIG. 6 is a front cross-sectional view of the travel drive unit.

[0017] FIG. 7 is a plan cross-sectional view of the travel drive unit.

[0018] FIG. 8 is a lateral view of the adjustment means.

[0019] FIG. 9 is a front view of an adjustment mechanism.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] Hereinafter, embodiments of a stacker crane according to the present invention are described with reference to the drawings. Throughout the specification the term "fore-and-aft direction" is used to indicate the orientation along which the stacker crane A moves.

[0021] As shown in FIG. 1, a stacker crane A travels over a single travel rail 2 disposed on a floor surface along a work path formed between storage racks. A travel vehicle 3 that travels along the travel rail 2 is provided with a pair of support posts 5, with a spacing between them in the longitudinal or the fore-and-aft direction, that serve as guides for raising and lowering a vertically movable platform 4. The upper end portions of the support posts 5 are linked to each other by an upper frame 7 that is guided along a guide rail 6 disposed above the work path. The stacker crane A automatically moves over the work path and transfers articles to and from the storage racks. The stacker crane A and the storage racks together make up an automated warehouse.

[0022] A raising and lowering wire 13 is connected to the front and rear end portions of the vertically movable platform 4, supporting the vertically movable platform 4 in a suspended manner. Two article transferring devices 14 are arranged side by side in the front-to-back direction, that is, the direction in which the travel vehicle 3 moves, on the vertically movable platform 4, and the article transferring devices 14 transfer articles between the storage racks and the stacker crane A.

[0023] As for the raising and lowering wire 13, one of its ends is connected to the vertically movable platform 4, its middle portion is wound over driven pulleys 15 that are provided on the upper frame 7, and its other end is connected to a winding drum 17 that is supported on one of the pair of front and rear support posts 5. Accordingly, the vertically movable platform 4 is drivingly raised and lowered through the action of winding out or winding in the raising and lowering wire 13 by rotatively driving the winding drum 17 forward and in reverse with an electric motor for raising and lowering M2.

[0024] As shown in FIG. 2, the support posts 5 serve as guides for guide rollers 8 (guided portions) provided on the vertically movable platform 4. A recessed portion is provided in the longitudinal direction in one face of each of the support posts 5, and a projecting portion 5a (guide portion) is provided within the recessed portion. The configuration is such that the guide rollers 8 are guided by the projecting portion 5a, thereby guiding the vertically movable platform 4 along the raising and lowering path.

[0025] As shown in FIG. 2, three guide rollers 8 that abut against the top surface and the two side faces of the projecting portion 5a, respectively, are provided at the front end portion and at the rear end portion of the vertically movable platform 4. When drivingly raising or lowering the vertically movable platform 4 by the electric motor for raising and lowering M2 rotatively driving the winding drum 17 in the forward or reverse direction, the vertically movable platform 4 is guidingly raised or lowered while movement thereof in the fore-and-aft and lateral directions on the support post 5 is restricted by the guide rollers 8

abutting against the projecting portion **5a**, and thus the vertically movable platform **4** is raised and lowered along the raising and lowering path.

[0026] The travel vehicle **3** is described next.

[0027] As shown in **FIG. 3**, the travel vehicle **3** is provided with a pair of travel wheels **9**, disposed with a spacing therebetween in the fore-and-aft direction, that are rotatively driven by drive means **10** and travel along the travel rail **2**. The drive means **10** is fixedly supported on a vehicle frame **16** in the travel vehicle **3**, and the travel wheels **9** are rotatably supported at the front end portion and the rear end portion of the vehicle frame **16**. The drive means **10** is provided for each the travel wheel **9**.

[0028] As shown in **FIG. 5**, the travel wheels **9** are rotatably supported to the left and right of the center of the vehicle frame **16**, and the drive means **10** is provided with a pair of left and right travel motors **M1** supported on the vehicle frame **16** and located to the right and the left of the travel wheels **9**. The right and left travel motors **M1** are configured so as to rotatively drive one travel wheel **9** each, and thus the two front and rear travel wheels **9** are rotatively driven by a total of four travel motors **M1**.

[0029] As shown in **FIGS. 2 and 5**, the vehicle frame **16** is configured by connecting a pair of front and rear support frames **25** that support the travel wheels **9** and the drive means **10**, via a connection frame **12**. The connection frame **12** is constituted by right and left frame members **12a** located on the respective side of the travel rail **2**.

[0030] Each support frame **25** is configured such that the travel wheels **9** are rotatably supported to the left and right of center, the travel motors **M1** are fixedly supported on the right and left side portions, and the lower end portion of the support post **5** is connected to supported by the upper end portion. The travel wheel **9** and the drive means **10** are incorporated into a single unit with the support frame **25**, thereby forming a travel drive unit **11**.

[0031] The travel drive units **11** are described next.

[0032] As shown in **FIGS. 4 to 7**, in addition to the travel wheel **9**, the drive means **10**, and the support frame **25**, each travel drive unit **11** is provided with a unit cover **19** that covers the drive means **10**, a pair of guide wheels **20** that are in contact with the travel rail **2** in order to restrict lateral movement of the stacker crane **A** with respect to the travel rail **2** and that guide the stacker crane **A** along the travel rail **2**, restriction wheels **21** that are in contact with the travel rail **2** so as to restrict upward movement and thereby restrict upward floating of the travel wheel **9** from the travel rail **2**, and a servo-type adjustment means **24** for adjusting the contact pressure of the restriction wheels **21** against the travel rail **2** by raising or lowering the restriction wheels **21**.

[0033] An annular travel tire portion **9a**, which is an elastic member made of urethane rubber, is attached to the outer circumferential portion of the travel wheel **9**, and restriction tire portions **21a**, which are annular elastic members made of urethane rubber, are attached to the outer circumferential portion of the restriction wheels **21**.

[0034] In other words, the configuration is such that lateral movement of the stacker crane **A** with respect to the travel rail **2** is restricted by the guide wheels **20** abutting against the side faces of the travel rail **2**, so that the stacker crane **A** is

moved over and along the travel rail **2** by rotatively driving the travel wheels **9** with the drive means **10** so that the travel wheels **9** travel over the upper face of the travel rail **2**, which has a T-shaped cross-sectional shape when viewed in the fore-and-aft direction. Further, the travel wheels **9** are kept from floating upward from the travel rail **2** by the restriction wheels **21** abutting against the lower face of the travel rail **2**, keeping the travel wheels **9** from floating upward when the stacker crane **A** is accelerated or decelerated and thereby preventing the travel wheels **9** from slipping.

[0035] As shown in **FIG. 5**, an extension guide rail **22** for guiding the guide rollers **8** of the vertically movable platform **4** upward and downward is provided on the support frames **25** in such a manner that it is continuous with the projecting portion **5a** of the support post **5**. These allow the raising and the lowering platform **4** to be lowered close to the lower end of the stacker crane **A**.

[0036] As shown in **FIG. 6**, the travel wheels **9** are supported in such a manner that they can rotate about an axis in the horizontal direction with respect to the support frame **25**. The drive means **10** are supported on the support frame **25** in such a manner that they are located on either side of the travel wheels **9**. The drive means **10** are configured such that the travel motors **M1** are fixedly supported on the right side and the left side portion of the support frame **25**, the right and left travel motors **M1** together rotatively driving one travel wheel **9**. It should be noted that the drive means **10** each are provided with a braking mechanism, which is not shown because it is conventional art, in addition to the travel motors **M1**. The drive means **10** can also include a deceleration gear mechanism.

[0037] Describing the support frame **25** more specifically, as shown in **FIGS. 4 and 6**, the support frame **25** includes a support platform portion **25a** for supporting the lower end portion of the support post **5**, and right and left support portions **25b** that are positioned below the support platform portion **25a** and that are for supporting the travel wheels **9** and the drive means **10**.

[0038] The lower end of the support post **5** is connected to the support platform portion **25a** through a flange provided at the lower end of the support post **5** and nuts and bolts, and the support post **5** is supported such that the lower end of the support post **5** is positioned above the upper end of the travel wheels **9** and the upper end of the drive means **10**.

[0039] Furthermore, the travel wheel **9** is supported between the right support portion **25b** and the left support portion **25b** in such a manner that it can rotate about an axis in the horizontal direction. The travel motors **M1** are fixedly supported to the outer face side of the right support portion **25b** and the left support portion **25b**, and each travel motor **M1** is provided on the support frame **25** so that the drive shaft of the travel motor **M1** rotates about the same axis as the travel wheel **9**.

[0040] As shown in **FIGS. 4 and 7**, the frame members **12a** are connected to the rear end portions of the left and right support portions **25b** of the front-side support frame **25** and to the front end portions of the left and right support portions **25b** of the rear-side support frame **25**, and thus the pair of front and rear support frames **25** are connected via the connection frame **12**.

[0041] The guide wheels **20** are supported at the front end portions of the left and right support portions **25b** of the

front-side support frame **25** and at the rear end portions of the left and right support portions **25b** of the rear-side support frame **25**, in such a manner that they can rotate about a vertical axis via guide support members **23**.

[0042] Further, the restriction wheels **21** are supported at a central portion in the front-to-back direction of the left and right support portions **25b** of the front-side support frame **25** and at a central portion in the front-to-back direction of the left and right support portions **25b** of the rear-side support frame **25**, in such a manner that they can rotate about a horizontal axis via the adjustment means **24**.

[0043] The restriction wheels **21** are supported by the support frames **25** in such a manner that they are in contact with the travel rail **2** with contact pressure that is due to the elasticity of the restriction tire portions **21a**. The restriction wheels **21**, being in contact with the lower face of the travel rail **2** with the contact pressure, keep the travel wheels **9** from floating upward from the travel rail **2**. Each restriction wheel **21** is supported in such a manner that it can be raised and lowered with respect to the corresponding travel drive unit **11**, and the contact pressure applied by the restriction wheels **21** to the travel rail **2** is adjusted by raising and lowering the restriction wheels **21** with the adjustment means **24** so as to elastically deform the restriction tire portions **21a**.

[0044] Describing the adjustment means **24** more specifically, as shown in FIGS. **6**, **8**, and **9**, the adjustment means **24** is a servo-type eccentric cam mechanism that is provided with an operation member **27** that is supported by a base holder **26**, which is fixedly supported to the outer surface side of the right support portion **25b** and the left support portion **25b** of the support frame **25**, in such a manner that it can freely rotate about a horizontal axis, and a support member **28** that rotatively supports the pair of front and rear restriction wheels **21** via bearings and that is fitted into and supported by the operation member **27** in such a manner that it can pivot deviated with respect to the rotation axis of the operation member **27**. The adjustment means **24** is also provided with a lock mechanism **29** that can switch between a fastened state where rotation of the operation member **27** is locked and an unfastened state in which the lock on rotation is released.

[0045] As shown in FIG. **9**, the configuration of the eccentric cam mechanism of the support member **28** is such that the shaft portion **28a** of the support member **28** is supported by the operation member **27** in such a manner that its pivot axis **Y** is parallel to the rotation axis **X** of the operation member **27** but deviated from the rotation axis **X**, so that by rotatively actuating the shaft portion **28a** about the rotation axis **X**, the shaft portion **28a** rotates in a relative manner about the pivot axis **Y** due to its own weight and being abutted against the travel rail **2**, causing the support member **28** to move along the rotation axis **X** while maintaining its orientation. As a result, the support member **28** is raised and lowered with respect to the travel drive unit **11**. Also, by raising and lowering the support member **28** in this manner, the two restriction wheels **21** supported by the support member **28** are also raised and lowered with respect to the travel drive unit **11**, causing the restriction tire portions **21a** to be elastically deformed due to abutting against the lower surface of the travel rail **2** and therefore altering the contact pressure of the restriction wheels **21** with respect to the travel rail **2**.

Other Embodiments

[0046] (1) In the foregoing embodiment, a pair of front and rear travel wheels **9** that are rotatively driven by the drive means **10** are arranged at the front end portion and the rear end portion of the vehicle frame **16**. However, it is also possible to adopt a configuration in which a travel wheel **9** is provided at only one of either the front end portion or the rear end portion of the vehicle frame **16**, and a driven wheel that freely rotates is provided at the front end portion or the rear end portion of the vehicle frame **16** that has not been provided with the travel wheel **9**.

[0047] (2) In the foregoing embodiment, the vehicle frame **16** is achieved by connecting the front and rear support frames **25** via the connection frame **12**, but it is also possible for the vehicle frame **16** to be made of a single frame.

[0048] In the aforementioned embodiment, the travel wheels **9** and the drive means **10** are supported by the support frames **25**, but it is also possible for the travel wheels **9** and the drive means **10** to be supported by the connection frame **12**.

[0049] (3) In the foregoing embodiment, the lower ends of the support posts **5** are connected to and supported by the upper portions of the support frames **25**, but it is also possible for the lower ends of the support posts **5** to be connected to and supported by the lower, forward, or rear portions of the support frames **25**, or alternatively, for the lower ends of the support posts **5** to be connected to and supported by the vehicle frame **16**.

[0050] (4) In the foregoing embodiment, each travel motor **M1** is provided such that the drive shaft of the travel motor **M1** rotates about the same axis as the travel wheel **9**. However, it is also possible to provide each travel motor **M1** in such a manner that the rotation axis of its drive shaft is oriented vertically, for example, and thus the drive shaft of the travel motor **M1** does not rotate about the same axis as the travel wheel **9**.

[0051] (5) In the foregoing embodiment, the restriction wheels **21** are supported by the support frame **25** in such a manner that they are in contact with the travel rail **2** with a contact pressure due to the elasticity of the elastic members **21a**. However, it is also possible for the restriction wheels **21** to be supported by the support frame **25** in such a manner that they are in contact with the travel rail **2** with a contact pressure, without providing the elastic members **21a**.

What is claimed is:

1. A stacker crane that is configured to move on a single rail provided along one or more racks, comprising:

a first wheel that moves on the rail;

a vehicle frame supported by the first wheel;

a first motor that is supported by the vehicle frame such that the first motor is disposed on a right side of the first wheel, and that is capable of driving the first wheel; and

a second motor that is supported by the vehicle frame such that the second wheel is disposed on a left side of the first wheel, and that is capable of driving the first wheel.

2. The stacker crane according to claim 1, further comprising:

a second wheel that is disposed spaced apart from the first wheel in a fore-and-aft direction, and that supports the vehicle frame;

- a third motor that is supported by the vehicle frame such that the third motor is disposed on a right side of the second wheel, and that is capable of driving the second wheel; and
- a fourth motor that is supported by the vehicle frame such that the fourth wheel is disposed on a left side of the second wheel, and that is capable of driving the second wheel.
- 3.** The stacker crane according to claim 2,
- wherein the first wheel is disposed at a front end portion of the vehicle frame; and
- wherein the second wheel is disposed at a rear end portion of the vehicle frame.
- 4.** The stacker crane according to claim 3,
- wherein the vehicle frame comprises:
- a first support frame that supports the first wheel and the first and the second motors;
 - a second support frame that supports the second wheel and the third and the fourth motors; and
 - a connection frame that connects the first support frame and the second support frame.
- 5.** The stacker crane according to claim 1, further comprising:
- a first support post that is fixed to the vehicle frame;
 - a second support post that is fixed on the vehicle frame, spaced apart from the first support post in a fore-and-aft direction; and
 - a vertically movable platform that is guided by the first support post and the second support post, and that is capable of moving vertically with respect to the vehicle frame;
- wherein the vertically movable platform is provided with a first article transferring device that is capable of transferring articles to the one or more of the racks.
- 6.** The stacker crane according to claim 5, further comprising:
- a second article transferring device that is provided on the vertically movable platform, and that is capable of transferring articles to the one or more of the racks.
- 7.** The stacker crane according to claim 5, further comprising:
- a guide portion that abuts against a roller provided on the vertically movable platform, and that is formed in each of the first and the second support posts.
- 8.** The stacker crane according to claim 1,
- wherein a rotation axis of the first wheel and a rotation axis of the first motor are disposed coaxially, and the rotation axis of the first wheel and a rotation axis of the second motor are disposed coaxially.
- 9.** The stacker crane according to claim 2,
- wherein a rotation axis of the second wheel and a rotation axis of the third motor are disposed coaxially, and the rotation axis of the second wheel and a rotation axis of the fourth motor are disposed coaxially.
- 10.** The stacker crane according to claim 1, further comprising:
- a first restriction wheel that is supported by and rotatable with respect to the vehicle frame, and that restricts lifting of the first wheel from the rail.
- 11.** The stacker crane according to claim 10, further comprising:
- a second restriction wheel that is supported by and rotatable with respect to the vehicle frame, and that works in collaboration with the first restriction wheel to restrict lifting of the first wheel from the rail.
- 12.** The stacker crane according to claim 11, further comprising:
- adjustment means that is disposed between the vehicle frame, and the first restriction wheel and the second restriction wheel, and that adjusts the positions of the first restriction wheel and the second restriction wheel with respect to the vehicle frame.
- 13.** The stacker crane according to claim 2, further comprising:
- a third restriction wheel that is supported by and rotatable with respect to the vehicle frame, and that restricts lifting of the second wheel from the rail.
- 14.** The stacker crane according to claim 13, further comprising:
- a fourth restriction wheel that is supported by and rotatable with respect to the vehicle frame, and that works in collaboration with the third restriction wheel to restrict lifting of the second wheel from the rail.
- 15.** The stacker crane according to claim 14, further comprising:
- adjustment means that is disposed between the vehicle frame, and the third restriction wheel and the fourth restriction wheel, and that adjusts the positions of the third restriction wheel and the fourth restriction wheel with respect to the vehicle frame.
- 16.** The stacker crane according to claim 1, further comprising:
- an upper frame that is capable of engaging with a guide rail that is fixed to an upper position of the racks, and that is fixed to upper portions of the first and the second support posts.
- 17.** A stacker crane that is configured to move on a single rail provided along one or more racks, and that is configured to be guided by a guide rail disposed spaced apart from the rail in a vertical direction, comprising:
- a first wheel that moves on the single rail;
 - a vehicle frame supported by the first wheel;
 - a first support post that is fixed to the vehicle frame;
 - a second support post that is fixed on the vehicle frame, spaced apart from the first support post in a fore-and-aft direction;
 - a vertically movable platform that is guided by the first support post and the second support post, and that is capable of moving vertically with respect to the vehicle frame, wherein the vertically movable platform is provided with a first article transferring device that is capable of transferring articles to the one or more of the racks;

an upper frame that is capable of engaging with the guide rail, and that is fixed to an upper portion of each the first and the second support posts;

a first motor that is supported by the vehicle frame such that the first motor is disposed on a right side of the first wheel, and that is capable of driving the first wheel; and

a second motor that is supported by the vehicle frame such that the second wheel is disposed on a left side of the first wheel, and that is capable of driving the first wheel.

18. The stacker crane according to claim 17, further comprising:

a second wheel that is disposed spaced apart from the first wheel in a fore-and-aft direction, and that supports the vehicle frame;

a third motor that is supported by the vehicle frame such that the third motor is disposed on a right side of the second wheel, and that is capable of driving the second wheel; and

a fourth motor that is supported by the vehicle frame such that the fourth wheel is disposed on a left side of the second wheel, and that is capable of driving the second wheel.

19. The stacker crane according to claim 17, further comprising:

a second article transferring device that is provided on the vertically movable platform, and that is capable of transferring articles to the rack.

* * * * *