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(54) **AN AUTOMATICALLY-GUIDED VEHICLE PROVIDED WITH FORKS FOR MOVING A SUPPORT STRUCTURE OF TILES**

AUTOMATISCH GEFÜHRTES FAHRZEUG MIT GABELN ZUM BEWEGEN EINER FLIESENTRAGSTRUKTUR

VÉHICULE À GUIDAGE AUTOMATIQUE POURVU DE FOURCHES DESTINÉES À DÉPLACER UNE STRUCTURE DE SUPPORT DE PANNEAUX

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US-A- 4 957 408 **US-A1- 2008 199 298**

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the technical sector concerning automatically-guided vehicles (AGV) provided with forks for moving a support structure of tiles.

DESCRIPTION OF THE PRIOR ART

[0002] A known automatically-guided vehicle provided with forks comprises: a vertical framework; a carriage which is vertically movable along the vertical framework; and a first fork and a second fork which are borne by the carriage.

[0003] A known support structure of tiles comprises: a plurality of uprights (usually four in number), each of which is provided with a first coupling profile at a relative first end and a second coupling profile at a relative second end, opposite the relative first end; a loading plane for receiving the tiles, which is interposed between the first coupling profile and the second coupling profile of each upright of the plurality of uprights.

[0004] In order to raise a support structure of tiles, the automatically-guided vehicle positions in such a way that the forks contact the lower surface of the loading plane; thereafter the carriage for raising the forks is activated. At this point, the automatically-guided vehicle can move the support structure of tiles and release them where required, activating the carriage to lower the forks.

[0005] In particular, to stack a support structure of tiles on a second support structure of tiles, which for example is at the top of a stack of support structures of pre-existing tiles, it is necessary for the first coupling profile of each upright of the first support structure of tiles to couple to the second coupling profile of each upright of the second support structure of tiles.

[0006] This operation is carried out at height (even up to 4-5 metres, in consideration of the height of the store, where the support structures of the tiles are located, and the height of the pre-existing stack) and with the first support structure loaded with tiles.

[0007] The weight of the first support structure of tiles and the tiles loaded thereon determines a flexion of the vertical framework which is greater in proportion with the height of the first support structure of tiles to be loaded on the stack: therefore, the vertical framework is inclined forwards (that is, towards the first support structure of tiles) by an angle with respect to a vertical plane. As a consequence, the forks also incline downwards by an angle with respect to a horizontal plane, due to the fact that they are borne by the vertical framework via the carriage. Further, the forks further incline downwards with respect to the horizontal plane, due to the flexion to which the forks are subject due to the weight that they have to bear.

[0008] Therefore, at the time of stacking the first support structure of tiles is not horizontal but inclined downwards by an angle, which could prevent the coupling of the first coupling profile of each upright of the first support structure of tiles couples to the second coupling profile of each upright of the second support structure of tiles, which is at the top of the stack.

[0009] Consequently, the first support structure of tiles and the tiles loaded thereon might fall: the first support structure of tiles and the tiles loaded thereon can therefore be damaged. Further, the falling of the first support structure of tiles might strike and damage one or more support structures of tiles of the pre-existing stack and/or the automatically-guided vehicle itself. The damage, as can be imagined, might be of a very great extent.

[0010] The features of the preamble of claim 1 are known from US 2008/199298, which discloses a method and system for automatically loading and unloading a transport. A guidance system follows a travel path to a position near the transport and then a sensor profiles a transport so that a transport path is determined for an AGV to follow into the transport to place a load and for exiting the transport upon placement of the load.

[0011] US 4 957 408 discloses a forklift comprising: tilt sensors mounted on the prongs; a computer which calculates the tilt angles of the prongs, based on the output signals from the sensors; a driving device which receives the output signals from the computer and brings the prongs into the horizontal.

SUMMARY OF THE INVENTION

[0012] The aim of the present invention consists in obviating the above-mentioned drawbacks.

[0013] The above-described aim is obtained with an automatically-guided vehicle provided with forks for moving a support structure of tiles according to claim 1, and with a method for moving a support structure of tiles according to claim

[0014] When the automatically-guided vehicle lifts, by means of the forks, a support structure of tiles loaded with tiles, the first fork and the second fork flex downwards and incline by an angle with respect to the horizontal plane, as explained in the foregoing.

[0015] The first sensor detects the inclination and communicates it to the control unit. The control unit can command the actuator means to move the first fork and the second fork up until the inclination of the first fork and the second fork with respect to the horizontal plane is lower than a first angle of tolerance.

[0016] It is thus possible to contain the inclination of the first fork and the second fork within the first angle of tolerance, regardless of the weight that the first fork and the second fork have to support and the height at which the forks are situated.

[0017] This advantageously makes the stacking operation of a support structure of tiles on a pre-existing stack of other support structures of tiles more secure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Specific embodiments of the invention will be described in the following part of the present description, according to what is set down in the claims and with the aid of the accompanying tables of drawings, in which:

- figures 1, not forming part of the present claimed invention, and 2, object of the present claimed invention, are perspective views of two embodiments of an automatically-guided vehicle provided with forks for moving a support structure of tiles;
- figures 3 and 4 are views from above, in larger scale, respectively of figures 1 and 2;
- figure 2A is an enlarged view of detail K of figure 2;
- figures 5-9 are lateral view of the automatically-guided vehicle, object of the present invention, according to the embodiment of figures 2, 2A and 4, during different movement steps of a support structure for tiles so that the support structure can be arranged on a stack of support structures of tiles that is already formed;
- figure 6A is a larger-scale view of detail H of figure 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] With reference to the appended tables of drawings, reference numeral (1) denotes in its entirety an automatically-guided vehicle provided with forks for moving a support structure of tiles, comprising: a vertical framework (3); a carriage (4) which is vertically movable along the vertical framework (3); a first fork (5) and a second fork (6) which are borne by the carriage (4); a first sensor (7) that is mounted on board the first fork (5) or the second fork (6), for respectively detecting an inclination of the first fork (5) or the second fork (6) with respect to a horizontal plane (xy) (figures 5-9 illustrate the outline of this plane); a control unit (8) which is connected to the first sensor (7); actuator means (9) which are arranged so as to move the first fork (5) and the second fork (6) in order to correct the inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy). The control unit (8) (figure 3, 4) is connected to the actuator means (9) and is configured for commanding the actuator means (9) as a function of the signal received from the first sensor (7).

[0020] The vertical framework (3) can comprise a pair of uprights (10) superiorly connected by a cross-member (11) to form a frame. In this case the carriage (4), can be coupled to the vertical framework (3) in order to slide along the pair of uprights (10).

[0021] The first fork (5) and the second fork (6) share, substantially in equal parts, the weight of a support structure di tiles (2) to be lifted. Therefore, the forks are stressed equally and the first sensor (7) can be arranged either on the first fork (5) or the second fork (6).

[0022] The first sensor (7) is preferably a first horizontal inclinometer.

[0023] The first fork (5) or the second fork (6) preferably comprises a first housing (12) (figures 3, 4) to receive the first horizontal inclinometer. The first housing (12) can be an undercut fashioned on the upper part of the first fork (5) or of the second fork (6).

[0024] The automatically-guided vehicle (1) can comprise a third sensor, for example a second horizontal inclinometer, which is mounted on board the second fork (6) to detect the inclination of the second fork (6) (embodiment not illustrated); the first sensor (7), for example the first horizontal inclinometer, is mounted on-board the first fork (5) in order to detect the inclination of the first fork (5).

[0025] The third sensor can be connected to the control unit (8) and the control unit (8) can be configured for commanding the actuator means (9) as a function of the signal received from the first sensor (7) and from the third sensor. The second fork (6) can comprise a second housing (not illustrated) in order to receive the second horizontal inclinometer; the second housing can be an undercut fashioned on the upper part of the second fork (6).

[0026] The automatically-guided vehicle (1) comprises a frame (21).

[0027] The automatically-guided vehicle (1) can comprise a main body (14).

[0028] The automatically-guided vehicle (1) can comprise a horizontal frame (15) which projects from the main body (14).

[0029] The horizontal frame (15) can have a substantially planar shape, in the sense that the relative thickness can be much smaller (at least five times, preferably at least ten times smaller) than the width and length of the horizontal frame (15).

[0030] The horizontal frame (15) can project from the lower portion of the main body (14), and is distant from the flooring, for example between five and thirty centimetres from the floor surface.

[0031] The horizontal frame (15) can in turn comprise a first arm (16) and a second arm (17) which are flanked to one another and which are flanked to the first fork (5) and the second fork (6), and a first rolling element (18) and a second rolling element (19) which are borne respectively by the first arm (16) and by the second arm (17). The first fork (5) and the second fork (6) can be interposed between the first arm (16) and the second arm (17).

[0032] In a first embodiment not forming part of the present claimed invention, the first fork (5) and the second fork (6) are rotatable with respect to the carriage (4), while the actuator means (9) comprise a first actuator (91) for rotating the first fork (5) and the second fork (6) with respect to the carriage (4).

[0033] The first fork (5) and the second fork (6) are preferably rotoidally coupled to the carriage (4) with

respect to a first hinge axis (Y1) (figure 6A) that is substantially horizontal.

[0034] In a second embodiment not forming part of the present claimed invention, the vertical framework (3) is rotatable with respect to the frame (21) (figure 6) of the automatically-guided vehicle (1), while the actuator means (9) comprise a second actuator (92) for rotating the vertical framework (3) with respect to the frame (21). The rotation of the vertical framework (3) by means of the second actuator (92) can correct the inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy).

[0035] The vertical framework (3) is preferably rotoidally coupled to the frame (21) with respect to a second hinge axis (Y2) (see figure 6 once more) which is substantially horizontal.

[0036] A third embodiment which forms part of the present claimed invention unites the first embodiment with the second embodiment. Therefore, the vertical framework (3) is rotatable with respect to the frame (21) of the automatically-guided vehicle (1), the first fork (5) and the second fork (6) are rotatable with respect to the carriage (4), the actuator means (9) comprise a first actuator (91) for rotating the first fork (5) and the second fork (6) with respect to the carriage (4) and a second actuator (92) for rotating the vertical framework (3) with respect to the frame (21).

[0037] The activating of both the first actuator (91) and the second actuator (92) has the effect of moving the first fork (5) and the second fork (6) in order to correct the inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy).

[0038] A further object of the present invention is a method for moving a support structure of tiles (2), by means of the automatically-guided vehicle (1) as according to the third embodiment, comprising steps of: raising a support structure of tiles (2); detecting the inclination of the first fork (5) or the second fork (6) with respect to a horizontal plane (xy); if the first fork (5) or the second fork (6) is inclined with respect to the horizontal plane (xy) by a greater angle than a first angle of tolerance, moving the first fork (5) and the second fork (6) in order to correct the inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy), until the first fork (5) and the second fork (6) are inclined with respect to the horizontal plane (xy) by a smaller angle than the first angle of tolerance.

[0039] The first angle of tolerance can be of about 2 degrees. In a fourth embodiment forming part of the present claimed invention (figures 2, 2A, 4), the automatically-guided vehicle (1) comprises a second sensor (13) which is mounted on board the vertical framework (3) for detecting the inclination of the vertical framework (3) with respect to a vertical plane (yz) (see the broken lines illustrated in figures 5-9). The control unit (8) is connected to the second sensor (13).

[0040] The second sensor (13) is preferably a vertical inclinometer.

[0041] Again with reference to the fourth embodiment, the vertical framework (3) is rotatable with respect to the frame (21) of the automatically-guided vehicle (1), the first fork (5) and the second fork (6) are rotatable with respect to the carriage (4), the actuator means (9) comprise a first actuator (91) for rotating the first fork (5) and the second fork (6) with respect to the carriage (4) and a second actuator (92) for rotating the vertical framework (3) with respect to the frame (21).

[0042] A further object of the present invention concerns a method for moving a support structure of tiles (2), by means of the automatically-guided vehicle (1) defined in the foregoing with the fourth embodiment, which method comprises, with respect to the method already defined in the foregoing, the step of detecting the inclination of the vertical framework (3) with respect to a vertical plane (yz). The method further comprises: if the first fork (5) or the second fork (6) is inclined with respect to the horizontal plane (xy) by a greater angle than a first angle of tolerance, carrying out following sub-steps:

a) if the vertical framework (3) is inclined with respect to the vertical plane (yz) by a smaller angle than the second angle of tolerance, rotating the vertical framework (3) by means of the second actuator (92) so as to correct the inclination of the vertical framework (3) with respect to the vertical plane (yz), until the vertical framework (3) is inclined with respect to the vertical plane (yz) by a smaller angle than the second angle of tolerance;

b) rotating the first fork (5) and the second fork (6) by means of the first actuator (91) in order to correct the inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy), until the first fork (5) and the second fork (6) are inclined with respect to the horizontal plane (xy) by a smaller angle than the first angle of tolerance.

[0043] The second angle of tolerance can be of about 2 degrees.

[0044] Sub-step b) is preferably carried out only after sub-step a) has been carried out, if the first fork (5) and the second fork (6) are still inclined with respect to the horizontal plane (xy) by a greater angle than the first angle of tolerance.

[0045] There follows a description of how the automatically-guided vehicle (1), according to the fourth embodiment of the present invention, can move a support structure of tiles (2), initially arranged on a flooring (figure 5). Refer to figures from 5-9 and 6A.

[0046] Figure 5 illustrates a first support structure of tiles (2) positioned on the floor, which is to be raised and arranged on a second support structure of tiles (222) which is located on the top of a pre-existing stack (22) of support structures of tiles (see figure 7 for example). Normally each support structure of tiles (2) is loaded with tiles, which for the sake of simplicity have not been illustrated.

[0047] Each support structure of tiles (2) comprises: a plurality of uprights (24) (usually four in number), each of which is provided with a first coupling profile (23) at a relative first end and a second coupling profile (25) at a relative second end, opposite the relative first end; a loading plane (26) for receiving the tiles, which is interposed between the first coupling profile (23) and the second coupling profile (25) of each upright (24) of the plurality of uprights.

[0048] The automatically-guided vehicle (1) nears the first support structure of tiles (2) to be lifted and stacked (see figure 5), until the horizontal frame (15) is arranged below the first support structure of tiles (2). Thereafter, the carriage (4) is activated by motor means (not illustrated), to lift the forks (5, 6) and then also the first support structure of tiles (2) (see figure 6).

[0049] As can be observed in figure 6 (see the broken lines), the weight of the first support structure of tiles (2) determines an inclination of the vertical framework (3) with respect to the vertical plane (yz), detected by the second sensor (13), as well as an inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy), detected by the first sensor (12).

[0050] If the first fork (5) (on which the first sensor (12) is fixed, but like considerations are also true if the first sensor (12) is arranged on the second fork (6)) is inclined with respect to the horizontal plane (xy) by a greater angle than a first angle of tolerance, the following sub-steps might be carried out:

a) if the vertical framework (3) is inclined with respect to the vertical plane (yz) by a greater angle than a second angle of tolerance rotating the vertical framework (3) by means of the second actuator (92) so as to correct the inclination of the vertical framework (3) with respect to the vertical plane (yz), until the vertical framework (3) is inclined with respect to the vertical plane (yz) by a smaller angle than the second angle of tolerance;

b) if notwithstanding the correction of point a) the first fork (5) is still inclined with respect to the horizontal plane (xy) by a greater angle than a first angle of tolerance, rotating the first fork (5) and the second fork (6) by means of the first actuator (91) in order to correct the inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy), until the first fork (5) and the second fork (6) are inclined with respect to the horizontal plane (xy) by a smaller angle than the first angle of tolerance.

[0051] Once the above-described method has been carried out, the first fork (5) and the second fork (6) are inclined with respect to the horizontal plane (xy) by a smaller angle than the first angle of tolerance.

[0052] At this point the automatically-guided vehicle (1) nears (figure 7) to the pre-existing stack (22) until the horizontal frame (15) is arranged beneath the support structure of tiles of the stack (22) positioned on the flooring (fig.8).

[0053] Subsequently the carriage (4) is activated by the motor means to lower the forks (5, 6) until the first coupling profile (23) of each upright (24) of the first support structure of tiles (2) couples to the second coupling profile (25) of each upright (24) of the second support structure of tiles (222) (figure 9).

[0054] It is understood that the above has been described by way of non-limiting example and that any technical-functional variants are considered to fall within the protective scope of the present technical solution, as claimed in the following.

Claims

1. An automatically-guided vehicle (1) provided with forks for moving a support structure of tiles (2), comprising:

a vertical framework (3);
a carriage (4) which is vertically movable along the vertical framework (3);
a first fork (5) and a second fork (6) which are borne by the carriage (4);
a first sensor (7);
a control unit (8) which is connected to the first sensor (7);
actuator means (9) which are arranged so as to move the first fork (5) and the second fork (6) in order to correct the inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy);
wherein the control unit (8) is connected to the actuator means (9) and is configured for commanding the actuator means (9) as a function of the signal received from the first sensor (7);
characterised in that:

the first sensor (7) is mounted on board the first fork (5) or the second fork (6), for respectively detecting an inclination of the first fork (5) or the second fork (6) with respect to a horizontal plane (xy);
the first fork (5) and the second fork (6) are rotatable with respect to the carriage (4) and wherein the actuator means (9) comprise a first actuator (91) for rotating the first fork (5) and the second fork (6) with respect to the carriage (4);
it comprises a frame (21), wherein the vertical framework (3) is rotatable with respect to the frame (21) and wherein the actuator means (9) comprise a second actuator (92) for rotating the vertical framework (3) with respect to the frame (21).

2. The automatically-guided vehicle (1) provided with forks according to claim 1, wherein: it comprises a second sensor (13) which is mounted on board the vertical framework (3) for detecting the inclination of the vertical framework (3) with respect to a vertical plane (yz); the control unit (8) is connected to the second sensor (13).

3. The automatically-guided vehicle (1) provided with forks according to any one of the preceding claims, wherein the first sensor (7) is a first horizontal inclinometer.

4. The automatically-guided vehicle (1) provided with forks according to any one of claims from 2 to 3, wherein the second sensor (13) is a vertical inclinometer.

5. A method for moving a support structure of tiles (2), by means of an automatically-guided vehicle (1) according to claim 1, comprising steps of:

raising a support structure of tiles (2);
detecting the inclination of the first fork (5) or the second fork (6) with respect to a horizontal plane (xy);
if the first fork (5) or the second fork (6) is inclined with respect to the horizontal plane (xy) by a greater angle than a first angle of tolerance, moving the first fork (5) and the second fork (6) in order to correct the inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy), until the first fork (5) and the second fork (6) are inclined with respect to the horizontal plane (xy) by a smaller angle than the first angle of tolerance.

6. The method for moving a support structure of tiles (2) according to the preceding claim, by means of an automatically-guided vehicle (1) according to claim 2, wherein:

the method comprises a step of detecting the inclination of the vertical framework (3) with respect to a vertical plane (yz);
if the first fork (5) or the second fork (6) is inclined with respect to the horizontal plane (xy) by a greater angle than a first angle of tolerance, carrying out following sub-steps: if the vertical framework (3) is inclined with respect to the vertical plane (yz) by a greater angle than a second angle of tolerance rotating the vertical framework (3) by means of the second actuator (92) so as to correct the inclination of the vertical framework (3) with respect to the vertical plane (yz), until the vertical framework (3) is inclined with respect to the vertical plane (yz) by a smaller angle than the second angle of tolerance;
rotating the first fork (5) and the second fork (6) by means of the first actuator (91) in order to correct the inclination of the first fork (5) and the second fork (6) with respect to the horizontal plane (xy), until the first fork (5) and the second fork (6) are inclined with respect to the horizontal plane (xy) by a smaller angle than the first angle of tolerance.

Patentansprüche

1. Automatisch geführtes Fahrzeug (1), das mit Gabeln zum Bewegen einer Trägerstruktur für Fliesen (2) ausgestattet ist, umfassend:

einen vertikalen Rahmen (3);
einen Wagen (4), der entlang des vertikalen Rahmens (3) vertikal beweglich ist;
eine erste Gabel (5) und eine zweite Gabel (6), die vom Wagen (4) getragen werden;
einen ersten Sensor (7);
eine Steuereinheit (8), die mit dem ersten Sensor (7) verbunden ist;
Betätigungsmittel (9), die so angeordnet sind, dass sie die erste Gabel (5) und die zweite Gabel (6) bewegen, um die Neigung der ersten Gabel (5) und der zweiten Gabel (6) relativ zur Horizontalebene (xy) zu korrigieren;
wobei die Steuereinheit (8) mit den Betätigungsmitteln (9) verbunden ist und so konfiguriert ist, dass sie die Betätigungsmittel (9) in Abhängigkeit von dem vom ersten Sensor (7) empfangenen Signal steuert;
dadurch gekennzeichnet, dass:

der erste Sensor (7) an Bord der ersten Gabel (5) oder der zweiten Gabel (6) montiert ist, um jeweils eine Neigung der ersten Gabel (5) oder der zweiten Gabel (6) relativ zu einer Horizontalebene (xy) zu erfassen;
die erste Gabel (5) und die zweite Gabel (6) relativ zum Wagen (4) drehbar sind, und wobei die Betätigungsmittel (9) einen ersten Betätiger (91) umfassen, um die erste Gabel (5) und die zweite Gabel (6) relativ zum Wagen (4) zu drehen;
es einen Rahmen (21) umfasst, wobei der vertikale Rahmen (3) relativ zum Rahmen (21) drehbar ist, und wobei die Betätigungsmittel (9) einen zweiten Betätiger (92) umfassen, um den vertikalen Rahmen (3) relativ zum Rahmen (21) zu drehen.

2. Das automatisch geführte Fahrzeug (1) mit Gabeln gemäß Anspruch 1, wobei: es einen zweiten Sensor (13) umfasst, der an Bord des vertikalen Rahmens (3) montiert ist, um die Neigung des vertikalen Rah-

mens (3) relativ zu einer Vertikalebene (yz) zu erfassen; die Steuereinheit (8) mit dem zweiten Sensor (13) verbunden ist.

3. Das automatisch geführte Fahrzeug (1) mit Gabeln gemäß einem der vorhergehenden Ansprüche, wobei der erste Sensor (7) ein erster horizontaler Neigungsmesser ist.

4. Das automatisch geführte Fahrzeug (1) mit Gabeln gemäß einem der Ansprüche 2 bis 3, wobei der zweite Sensor (13) ein vertikaler Neigungsmesser ist.

5. Verfahren zum Bewegen einer Trägerstruktur für Fliesen (2) mittels eines automatisch geführten Fahrzeugs (1) gemäß Anspruch 1, umfassend die Schritte:

Anheben einer Trägerstruktur für Fliesen (2);
Erfassen der Neigung der ersten Gabel (5) oder der zweiten Gabel (6) relativ zu einer Horizontalebene (xy);
falls die erste Gabel (5) oder die zweite Gabel (6) relativ zur Horizontalebene (xy) um einen Winkel größer als ein erster Toleranzwinkel geneigt ist, Bewegen der ersten Gabel (5) und der zweiten Gabel (6), um die Neigung der ersten Gabel (5) und der zweiten Gabel (6) relativ zur Horizontalebene (xy) zu korrigieren, bis die erste Gabel (5) und die zweite Gabel (6) relativ zur Horizontalebene (xy) um einen Winkel kleiner als der erste Toleranzwinkel geneigt sind.

6. Das Verfahren zum Bewegen einer Trägerstruktur für Fliesen (2) gemäß dem vorhergehenden Anspruch mittels eines automatisch geführten Fahrzeugs (1) gemäß Anspruch 2, wobei:

das Verfahren einen Schritt zum Erfassen der Neigung des vertikalen Rahmens (3) relativ zu einer Vertikalebene (yz) umfasst;
falls die erste Gabel (5) oder die zweite Gabel (6) relativ zur Horizontalebene (xy) um einen Winkel größer als ein erster Toleranzwinkel geneigt ist, die folgenden Teil-Schritte ausführen:

falls der vertikale Rahmen (3) relativ zur Vertikalebene (yz) um einen Winkel größer als ein zweiter Toleranzwinkel geneigt ist, Drehen des vertikalen Rahmens (3) mittels des zweiten Betätigers (92), um die Neigung des vertikalen Rahmens (3) relativ zur Vertikalebene (yz) zu korrigieren, bis der vertikale Rahmen (3) relativ zur Vertikalebene (yz) um einen Winkel kleiner als der zweite Toleranzwinkel geneigt ist;
Drehen der ersten Gabel (5) und der zweiten Gabel (6) mittels des ersten Betätigers (91), um die Neigung der ersten Gabel (5) und der zweite Gabel (6) relativ zur Horizontalebene (xy) zu korrigieren, bis die erste Gabel (5) und die zweite Gabel (6) relativ zur Horizontalebene (xy) um einen Winkel kleiner als der erste Toleranzwinkel geneigt sind.

Revendications

1. Véhicule à guidage automatique (1) équipé de fourches pour déplacer une structure de support de carreaux (2), comprenant :

un bâti vertical (3) ;
un chariot (4) mobile verticalement le long du bâti vertical (3) ;
une première fourche (5) et une deuxième fourche (6) portées par le chariot (4) ;
un premier capteur (7) ;
une unité de commande (8) connectée au premier capteur (7) ;
des moyens actionneurs (9) agencés pour déplacer la première fourche (5) et la deuxième fourche (6) afin de corriger l'inclinaison de la première fourche (5) et de la deuxième fourche (6) par rapport au plan horizontal (xy) ;
dans lequel l'unité de commande (8) est connectée aux moyens actionneurs (9) et est configurée pour commander les moyens actionneurs (9) en fonction du signal reçu du premier capteur (7) ;
caractérisé en ce que :

le premier capteur (7) est monté à bord de la première fourche (5) ou de la deuxième fourche (6), pour détecter respectivement une inclinaison de la première fourche (5) ou de la deuxième fourche (6) par rapport à un plan horizontal (xy) ;
la première fourche (5) et la deuxième fourche (6) sont rotatives par rapport au chariot (4), et dans lequel les moyens actionneurs (9) comprennent un premier actionneur (91) pour faire pivoter la première fourche (5) et la deuxième fourche (6) par rapport au chariot (4) ;
il comprend un cadre (21), dans lequel le bâti vertical (3) est rotatif par rapport au cadre (21), et dans lequel les moyens actionneurs (9) comprennent un deuxième actionneur (92) pour faire pivoter le bâti vertical (3) par rapport au cadre (21).

2. Le véhicule à guidage automatique (1) équipé de fourches selon la revendication 1, dans lequel : il

comprend un deuxième capteur (13) monté à bord du bâti vertical (3) pour détecter l'inclinaison du bâti vertical (3) par rapport à un plan vertical (yz) ; l'unité de commande (8) est connectée au deuxième capteur (13).

3. Le véhicule à guidage automatique (1) équipé de fourches selon l'une quelconque des revendications précédentes, dans lequel le premier capteur (7) est un premier inclinomètre horizontal.

4. Le véhicule à guidage automatique (1) équipé de fourches selon l'une quelconque des revendications 2 à 3, dans lequel le deuxième capteur (13) est un inclinomètre vertical.

5. Procédé de déplacement d'une structure de support de carreaux (2), au moyen d'un véhicule à guidage automatique (1) selon la revendication 1, comprenant les étapes de :

soulever une structure de support de carreaux (2) ;
détecter l'inclinaison de la première fourche (5) ou de la deuxième fourche (6) par rapport à un plan horizontal (xy) ;
si la première fourche (5) ou la deuxième fourche (6) est inclinée par rapport au plan horizontal (xy) d'un angle supérieur à un premier angle de tolérance, déplacer la première fourche (5) et la deuxième fourche (6) afin de corriger l'inclinaison de la première fourche (5) et de la deuxième fourche (6) par rapport au plan horizontal (xy), jusqu'à ce que la première fourche (5) et la deuxième fourche (6) soient inclinées par rapport au plan horizontal (xy) d'un angle inférieur au premier angle de tolérance.

6. Le procédé de déplacement d'une structure de support de carreaux (2) selon la revendication précédente, au moyen d'un véhicule à guidage automatique (1) selon la revendication 2, dans lequel :

le procédé comprend une étape de détection de l'inclinaison du bâti vertical (3) par rapport à un plan vertical (yz) ;
si la première fourche (5) ou la deuxième fourche (6) est inclinée par rapport au plan horizontal (xy) d'un angle supérieur à un premier angle de tolérance, exécuter les sous-étapes suivantes :

si le bâti vertical (3) est incliné par rapport au plan vertical (yz) d'un angle supérieur à un deuxième angle de tolérance, faire pivoter le bâti vertical (3) au moyen du deuxième actionneur (92) afin de corriger l'inclinaison du bâti vertical (3) par rapport au plan vertical (yz), jusqu'à ce que le bâti vertical (3) soit incliné par rapport au plan vertical (yz) d'un angle inférieur au deuxième angle de tolérance ;
faire pivoter la première fourche (5) et la deuxième fourche (6) au moyen du premier actionneur (91) afin de corriger l'inclinaison de la première fourche (5) et de la deuxième fourche (6) par rapport au plan horizontal (xy), jusqu'à ce que la première fourche (5) et la deuxième fourche (6) soient inclinées par rapport au plan horizontal (xy) d'un angle inférieur au premier angle de tolérance.

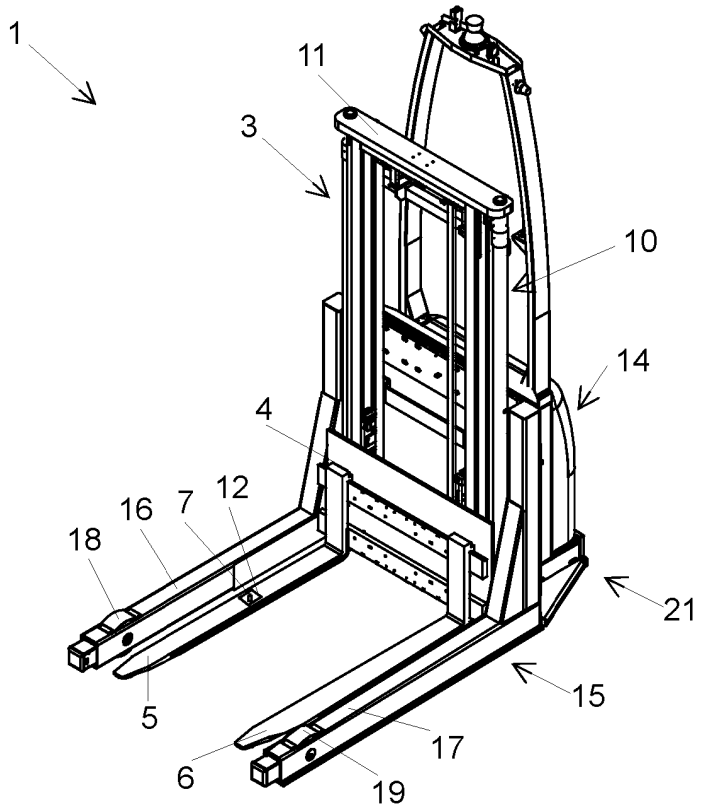
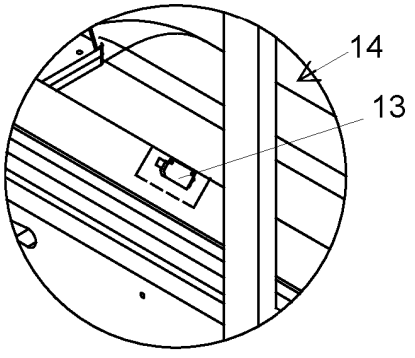
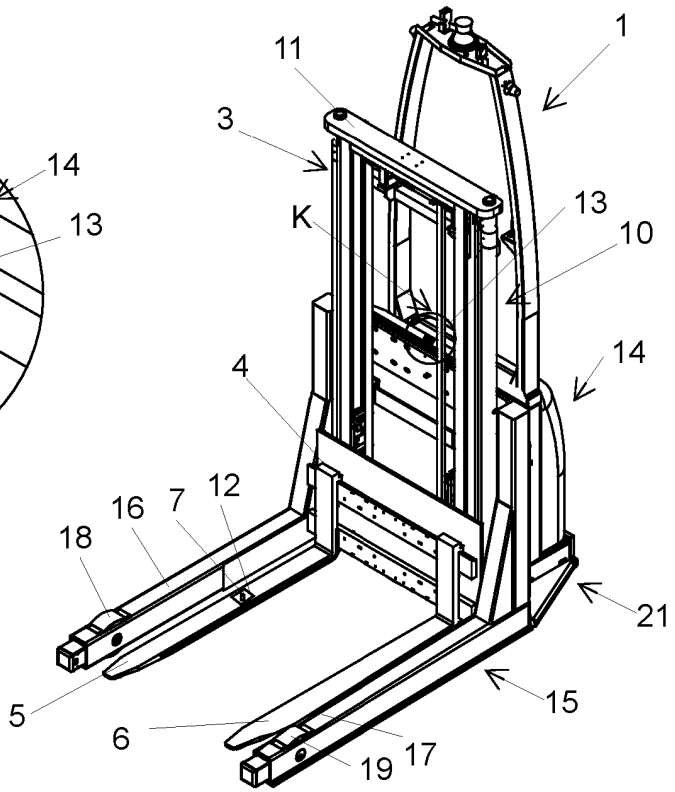


FIG.1

FIG.2

FIG.2A





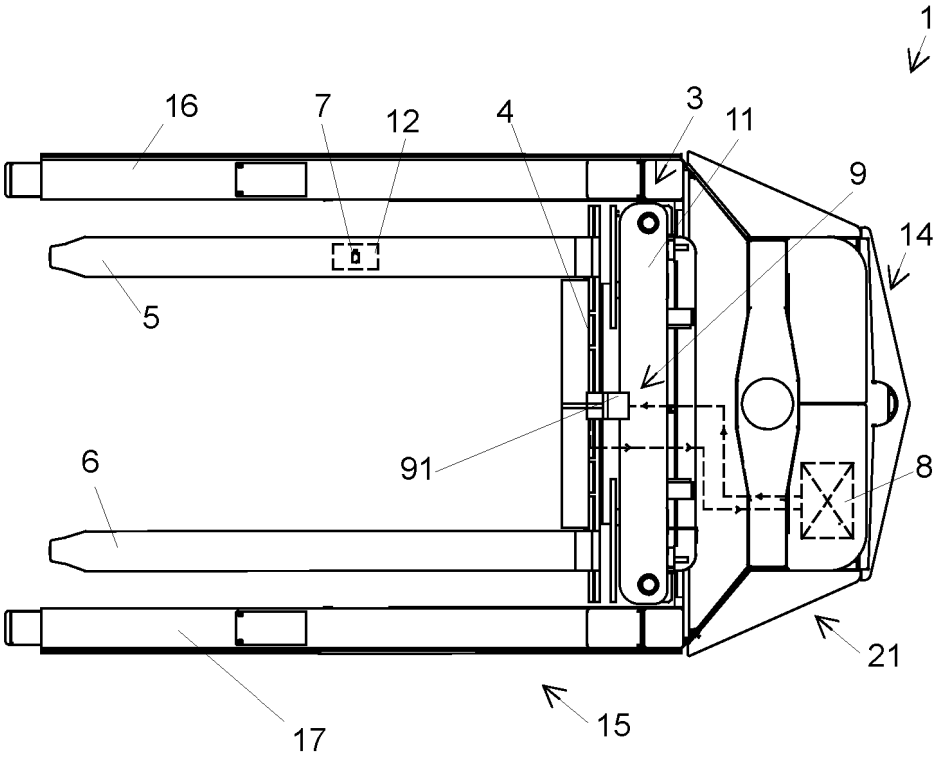

1
16
7
12
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9
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5
6
91
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21
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15

FIG.3

FIG.4

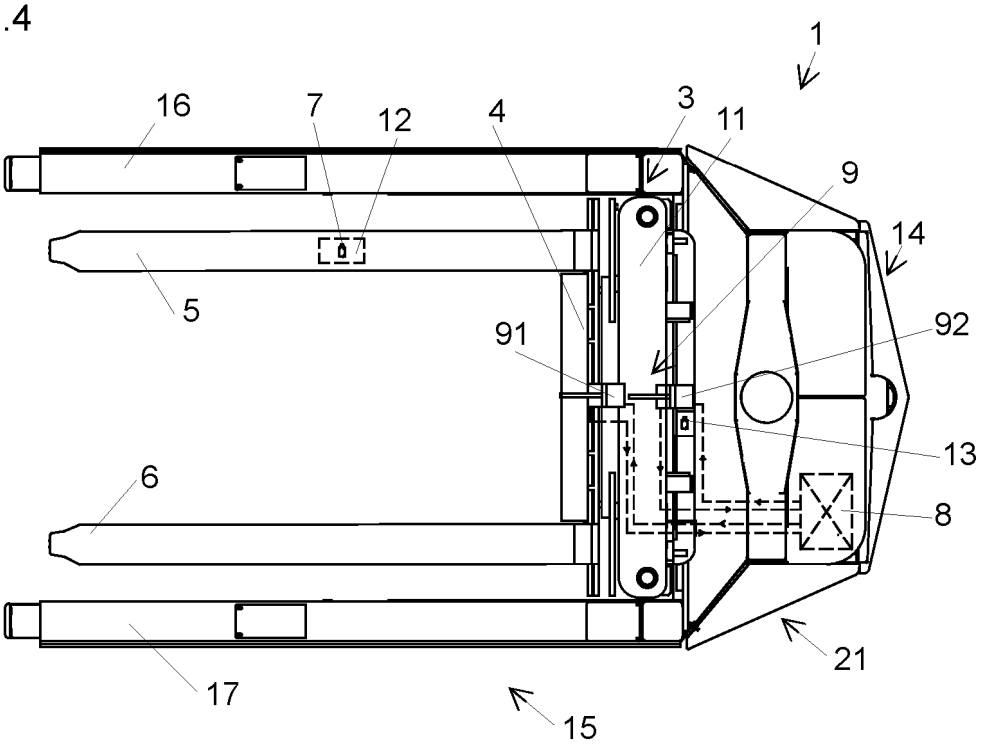

1
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92
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15

FIG.5

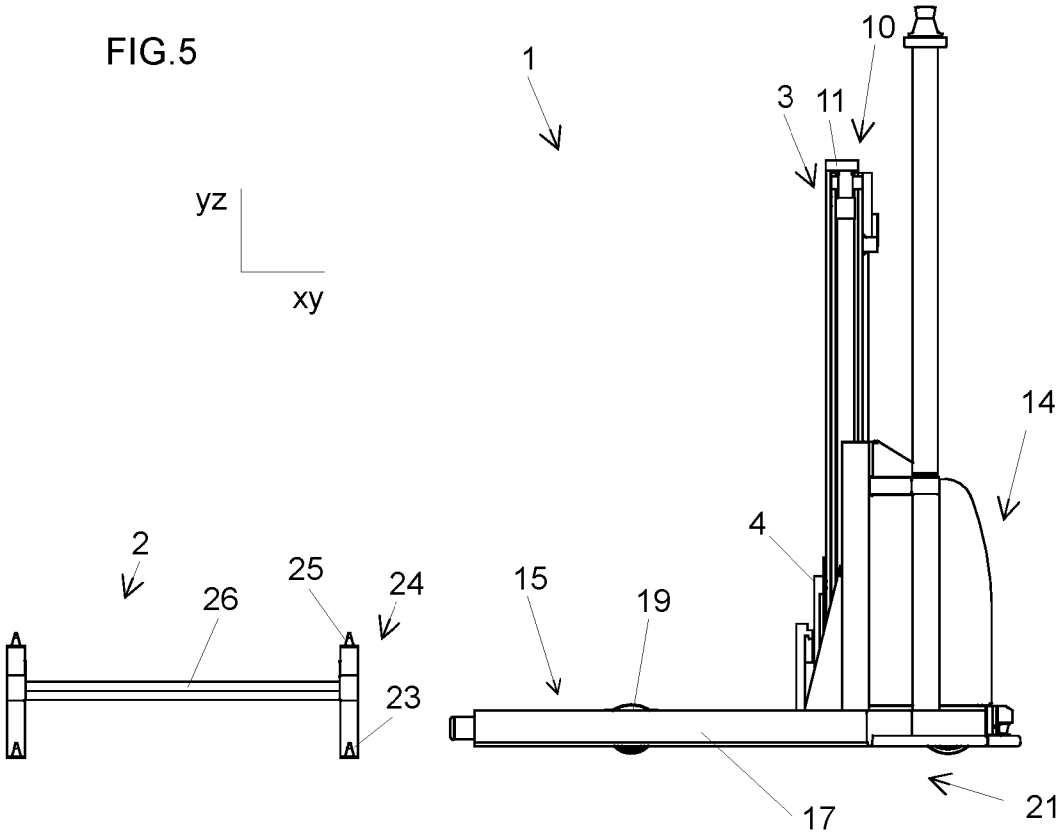


FIG.6A

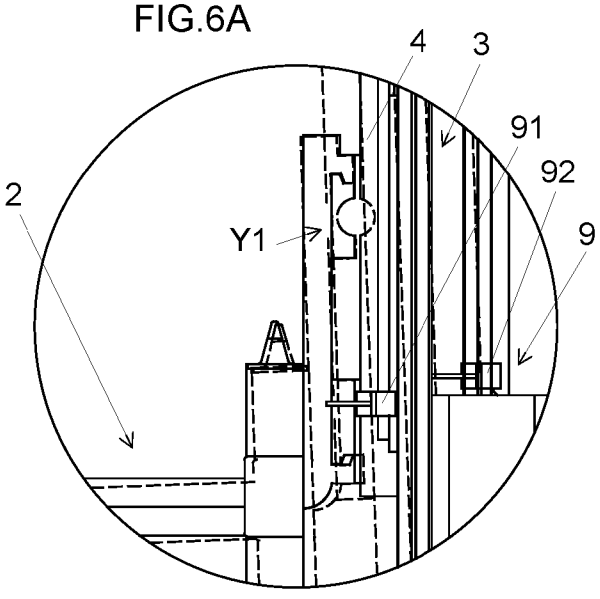


FIG.6

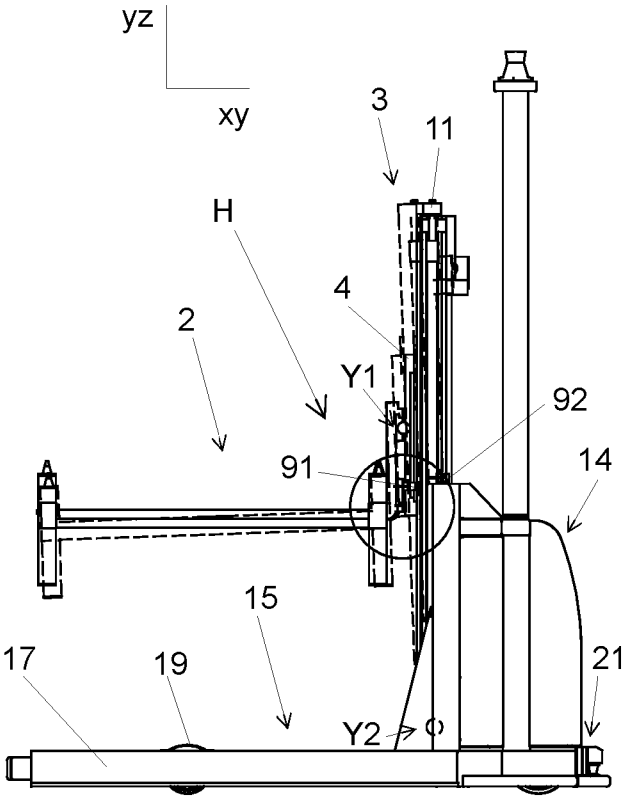


FIG.7

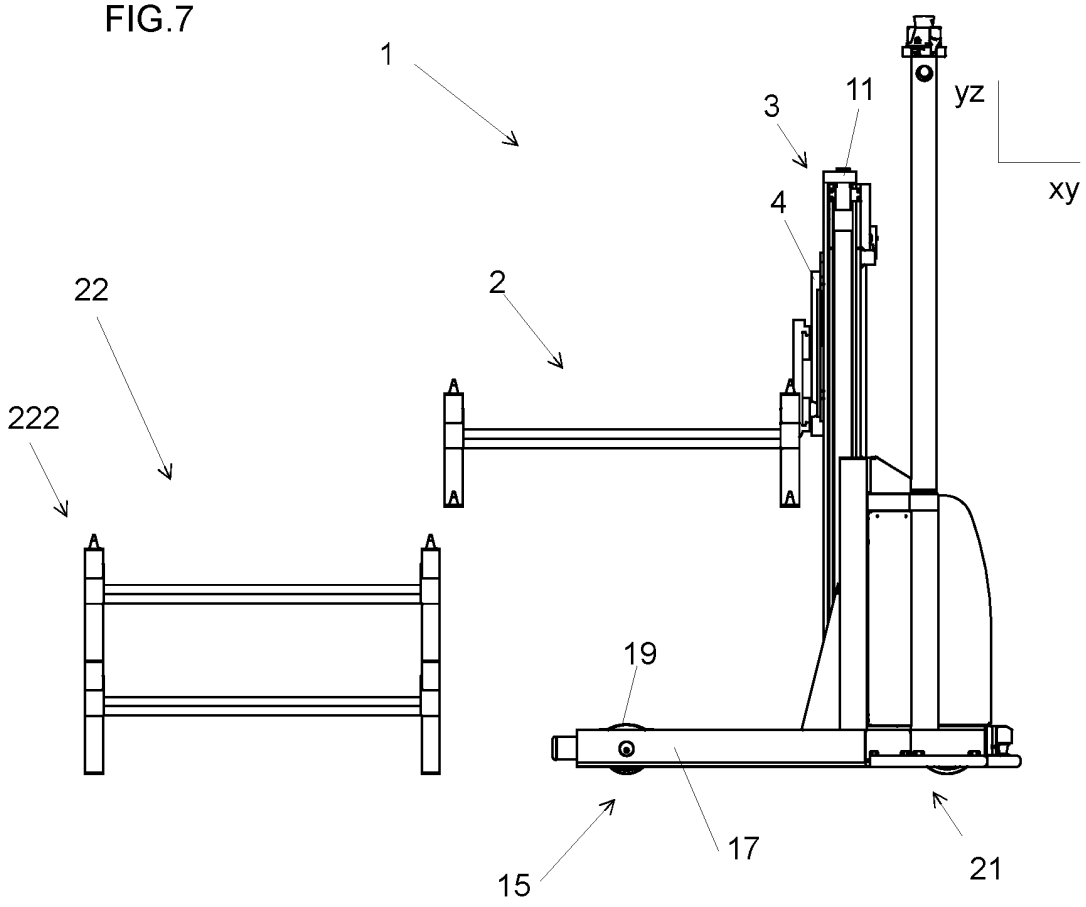

1
3
11
yz
xy
4
2
22
222
19
15
17
21

FIG.8

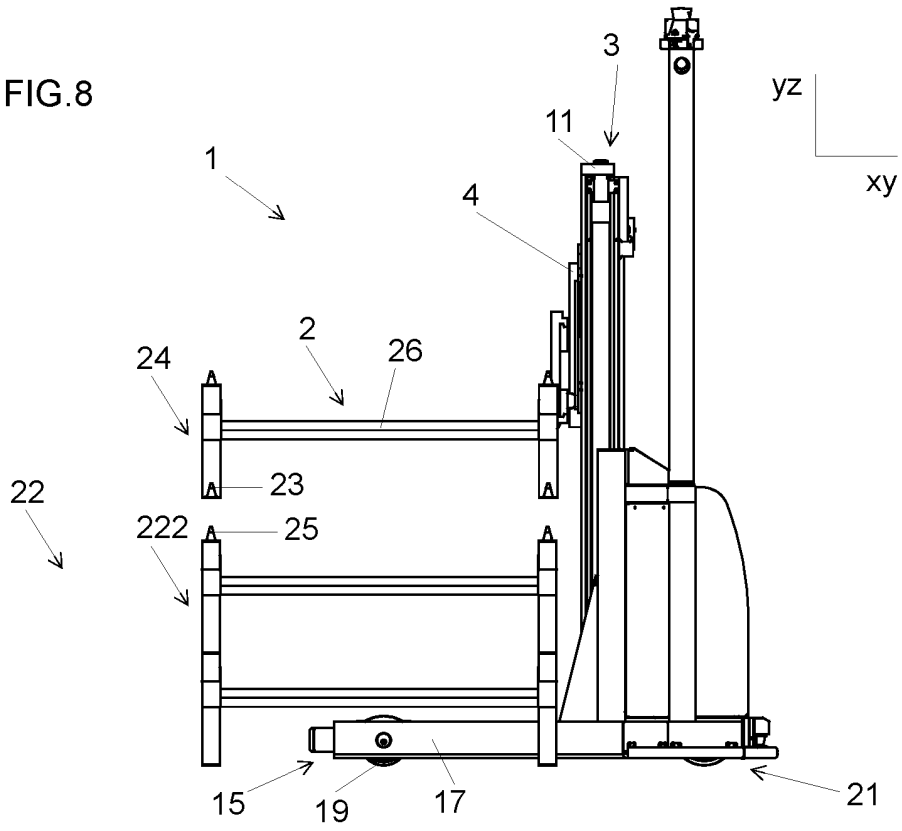
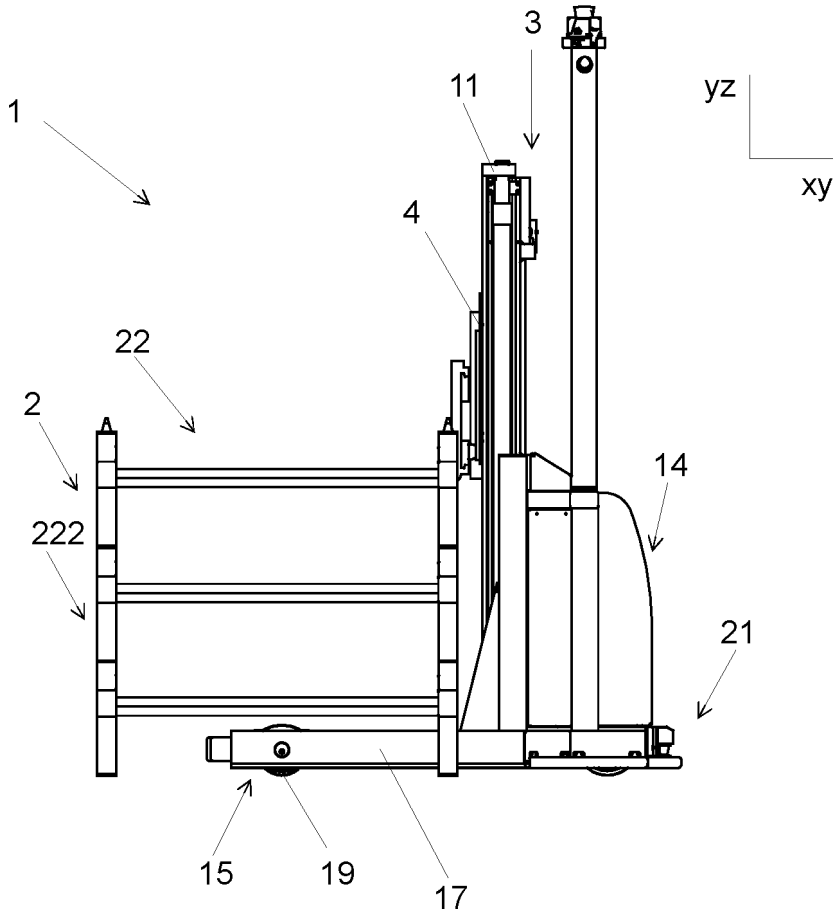

3
yz
11
xy
1
4
2
26
24
23
22
222
25
15
19
17
21

FIG.9



REFERENCES CITED IN THE DESCRIPTION

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