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(54) Control and guide group for a mast of 2-way, 4-way or multidirectional side-loading lift trucks as well as 2-way, 4-way or multidirectional side-loading lift truck.

(57) The present invention relates to a group for guiding and controlling the translation of a lifting group (1) of a 2-way, 4-way or multidirectional side-loading lift truck (3), comprising:
- at least one rectilinear guide member (7a, 7b);
- an outlet carriage (4) having at least one roller (5) and/or sliding block (50, 500) adjustably mounted on a pin (6), substantially horizontal in use, which has external surface (5a) for the rolling or sliding engagement with a respective rectilinear guide member (7a, 7b), the external surface (5a) being shaped in a manner so as to ensure a slidable shape engagement with a respective rectilinear guide member (7a, 7b), thereby preventing transverse movements of each roller (5) or sliding block (50, 500) with respect to a respective rectilinear guide member (7a, 7b),
the group further comprising means for regulating or adjusting the position of the at least one roller (5) or sliding block (50, 500) on the axle or pin (6).

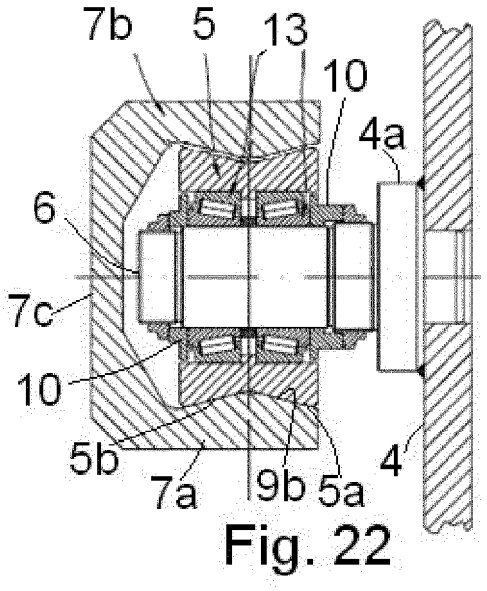

Fig. 22

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Description

[0001] The present invention regards a group for controlling and guiding the translation of a lifting group or mast for a 2-way, 4-way or multidirectional side-loading lift truck suitable for resolving movement problems of the lifting group movably mounted in the outlet space (well width) of a lift truck in jargon called "side-loading" truck; and in general the present invention regards the problem of correctly guiding the translation movements of the lifting group, in jargon also termed "mast". The present invention also regards an internal combustion, electrical or hybrid lift truck (lateral, multidirectional, 2-way, 4-way etc.).

[0002] An one-sided loading lift truck is a vehicle generally comprising a U-shaped (as seen from plan view) frame, which delimits a space termed "outlet space" or "well width" and is mounted on two (front and rear) axles with a pair of wheels each, an engine group typically for the pair of wheels of the rear axle, a driver's cab mounted in front position on the frame, and a lifting group, the so-called mast. One group is also provided for, in jargon "outlet group" or "outlet carriage", which bears the lifting group and is slidably mounted in the space of the frame, an "outlet space" or "well width" delimited by the U-shaped frame, so as to move the mast along the outlet space (well width) in a direction perpendicular to the longitudinal axis of the side-loading lift truck or vehicle.

[0003] The translation movement of the outlet carriage, within and along the outlet space (well width) occurs by means of rollers or sliding blocks, called in jargon "outlet rollers or sliding blocks" intended to slide within and along substantially C-shaped rectilinear guides provided on the sides of the outlet space (well width). Normally, the outlet group is provided with adjustable "opposing" rollers or sliding blocks. The opposing rollers are integrated or mounted, e.g. arranged laterally around the pin of the respective outlet rollers, so as to be in sliding contact with the guide walls of the outlet group. The opposing rollers are normally equipped with adjusting screws, and can be adjusted starting from the opposite side by means of mechanical adjuster. In such case, there will be combined rollers.

[0004] Other known solutions provide for the use of opposing rollers separated from the outlet rollers and integrated, e.g. fixed on the guides or outlet guide plates for the outlet rollers.

[0005] The solutions proposed up to now give rise to problems generated by friction (stick and slip) phenomena, which are caused by the need that the opposing rollers and/or sliding blocks abut against the respective sliding surfaces and cause sudden oscillation movements of the outlet carriage and thus the mast, that can only in part be compensated with suitable handling dictated by the experience of the driver or handler of the side-loading lift truck.

[0006] In addition, the opposing rollers are rather fragile, and since they are subjected to frequent impacts, their lifetime is rather short, so that they require repeated substitutions.

[0007] Usually, another structural expedient is provided for, which ensures that there is always contact between the opposing roller and its respective outlet guide. This expedient, termed "pre-stress" in jargon, provides for obtaining the outlet opening in construction phase but not with parallel sides - rather, with substantially tapered sides. This implies that the distance between the guides of the outlet rollers decreases from the interior towards the exterior of the outlet space (well width), typically about 5 - 15mm between the two ends of the outlet space (well width). This means that in its disengagement motion, the outlet group must force and open or better yet mutually move away the guides on which it slides. In this manner, it is assured that the opposing rollers or sliding blocks always remain in contact with their own sliding guide or surface.

[0008] One such "outlet group-frame" system nevertheless results rather weak, since over time the prestress of the lift truck tends to be reduced, both due to wear and due to deformation of the frame and hence it is not possible to ensure an optimal guiding of for the outlet group. The movements of the outlet carriage thus cannot be suitably controlled, since the outlet opening loses its own initial prestress.

[0009] As a consequence, after a specific use time, it is necessary to recover or restore the initial configuration of the frame components. This is usually done by operating on suitable adjusting screws, in the case of opposing rollers and/or with the interposition of suitable compensation thicknesses in the case of sliding blocks. Such adjustment is often difficult, especially if there are geometric modifications caused, for example, by random impacts - even light ones - of the frame or of the mast against obstacles.

[0010] Hence, it is necessary to periodically lubricate the sliding surfaces of the outlet guides (regular adjustment and maintenance of the outlet group).

[0011] As will be understood, it is nearly impossible to ensure prestress values that are always identical, also due to the high structural tolerances of the frame which is constructed with metal structural work processes, typically via welding of its sheet metal components, and therefore it is difficult to obtain guides and thus outlet groups with narrow tolerances.

[0012] Solutions have also been proposed which provide for the use of guide rollers with vertical axis, as taught in the European patent EP-0 274 837 B1, which constitutes a development of the system taught by the United States patent US-3 739 931A. Such systems have already been abandoned for their intrinsic weakness.

[0013] Currently the movement of the outlet carriage within and along the outlet space (well width) is obtained by means of a pair of oil-pressure cylinders arranged crossed or tilted with respect to the exit-return direction of the outlet carriage.

[0014] Another solution is that taught in the German

patent DE-2 331 985A1.

[0015] With such solutions, in consideration of the volume differences of the cylinders, different movement speeds of the outlet carriage are obtained during its exit and during the return.

[0016] The conventionally used systems are thus unsuitable for ensuring perfectly controlled movements of the outlet carriage that supports the mast. In the case of jacks or hydraulic cylinders that are tilted with respect to the movement direction of the outlet carriage, when the exit of the outlet carriage or mast-carrier carriage is commanded, the tilt of the jacks changes as a function of the position reached by the outlet carriage. This means that the translation speed of the outlet carriage varies as a function of its position along the outlet space (well width), also because there is no constant ratio between the length of the section of stem extending from the cylinder of the jack and the commanded movement of the outlet carriage. This negatively affects the sensitivity and precision of control that the operator can exert on the system.

[0017] Solutions have also been proposed that are equipped with electronic control means, which while remedying the problem of the precision, drastically reduce the operating speed of the translation movements of mast-carrier carriage.

[0018] In addition, the section difference between the two sides (bottom side and stem side) of a hydraulic cylinder leads to a movement speed during the exit of the carriage that is considerably less than that of the return phase.

[0019] GB-1 026 794 teaches a vehicle provided with a lifting group having an outlet carriage comprising a plurality of rollers slidingly mounted in respective guides. According to a first embodiment, the rollers are provided with an annular rib or tread designed to slide within a seat delimited by a respective guide.

[0020] In accordance with another embodiment of GB-1 026 794, the rollers have a flanged end.

[0021] JP-2004-075303 relates to a vehicle with a lifting group having rollers slidingly mounted in respective guides and mounted for rotation on support pins. Each roller is provided with an abutting element slidingly mounted in a direction substantially parallel to its respective support pin, between a retracted position and a pushing extended position, in which the abutting element abuts against an inner surface of the guide.

[0022] JP-2006-117357 and JP-2008-201493 teach respective vehicles having a mast slidingly mounted in a respective outlet space (well width), and aim at solving the problem of guiding the displacement of the mast and its fork carriage.

[0023] Therefore, the main object of the present invention is to provide a group for guiding and controlling the translation motion of an outlet carriage or mast-carrier carriage in a 2-way, 4-way or multidirectional side-loading lift truck, which is suitable for blocking movements that are transverse to the exit-return direction of the respective mast-carrier carriage.

[0024] Another object of the present invention is to provide a guide and control group which is relatively simple and easy to obtain and which ensures a long useful lifetime without reducing the efficiency and the precision of use over time.

[0025] Another object of the present invention is to provide a guide and control group which is not affected by the so-called "stick and slip" phenomena.

[0026] Another object of the present invention is to provide a guide and control group, which does not require periodic resetting of the initial geometries of the frame, nor lubrication of the sliding surfaces of the outlet guides.

[0027] Another object of the present invention is to provide a guide and control group that lacks opposing rollers.

[0028] Another object of the present invention is to provide a side-loading lift truck or vehicle equipped with a guide and control group as specified above.

[0029] Another object of the present invention is to provide a 2-way, 4-way or multidirectional side-loading lift truck equipped with an actuation group for the outlet carriage or mast-carrier carriage suitable for ensuring linear, uniform and controlled movements at high precision.

[0030] Another object of the present invention is to provide a side-loading lift truck, in which the actuation group for the lifting group or mast is suitable for ensuring uniform movement speeds both during exit and return from/into the outlet space (well width).

[0031] According to a first aspect of the present invention, a guide and control group is provided for the translation of a lifting group of a 2-way, 4-way or multidirectional side-loading lift truck, comprising:

- at least one rectilinear guide member;
- an outlet carriage having at least one roller and/or a sliding block adjustably mounted on an in use substantially horizontal pin, which has an external surface for the rolling or sliding engagement with a respective rectilinear guide member, the external surface being so shaped as to ensure a relatively loose, slidable shape engagement with a respective rectilinear guide member, thereby preventing transverse movements of each roller or sliding block with respect to the respective rectilinear guide member,

the group further comprising means for regulating or adjusting the position of the at least one roller or sliding block on the axle or pin.

[0032] Preferably, the regulating or adjusting means comprises a pair of ring nut elements fit on the pin on opposite sides with respect to a respective roller or sliding block, and suitable for being moved in a controlled manner along its respective pin.

[0033] Further aspects and advantages of the present invention will be clearer from the following detailed description of specific embodiments of a guide and control group and of a lift truck or vehicle, the description being made with reference to the accompanying drawings, in which:

- Figure 1 is a side view of a lift truck according to the state of the art;
- Figure 2 is a side view that illustrates several components of the carriage of Fig. 1;
- Figure 3 is a view of a detail on an enlarged scale of Fig. 2;
- Figure 4 shows a section view of an opposing roller integrated in an outlet roller;
- Figure 5 schematically shows the structural expedient of the prestress of the outlet space (well width), according to the state of the art;
- Figures 6 and 7 are plan views of a side-loading lift truck according to the state of the art in respective work positions;
- Figures 8 and 9 are respectively front and plan views of components of a guide and control group according to the present invention;
- Figure 10 is an enlarged scale view of a detail of Fig. 8;
- Figure 11 is a side view with parts in section of an enlarged scale detail of the guide and control group of Fig. 8;
- Figure 12 is a perspective view of a roller for a guide and control group according to the present invention;
- Figure 13 is a perspective view with parts in section of the roller of Fig. 12;
- Figure 14 is a section view of the roller of Figure 12 applied to respective guides for a guide and control group according to the present invention;
- Figures 15-17 are slightly top perspective views of a side-loading lift truck or vehicle according to the present invention;
- Figures 18 to 21 are views similar to Figure 14 of respective embodiments of rollers and respective sliding guides for guide and control groups according to the present invention;
- Figure 22 is a view of the roller and respective guide similar to that of Figure 21;
- Figure 23 is a view similar to that of Figure 14 of another embodiment of rollers and respective sliding guides for a guide and control group according to the present invention;
- Figures 24 to 29 are views similar to Figure 14 of respective embodiments of rollers and sliding guides.
- Figures 30 and 31 are slightly top perspective views of components of a side-loading lift truck or vehicle according to respective embodiments of the present invention;
- Figure 32 is a slightly top perspective view of components of a side-loading lift truck or vehicle according to the present invention; and
- Figure 33 shows actuation means for a side-loading lift truck according to the present invention.

[0034] In the drawings, equivalent or similar parts or components were marked with the same reference numerals.

[0035] First, with reference to Figures 1 to 7, which regard the state of the art, a lift truck is illustrated with one-sided loading comprising a frame A, a pair of axles (front and rear) on which the frame A is mounted, each axle being equipped with a pair of wheels: rear B and front C, an engine group, a driver's cab D mounted on the frame typically at the front axle C, and a lifting group or mast E.

[0036] The carriage comprises an outlet carriage or group F, which supports the mast E and is intended to slidably translate within and along a lateral outlet space (well width) G delimited in the frame A, so as to allow the mast E to be moved between an internal or receded position (see Fig. 6 in particular) and an external or exit position (see Fig. 7 in particular) with respect to the bulk of the frame A.

[0037] The outlet group F is mounted, at two opposite sides thereof that are parallel to the walls of the lateral outlet space (well width) G, on a plurality (two or more) of outlet rollers H, in turn rotatably mounted on a respective pin, substantially horizontal in use, and designed to slide on respective lateral rectilinear guides L secured to the frame A at the outlet space (well width) G. Advantageously, on each side of the outlet space (well width) G, an upper and a lower rectilinear guide are provided for, between which the rollers H slide.

[0038] As will be noted, the rollers H have substantially cylindrical lateral surface for the rolling engagement with a respective rectilinear guide or substantially flat guide portion.

[0039] Sliding blocks and/or opposing rollers M are then provided for between the outlet rollers H and the guides L.

[0040] The rectilinear guides L (see Fig. 5) are usually prestressed such that those on one side of the outlet space (well width) are not parallel to the guides on the other side, i.e. the distance L1 between the guides at the external end of the outlet space (well width) is less than the distance L2 at the internal end of the outlet space (well width).

[0041] The actuation of the outlet group or mast-carrier carriage F is usually assigned to a pair crossed jacks N.

[0042] With reference to Figures 8 to 17, a first embodiment is illustrated of a group 1 for guiding and controlling the translation of the lifting group or mast 2 of a 2-way, 4-way or multidirectional side-loading lift truck or vehicle 3 equipped with monocoque frame 3a. The guide and control group 1 comprises an outlet group or outlet carriage 4 having one or more rollers 5 or sliding blocks, usually four or six, i.e. two or three mounted at each side of the guide or control group. Each roller 5 or sliding block is adjustably mounted on its own axle or pin 6, which is substantially horizontal in use.

[0043] The guide and control group 1 or better yet the outlet carriage 4 usually comprises a pair of plates 4a fixed (e.g. bolted or welded) on the flanks of the mast 2 and from which respective axes or pins 6 extend, which are substantially orthogonal to the translation direction

of the mast 2 in the outlet space (well width) 8 delimited in the frame 3a of the side-loading lift truck 3 and bearing on the free end thereof respective rollers 5. The outlet carriage 4 then comprises an intermediate framework 4b for connecting the plate(s) 4a on one side of the mast 2 to the plate(s) 4a on the other side of the mast 2.

[0044] One or more rectilinear guide members or guides 7a, 7b are then provided for the rollers 5 or sliding blocks. Preferably, the guides 7a, 7b are mounted on the sides of the outlet space (well width) 8 for the mast 2 delimited by the frame 3a of the side-loading lift truck 3, along which the respective rollers 5 of the guide and control group are intended to roll. More particularly, at each side of the outlet space (well width) 8, a lower guide 7a and an upper guide 7b are provided for, between which one or more rollers 5 or sliding blocks are driven (usually there are two or three). Still more particularly, the lower rectilinear guide member 7a has a sliding engagement surface for the roller(s) or sliding block(s) that is turned upward, while the upper rectilinear guide member 7b has a sliding engagement surface for the roller(s) or sliding block(s) that is turned downward.

[0045] At least one roller 5 or sliding block has its own external surface, preferably external or external lateral surface 5a of engagement via sliding or rolling on the respective guide(s) 7a, 7b.

[0046] The external surface 5a is shaped in such a manner as to ensure a suitable slidable shape engagement with a respective rectilinear guide member 7a, 7b, thereby preventing transverse movements, i.e. which are substantially parallel to the pin 6, of each roller 5 or sliding block with respect to the respective rectilinear guide member 7a, 7b.

[0047] By "slidable shape engagement" in the present invention, it is intended an engagement that as said prevents transverse movements (substantially parallel to the pin 6), and thus an exact correspondence is not intended, one (the roller) the opposite of the other (the rectilinear guide member), with the same size. Rather, a shape engagement is intended which allows the sliding of the outlet carriage 4 and thus of the mast 2 usually longitudinally along the guide or guides 7a, 7b, preventing, as said, transverse movements or movements that are substantially parallel to the pin 6 by the roller or rollers and hence of the respective outlet carriage 4 and mast 2.

[0048] Preferably, particularly with reference to a vehicle having an outlet carriage 4 provided with two or more rollers on one side thereof, and two or more rollers on the other side:

- the lower, in use, end of at least one front rollers, i. e. the rollers which are in front position when the outlet carriage is caused to be displaced from a rest position (Fig. 15) to an "all out" position (Fig. 17), of the mast is in shape engagement with a respective part of the guide 7a, whereas the higher, in use, end of such front roller/s can remain slightly detached (e. g. a few millimeters) from the respective part 7b of the guide, i. e. between the upper end of the front roller/s and a respective part of the guide 7b a small clearance SM is provided (see Figures 18 to 23), and
- the upper, in use, end of at least one back rollers, i. e. the rollers which are in a back position when the outlet carriage is caused to be displaced from a rest position (Fig. 15) to an "all out" position (Fig. 17), of the mast is in shape engagement with a respective part of the guide 7b, whereas the lower, in use, end of such back rollers can remain slightly detached (e. g. a few millimeters) from the respective part of the guide 7a, i. e. between lower end of the back roller and a respective part of the guide 7a a small clearance SM is provided (see Figures 24 to 29).

[0049] As it will be understood, owing to the weight of the load, e. g. a fork member borne by the outlet carriage and of the objects supported by it, the outlet carriage is likely to become slightly inclined at its front part at a level slightly lower than at its back part, and thus the front rollers are in engagement with the lower guide 7a, whereas the back rollers are engage the upper guide 7b.

[0050] Preferably, the lateral surface 5a has at least one receiving seat portion, such as a slidable receiving seat, or at least one relief engagement portion, sliding with respect to the remaining external lateral surface of the roller or better yet with respect to a cylindrical lateral surface of a conventional roller, while one or both rectilinear guide members correspondingly have at least one relief portion or at least one slidable receiving seat portion for the rolling or sliding shape engagement with a respective roller or rollers 5 or better yet with a receiving seat or relief portion of a respective roller, respectively.

[0051] More particularly, the rectilinear guide members have at least one portion in relief or at least one slidable receiving seat portion with respect to conventional rectilinear guides, the latter as known being substantially flat.

[0052] In the embodiment illustrated in Figures 8 to 14, the external lateral surface 5a of the roller(s) 5 is concave 5b (with concavity turned towards the exterior), while one or preferably both the lower and upper guides have a corresponding portion in relief 9b for the shape engagement with the respective concave surface 5b of the roller (s) 5.

[0053] The receiving seat 5b of the external lateral surface 5a is thus in rolling engagement with the relief or projecting portion 9b of the guides 7a, 7b, in a manner such that the engagement via rolling of the relief or projecting portion 9b with the receiving seat portion(s) 5b does not block the rolling movement or sliding movement of the roller 5 or sliding block longitudinally along the guides 7a, 7b, but prevents or blocks transverse movements, i.e. horizontal and parallel to the axle or pin 6, by the roller 5 or sliding block and hence of the outlet carriage 4 on the guides 7a, 7b.

[0054] Preferably, the upper rectilinear guide member 7a and the lower rectilinear guide member 7b are sym-

metrical with respect to each other with regard to a plane of symmetry that is intermediate thereto, and both have a relief portion or a receiving seat portion with respect to a flat guide surface.

[0055] The guide and control group then comprises means for regulating or adjusting the position of its respective roller 5 or sliding block on the axle or pin 6. Preferably, the means for regulating or adjusting comprises a pair of ring nut elements 10 fit on the axle or pin 6, on opposite sides from each other with respect to each roller 5 or sliding block and movable on the axis or pin 6 so as to allow the regulation or adjustment of the position of the roller 5 or sliding block horizontally on the axis or pin 6. The ring nut elements are adapted to be moved along the respective pin 6 so as to allow the controlled regulation or adjustment of the position of the respective roller 5 or sliding block, horizontally on the axle or pin 6.

[0056] More particularly, the pin or axle 6 is externally threaded, while the ring nuts 10 are internally threaded, such that if it is desired to move a roller 5 on the pin 6, it would be sufficient to move the two ring nuts 10 via screwing/unscrewing on the pin 6, thus causing the movement of the roller 5 on the axle or pin 6. For such purpose, holes or slots 10a can be provided for in the ring nuts 10 in which respective tools are insertable for controlling the rotation or screwing of the ring nuts 10 on the pin 6.

[0057] Owing to the provision of means for regulating or adjusting the position of a roller 5 or sliding block on the axle or pin 6, the position of the roller/s on the pin 6 can be adjusted as a function of the position of its respective guide and of the distance between the guide on one side (left side in Figures 15 to 17) of the outlet space (well width) and the guide on the other side (right side in Figures 15 to 17) thereof, since small construction tolerances should be taken into account, which could cause differences in the position of the guide/s, and in the width or transverse size of the outlet carriage, i. e. the distance between left and right guides.

[0058] With regard to the rollers 5, these can comprise an internal annular portion 11, intended to be threaded on the axle or pin 6, and a movable external annular portion 12 delimiting the external lateral surface 5a, with the interposition between them (between the internal portion 11 and the external portion 12), e.g. with bearing means, such as conical bearings 13, such that the external portion 12 is mounted for rotation on the internal portion 11.

[0059] Alternatively, the following could be provided for: ball bearings with oblique contact, conical bearings with double row of rollers, bearings with adjustable rollers, thrust bearing combined with rollers, rollers and/or ball bearings, with (shaped) thrust bearing made of antifriction material.

[0060] Moreover, when bearings designed to withstand axial loads are used, and particularly with reference to the case in which such bearings, in order to work properly, are to be pre-loaded (this applies in particular with conical or oblique bearings), the pair of ring nut elements 10 make it possible to pre-load the bearings, and thus the nut elements 10 are also useful in ensuring proper working of the bearings.

[0061] In place of, or in combination with the rollers, the guide and control group could also include sliding blocks, which would engage the respective guides via sliding.

[0062] The pin or axle 6 is generally rigidly connected, e.g. by means of welding or bolting, to plates 4a mounted (e.g. bolted or welded) on the sides of the mast 2.

[0063] The guides 7a, 7b can instead comprise an external section 14 that is fixable, e.g. boltable, to supports 15 in turn borne, e.g. welded, to the frame 3a of the truck 3. The guides can be naturally dismountable, or welded to the frame 3a.

[0064] According to the embodiment illustrated in the Figures, each support 15 delimits a hollow or cradle-like portion 15a in which the respective external section 14 is fixable, e.g. via screws 16 (which, as will be understood, ensure the possibility of substituting the sections 14); the section 14 has an intermediate portion 14a larger in thickness than the lateral portions 14b and intended to substantially shape engage the hollow or cradle-like portion 15a. For such purpose, it will be observed that each roller 5 is subjected to axial thrusts substantially in the direction of the pin or axle 6, and such thrusts are unloaded on the fixing screws 16. Due to the particular configuration of the support 15, the axial or lateral thrusts are actually supported or sustained by the hollow or cradle-like seat of the supports 15.

[0065] With particular reference to Figures 15 to 17, a lift truck is illustrated according to the present invention that is equipped with a lifting group or mast 2 in rest position (Fig. 15), intermediate position (Fig. 16), and final or "all out" position (Fig. 17).

[0066] It will be observed that a mast or lifting group 2 can comprise a pair of sections 2a with substantially vertical position, bridge-connected by means of suitable crossbars 2b.

[0067] On the sections 2a of the mast, a framework 2c is then slidably mounted, in a substantially vertical direction. Such framework 2c supports means for engaging and transporting a load, such as fork-like brackets or forks 2d extending upward from the framework 2c, in a substantially horizontal direction and with free end turned in the direction of disengagement of the mast from the outlet space (well width).

[0068] As will be understood, due to a guide and control group according to the present invention, the outlet roller or sliding block cannot be moved or in any case it is strongly prevented from being moved in an axial or parallel direction with respect to the pin or axle 6, but it can usually roll (rolling - in the case of a roller) or slide (sliding - in the case of a sliding block) on the respective guides. In this manner, one obtains the axial guide of the lifting group 2 in its horizontal translation movement of insertion and disengagement into/from the outlet space (well width) 8, in which the rollers or sliding blocks - in their

rolling or sliding on the guides or profiles rigidly fixed to the frame 3a of the truck - axially guide the lifting group or mast 2, which therefore does not require further sliding blocks and/or opposing rollers as occurs with the solutions proposed up to now.

[0069] In this manner, in addition to obtaining a high precision of movement of the mast, the operations of lubrication and adjustment are eliminated, which are necessary according to the solutions of the prior art. The outlet roller(s) or sliding block(s) according to the present invention are therefore suitable for supporting axial thrusts, which does not occur with the conventional outlet rollers or sliding blocks.

[0070] Due to the present invention, the sliding blocks and/or the opposing rollers are not necessary, and a substantially linear prism-shaped or semicircular guide is obtained which allows the translation movement of the lifting group or mast. In order to obtain this guide type, it is necessary to provide for suitable outlet rollers suitable for axially guiding the lifting group, also called mast.

[0071] Such rollers must then be positioned in a relatively precise manner on suitable outlet guides or profiles, and thus they could require an adjustment in axial sense.

[0072] To this regard, the guide and control group is also equipped with ring nuts 10, and thus it is also possible to axially adjust the center of application of the radial force. The ring nuts, preferably threaded, in fact allow moving, or better yet adjusting, the axial position of the respective roller or sliding block, both for correctly positioning the roller or sliding block on the outlet guides or profiles integral with the frame and for preloading the conical bearings of the roller as a function of the actual load requirements of the mast and the duration expected for the same.

[0073] The adjustment by means of the ring nuts can be carried out, for example, each time or at the time of assembly.

[0074] It will be understood that the configuration of the rollers or sliding blocks and respective guides could also be different, for example:

- one or more rollers could be equipped with an external circumferential relief portion 5c, e.g. V-shaped, with vertex directed outward, while the guides 7a, 7b could be prism-shaped and delimit a slidable receiving seat, e.g. overturned V-shaped 9c, i.e. with vertex directed away from the respective rollers, for a respective external circumferential relief - see Figures 18 and 24;
- one or more rollers could delimit a peripheral slidable and recessed receiving seat, e.g. with overturned V-shape 5f, i.e. with vertex turned away from the guides, while the guides 7a, 7b could be equipped with a relief portion 9f, e.g. configured as a V with vertex aimed towards the rollers, for the sliding engagement with the peripheral receiving seat 5f - see Figures 21 and 27.

[0075] With particular reference to the embodiments illustrated in Figures 19, 20, 25, and 26, preferably, one can mount a guide and control group like that illustrated in Figures 19 and 26 at one side of the outlet space (well width) (e.g. left side for a user who views the outlet space (well width) from the outside and thus in the direction of insertion of the mast in the outlet space (well width)) and a guide and control group like that illustrated in Figures 20, and 25 at the other side of the outlet space (well width) (e.g. right side of the outlet space (well width) for a user who views the outlet space (well width) from the outside and thus in the direction of insertion of the mast in the outlet space (well width).

[0076] The lower and upper guides could be connected by means of an intermediate portion 7c. For such purpose, Figures 22 and 28 illustrate a roller configured like that illustrated in Figures 21 and 27, respectively, but the two guides 7a, 7b are integrally made, e.g. obtained via extrusion and bridge-connected by means of the intermediate portion 7c.

[0077] With reference to Figures 23 and 29, a roller is illustrated that is equipped with a slightly curved and convex relief portion 5g, with convexity directed outward, i.e. towards the respective guides 7a, 7b, while the guides have a reception or housing portion 9g designed to be engaged via rolling by the relief portion 5g. Between the relief portion 5g and the receiving seats 9g there is, as said, a slidable form coupling or engagement which is suitable for preventing transverse movements of each roller 5 or sliding block with respect to the respective rectilinear guide member 7a, 7b, without however there being an exact correspondence (with the same size) of the roller or better yet of the relief portion 5g of the same with the receiving seat 9g of the rectilinear guide member.

[0078] A guide and control group according to the present invention can thus be equipped with one or more rollers which, with respect to the conventional rollers with a cylindrical lateral surface, have a cylindrical lateral surface or edge delimiting one or more receiving seats or one or more relief or projection portions intended to respectively engage via rolling relief portions or receiving seats of a guide or guide portion that is not flat.

[0079] Fig. 30 illustrates component parts of a mast with respective guide and control group including one or more sliding blocks 50 which have an external surface or edge which delimits a concave reception or housing seat 50b, with concavity turned towards the respective guide 7a, 7b with which the edge is intended to be engaged via sliding. The guides or guide portions 7a, 7b designed to be engaged with the respective edge or external surface of the sliding block 50 are instead substantially configured like those illustrated in Fig. 14, i.e. equipped with a relief or projecting portion 9b with convexity turned towards the respective sliding block 50. According to the illustrated embodiment, four sliding blocks are provided for, two masts on a respective pin being extended from a respective side of the mast 2 or from a plate fixed thereto, and with position substantially hori-

zontal and orthogonal to the direction of insertion/disengagement of the mast into/from the respective outlet space (well width).

[0080] The sliding blocks 50 can, for example, be substantially shaped as a block with substantially flat lateral walls.

[0081] Preferably, at least one of the upper 41 and lower 42 edges of each sliding block delimits at least one relief portion or at least one slidable receiving seat, while the respective guide delimits at least one slidable receiving seat portion or at least one relief portion, respectively, for the sliding engagement with a respective slidable receiving seat or with a respective slidable engagement relief of at least one sliding block 50, respectively.

[0082] Preferably, the upper 41 and lower 42 edge of each sliding block 50 delimit the concave housing seat 50b with convexity turned towards the respective lower 7a and upper 7a guide, respectively.

[0083] Moreover, as stated above, the guide and control group further comprises means for regulating or adjusting the position of the respective sliding block 50 on the axle or pin.

[0084] With reference to Fig. 31, a guide and control group is instead illustrated equipped with a respective sliding block 500 on each side of the mast. Such sliding block 500 has a much greater longitudinal extension (i.e. in the sliding direction on the respective guide) than the sliding blocks according to the embodiment of Figure 30, but delimits a housing seat with configuration substantially corresponding thereto. The guides 7a, 7b are instead substantially corresponding to those of the embodiment of Fig. 30. Each sliding block 500 is mounted on one, and preferably on a pair of axial pins extending in a direction substantially horizontal and orthogonal to the direction of insertion/disengagement of the mast into/from the outlet space (well width), starting from the sides of the mast or better yet from the plates fixed to the sides of the mast.

[0085] A guide and control group according to the present invention can then be equipped with one or more sliding blocks which, with respect to the conventional sliding blocks with a lower and upper edge that are substantially flat, instead have a lower and/or upper edge delimiting one or more receiving seats and one or more relief portions designed to engage via sliding, respectively relief portions or receiving seats of a guide or guide portion that is not flat.

[0086] With reference now to Figs. 32 and 33, a mast 2 of a lateral lift truck is illustrated, equipped with a guide and control group 1 according to the present invention, as well as actuation means 17, which comprise one or more linear actuators 18 having position substantially parallel to the translation direction of the lifting group in the respective outlet opening (or direction of insertion/disengagement in the/from the space).

[0087] Preferably, the actuation means comprise one or a pair of ball recirculation screws 18, each mounted on a lower end of one side of the mast 2.

[0088] A nut 19 moved by the ball recirculation screws 18 can also be provided, together with, on one side of the screw, a self-aligning support 20 fixable to the frame 3a of the track, and on the other side a support sleeve 21. Of course, there is also a motor 22, e.g. electric, hydraulic, pneumatic, etc., for controlling the rotation of the screws 18, which can be provided connected to the end of the screw(s) supported by the sleeve 21.

[0089] The ball recirculation screws drive the mast in its motion of insertion/disengagement by means of brackets 23, e.g. on one side fixed to the nut 19 and on the other side to the base of the mast 2.

[0090] Since the ball recirculation screws support limited (radial) loads, their use for driving a lifting group or mast in a lateral carriage is particularly permitted in combination with a guide and control group according to the present invention.

[0091] Due to the provision of at least one linear actuator with position substantially parallel to the direction of translation or insertion/disengagement of the lifting group in the respective space, it is possible to obtain a high linearity and movement precision.

[0092] This is particularly obtained with ball recirculation screws, since they ensure a high movement precision of the mast, and also allow eliminating the kinematic transmission mechanism of the jacks.

[0093] In addition, by using ball recirculation screws, it is possible to obtain outgoing and return phase speeds that are substantially corresponding, unlike that obtainable by using the jacks with position substantially parallel to the insertion/disengagement direction.

[0094] Moreover, the ball recirculation screws have much smaller sizes than the jacks, and thus one is able in a much easier manner to arrange them in the outlet space (well width), substantially under or over the guides.

[0095] GB-1 026 794, as a matter of fact, does not describe a group in which the roller includes a portion in slidable shape engagement with a respective portion of the guide, since the rib or tread does neither abut against nor engage the profiles of the guide. On the contrary, each roller slides on the plane surfaces of its respective guide.

[0096] GB-1 026 794 does not solve the problem of the lateral friction between roller and guide, which would be faced should the roller withstand the axial forces usually rising during the displacement of the mast.

[0097] According to the present invention, at least the lower end of one roller of the mast is in shape engagement with a respective part of the guide, whereas the upper end of the roller can be in loose engagement with its respective guide, thereby obtaining proper and correct guiding action for the roller, and thus of the must. The roller disclosed in GB-1 026 794 slides in a free way without being guided, and the rib or tread does not slidingly engage the guide, otherwise it would undergo substantial wear.

[0098] The engagement between a roller and its respective guide according to JP-2004-075303, works cor-

rectly only if the frame of the carriage is pre-tensioned, whereas pre-tensioning is not required in a group according to the present invention.

[0099] In so far as JP-2006-117357 and JP-2008-201493 are concerned, they aim at solving the problem of guiding the displacement of a mast and its fork carriage, whereas the application invention of the present application solves different problems, among which that of providing a guide and control group which is not affected by the so-called "stick and slip" phenomena.

[0100] The solutions taught by such prior art documents are reliable only with a precise manufacturing, and thus they are not suitable for being used in a lifting group of a side-loading lift truck, in which the construction tolerances are high, higher than 2-3 mm. As it will be understood, to reduce the tolerances, not praticable and expensive mechanic workings should be used.

[0101] Moreover, such Japanese documents teach vehicles having not adjustable rollers, i.e. rollers fixed to a respective pin.

[0102] It will be appreciated that none of the above-mentioned prior art solutions teaches a group provided with means for regulating or adjusting the position of a roller or sliding block on its axle or pin, and more particularly regulating or adjusting means including a pair of ring nut elements as is the case with the solution according to the present invention.

[0103] The guide and control group and the truck described above are susceptible to numerous modifications and variations within the protection scope defined by the contents of the claims.

[0104] Thus, for example, a guide and control group could be provided for that is equipped with rollers 5 and guides 7a, 7b only on one side of the mast and space delimited by the frame, while on the other side conventional rollers and guides could be provided. Moreover, it is possible to provide for a combination of rollers 5 and sliding blocks 50, 500.

[0105] One could also provide for an upper guide that is different from the respective lower guide, in a particular manner, where the guide and control group comprises sliding blocks.

[0106] It is in any case possible to use different upper and lower guides also with the rollers 5 according to the present invention. In such case, for example, the roller could have a groove in circumferential direction on its external ring and one of the upper or lower guides could have a longitudinal strip intended to be engaged in the slot of the roller(s).

Claims

1. A group for guiding and controlling the translation of a lifting group (1) of a 2-way, 4-way or multidirectional side-loading lift truck (3), comprising:

- at least one rectilinear guide member (7a, 7b);
- an outlet carriage (4) having at least one roller (5) and/or sliding block (50, 500) adjustably mounted on a pin (6), substantially horizontal in use, which has external surface (5a) for the rolling or sliding engagement with a respective rectilinear guide member (7a, 7b), said external surface (5a) being shaped in a manner so as to ensure a slidable shape engagement with a respective rectilinear guide member (7a, 7b), thereby preventing transverse movements of each roller (5) or sliding block (50, 500) with respect to a respective rectilinear guide member (7a, 7b),

and in that it comprises means for regulating or adjusting the position of said at least one roller (5) or sliding block (50, 500) on said axle or pin (6).

2. A group according to claim 1, **characterized in that** said means for regulating or adjusting comprises a pair of ring nut elements (10) fit on said pin (6) on opposite sides with respect to a respective roller (5) or sliding block (50, 500), and suitable for being moved in a controlled manner along its respective pin (6).

3. A group according to claim 2, **characterized in that** said pin (6) is externally threaded, while said ring nut elements (10) are internally threaded, whereby for the adjustment of the respective roller (5) or sliding block (50, 500) the screwing/unscrewing of said ring nut elements (10) on said pin (6) is carried out.

4. A group as claimed in any previous claim, **characterized in that** the lower or upper end of said at least one roller or sliding block is in shape engagement with a respective part of its respective guide, whereas the upper or lower end, respectively, of said roller is slightly detached from its respective part of the guide.

5. A group as claimed in claim 4, **characterized in that** said outlet carriage (4) comprises at least two rollers on one side, and at least two rollers on the other side, and **in that**:

- the lower, in use, end of at least one front rollers, i. e. the rollers (5) which are in front position when the outlet carriage is caused to be displaced from a rest position to an all out position, of the lifting group (1) is in shape engagement with a respective part of the guide (7a), whereas the upper, in use, end of said at least one front roller is detached from its respective part (7b) of the guide, and
- the upper, in use, end of at least one back rollers, i. e. the rollers (5) which are in a back posi-

tion when the outlet carriage is caused to be displaced from a rest position to an all out position, of the lifting group is in shape engagement with a respective part of the guide (7b), whereas the lower, in use, end of said at least one back roller is detached from its respective part of the guide (7a).

6. A group according to any previous claim, **characterized in that** said at least one roller (5) or sliding block (50, 500) comprises an external surface (5a) having at least one slidable receiving seat (5b, 5f) or slidable engagement relief (5c, 5d, 5e, 5g), whereas said at least one rectilinear guide member (7a, 7b) has at least one relief portion (9b, 9f) or at least one slidable receiving seat portion (9c, 9d, 9e, 9g) for the rolling or sliding engagement with a respective slidable receiving seat (5b, 5f) or with a respective slidable engagement relief portion (5c, 5d, 5e, 5g) of a respective roller.

7. A group according to any previous claim, **characterized in that** said external surface (5a) of said at least one roller (5) or sliding block (50, 500) is concave (5b), whereas said at least one guide member (7a, 7b) has a corresponding relief portion (9b) for the shape engagement with a respective concave surface of said at least one roller (5) or sliding block (50, 500).

8. A group according to any previous claim, **characterized in that** said at least one roller comprises an external circumferential relief (5c), whereas said at least one rectilinear guide member (7a, 7b) delimits at least one slidable receiving seat (9c) for a respective external circumferential relief (5c).

9. A group according to any claim from 1 to 7, **characterized in that** said at least one roller has a flanged side (5d, 5e), whereas said at least one rectilinear guide member delimits a notch or groove (9d, 9e) designed to receive at least one portion of said flanged side (5d, 5e).

10. A group according to any previous claim, **characterized in that** said at least one roller (5) comprises an internal annular portion (11) designed to be mounted on said pin (6), an external annular portion (12) mounted for rotation on said internal annular portion (11), and at least one bearing means (13) between said internal annular portion (11) and said external annular portion (12).

11. A group according to any preceding claim from 1 to 9, **characterized in that** said external surface of said at least one sliding block (50) has an upper edge (41) and a lower edge (42), whereas said at least one guide member comprises an upper guide (7a) and a lower guide (7b) designed to be slidably engaged, respectively, with said upper edge (41) and with said lower edge (42), at least one of said edges delimiting at least one relief portion or at least one slidable receiving seat, whereas the respective guide member respectively delimits at least one slidable receiving seat portion or at least one relief portion, for the sliding slidable engagement with a respective slidable receiving seat or with a respective slidable engagement relief of said at least one sliding block (50, 500), respectively.

12. A group according to any previous claim, **characterized in that** said at least one rectilinear guide member (7a, 7b) comprises an external section (14) fixable to a support (15) borne by said side-loading lift truck (3), said support (15) delimiting a cradle-like portion (15a) in which the respective external section (14) is fixable, said section (14) having an intermediate portion (14a) larger in thickness than the lateral portions (14b), and intended to substantially shape engage the hollow or cradle-like portion (15a).

13. A side-loading lift truck or vehicle delimiting an outlet space or well width (8) and comprising a lifting group (2) translatable in said outlet space or well width (8), at least one plate (4a) on each side of said lifting group (2), and at least one guide and control group (1) according to any preceding claim, said pin (6) of said guide and control group being integral with, and extended from, said at least one plate (4a).

14. A truck or vehicle according to claim 13, **characterized in that** it comprises actuation means for said lifting group including at least one linear actuator in a position substantially parallel to the direction of translation of said lifting group (2) in said outlet space or well width (8).

15. A truck or vehicle according to claim 14, **characterized in that** said actuation means comprises a pair of ball recirculation screws (18), each at one side of said lifting group (2).

Fig. 1

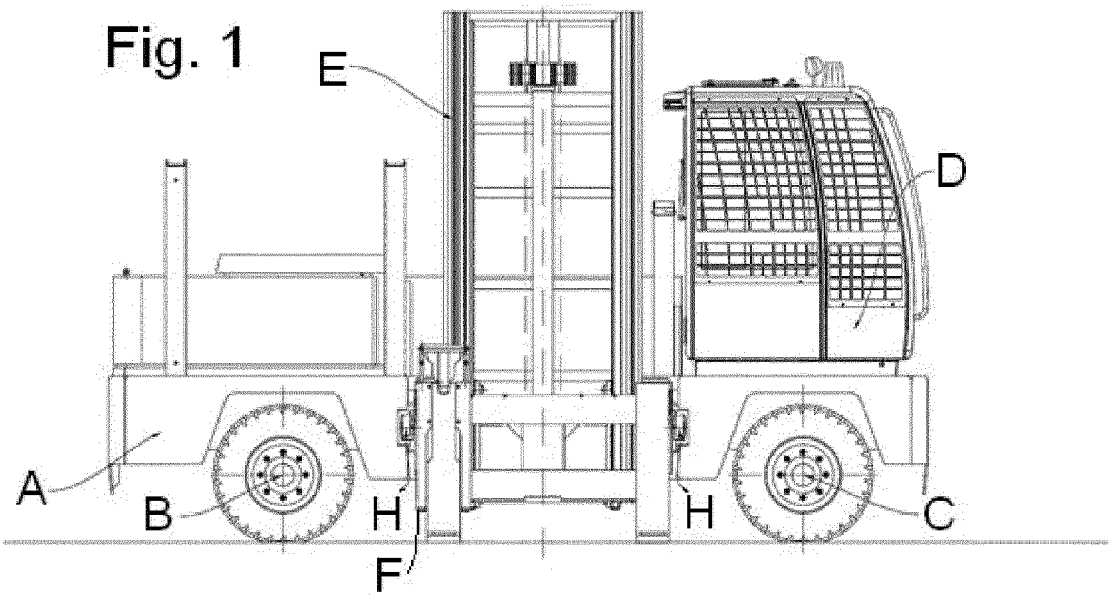


Fig. 2

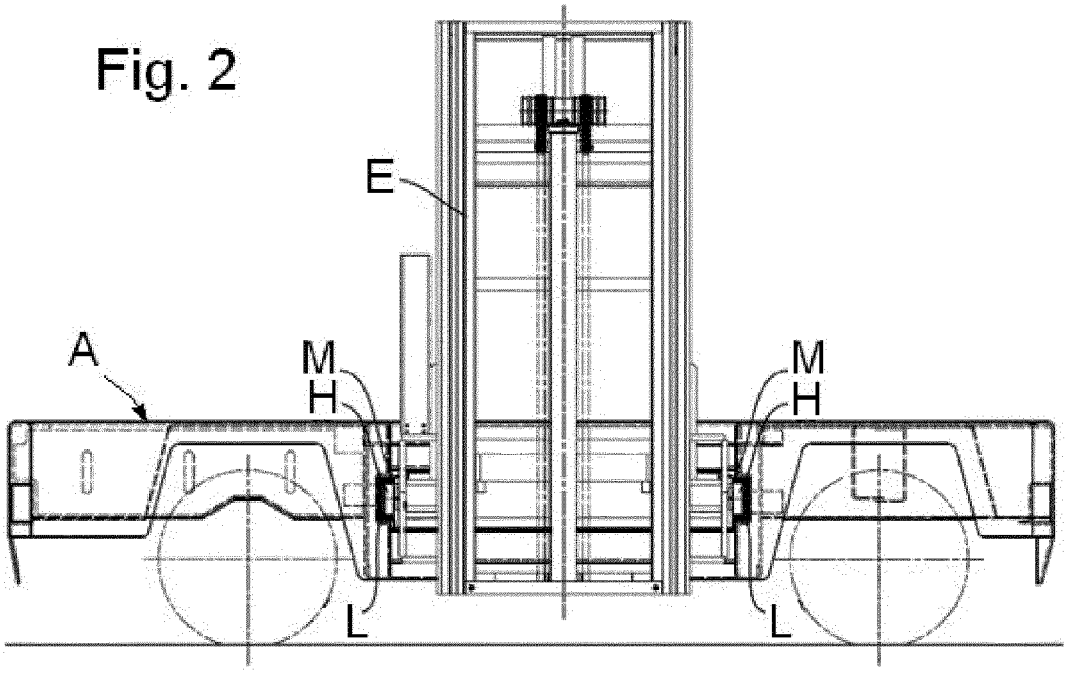


Fig. 3

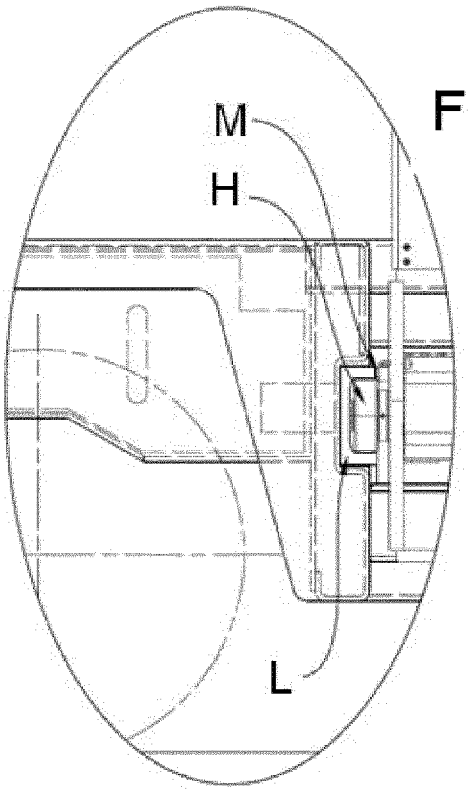


Fig. 4

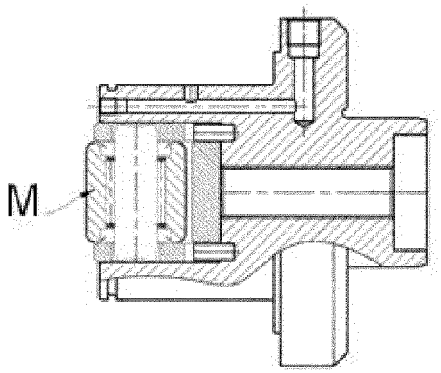
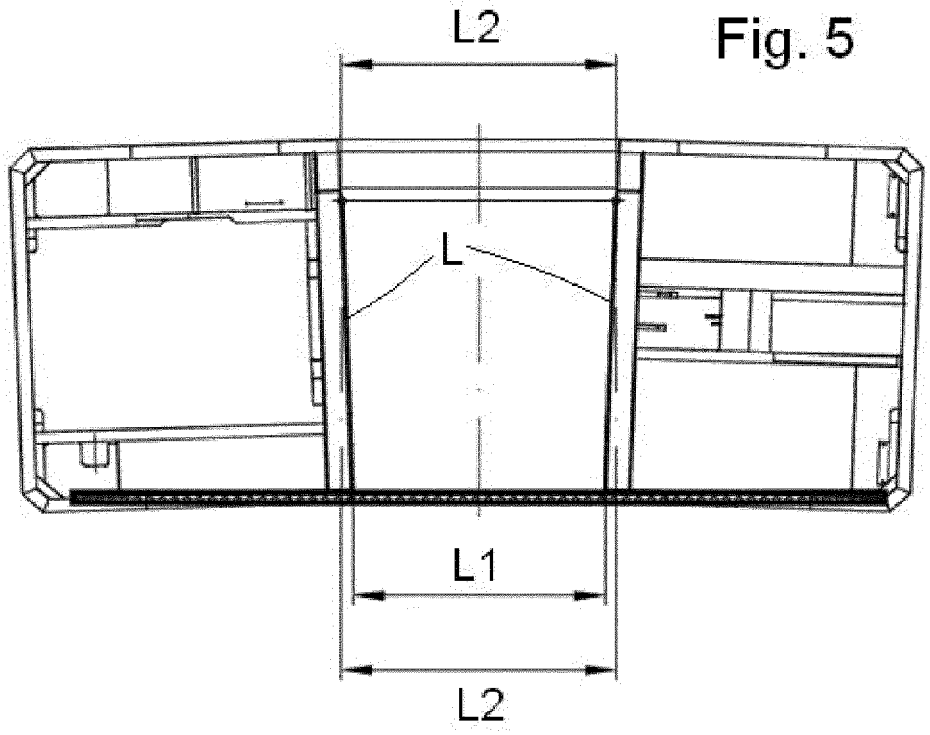


Fig. 5



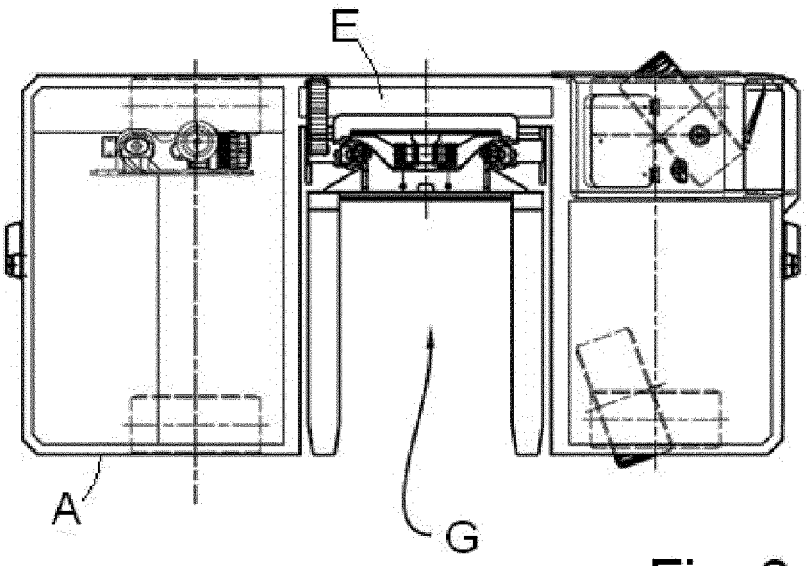


Fig. 6

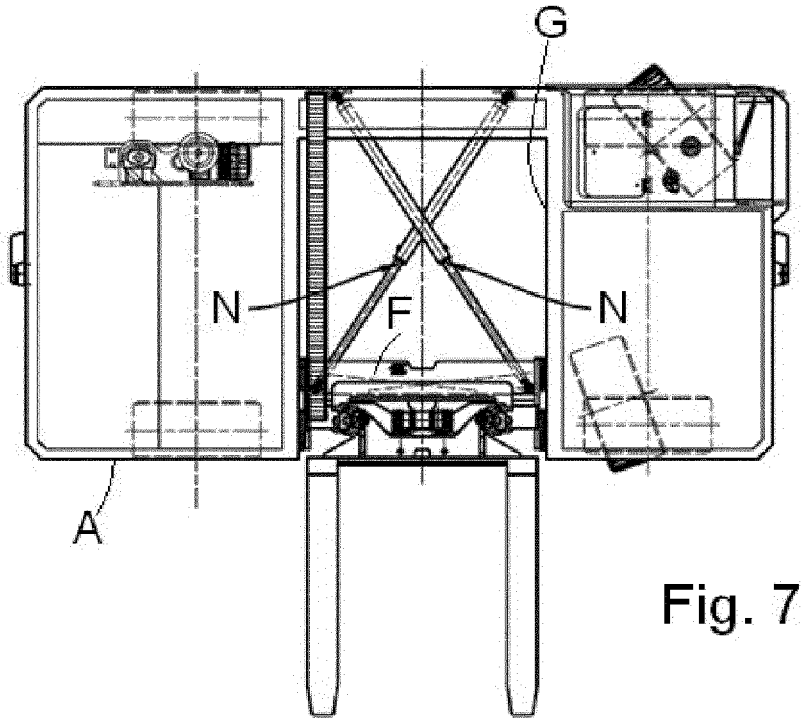


Fig. 7

Fig. 8

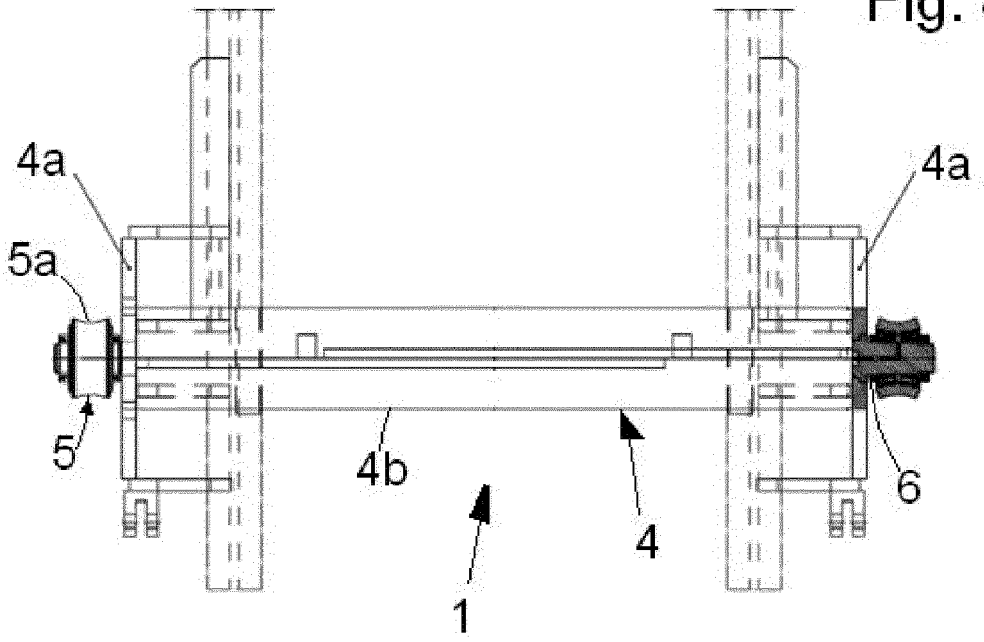
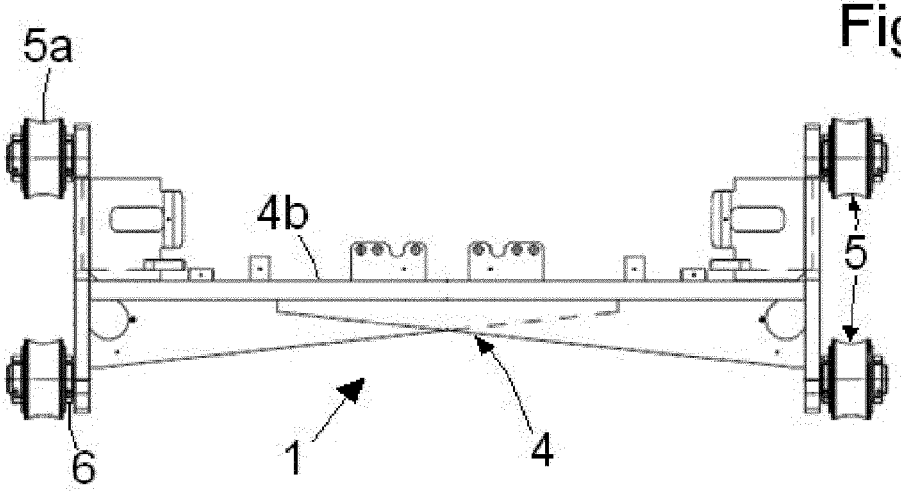


Fig. 9



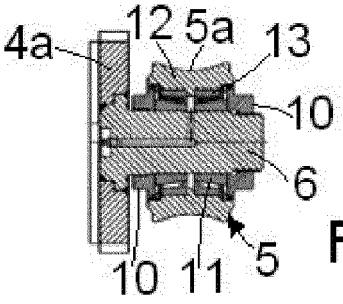


Fig. 10

Fig. 11

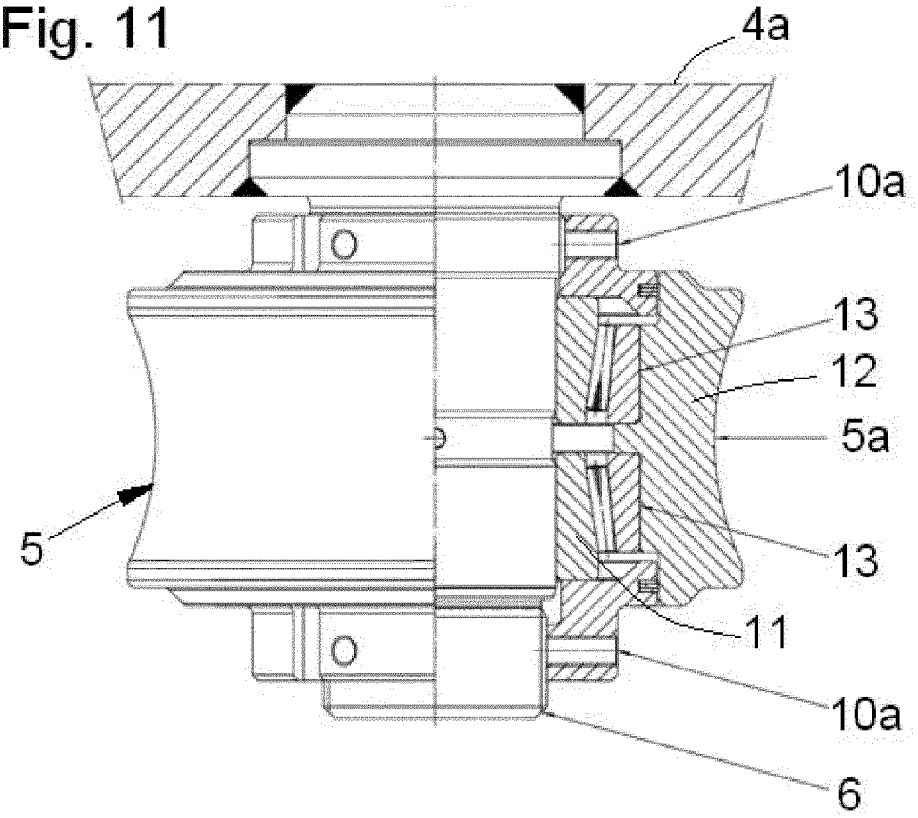


Fig. 14

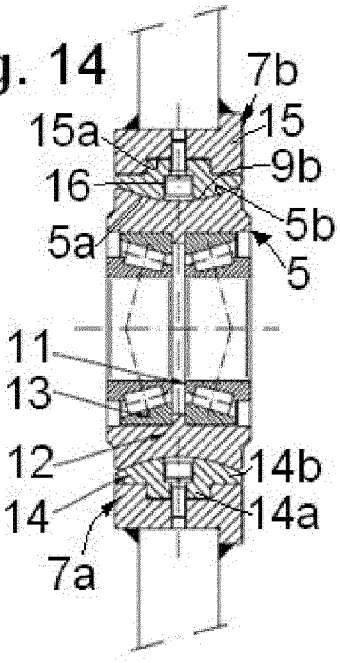


Fig. 12

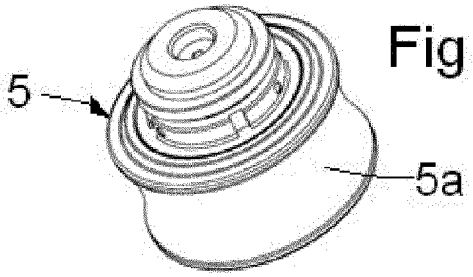
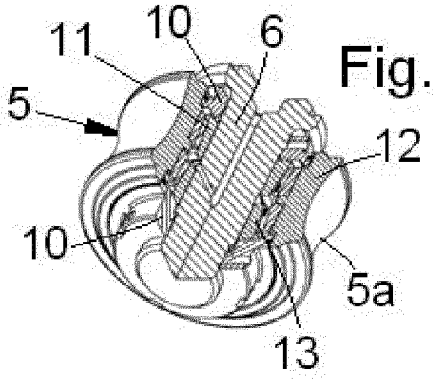


Fig. 13



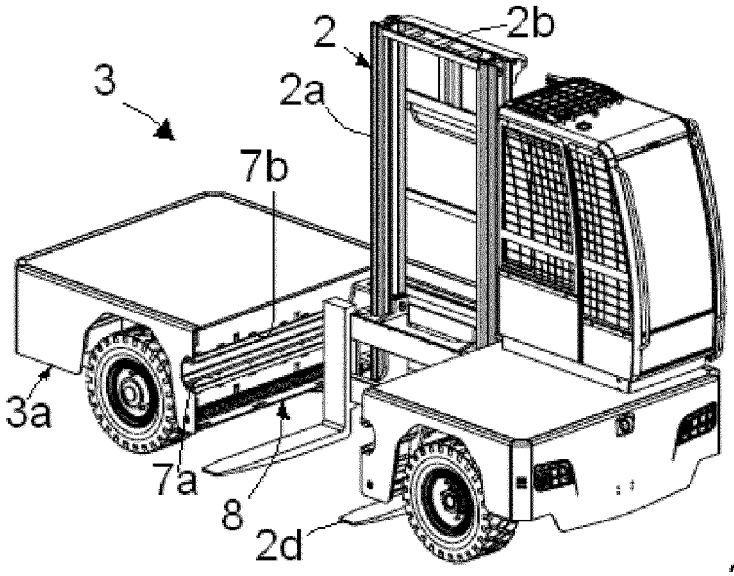


Fig. 15

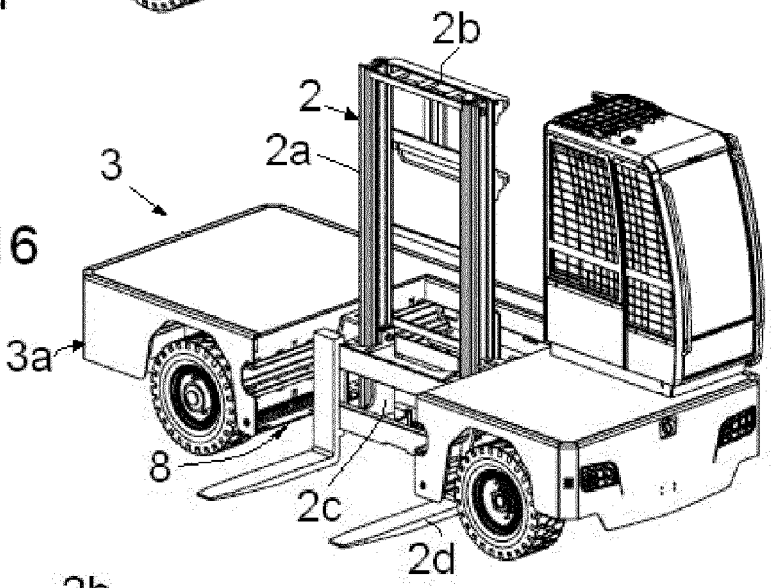


Fig. 16

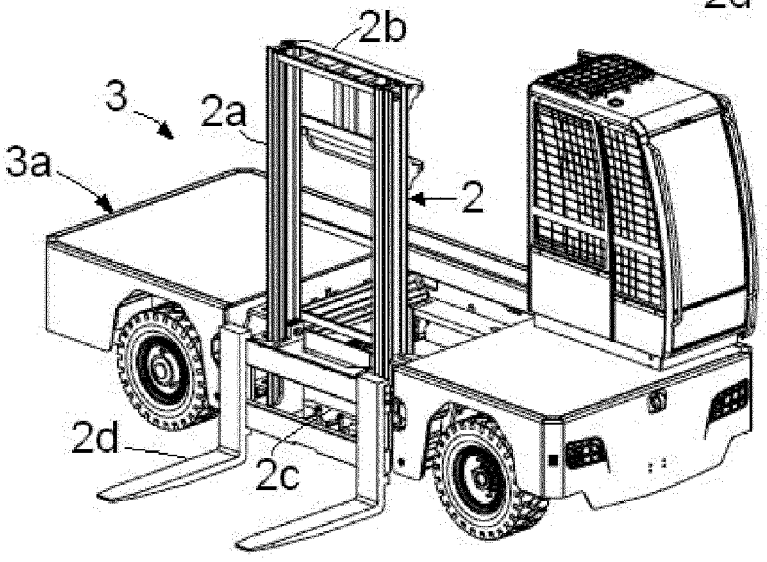
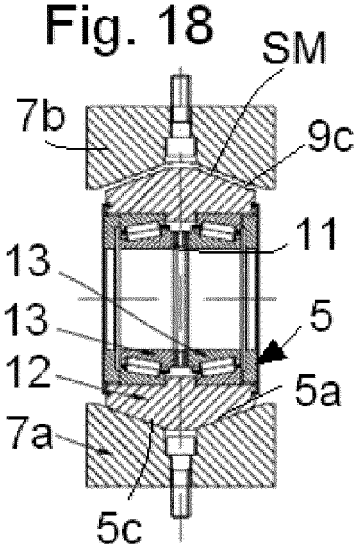


Fig. 17

Fig. 18



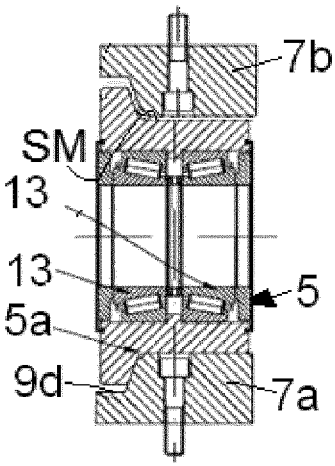
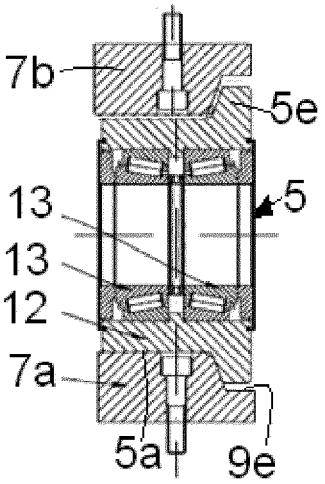


Fig. 19

Fig. 20



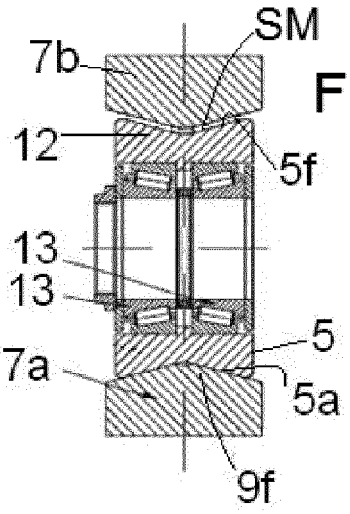


Fig. 21

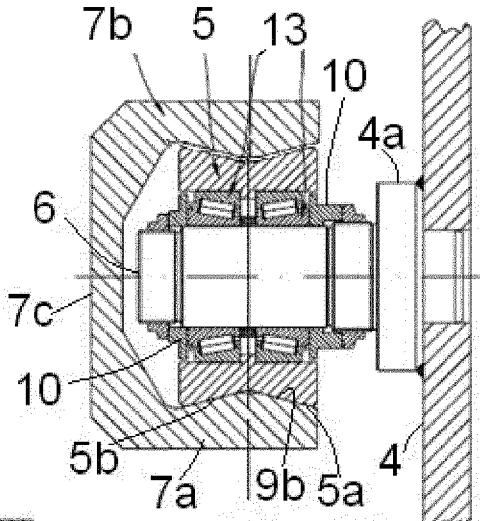


Fig. 22

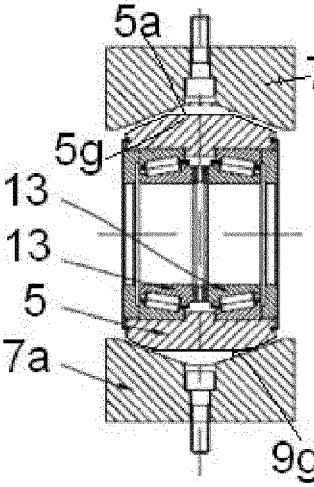
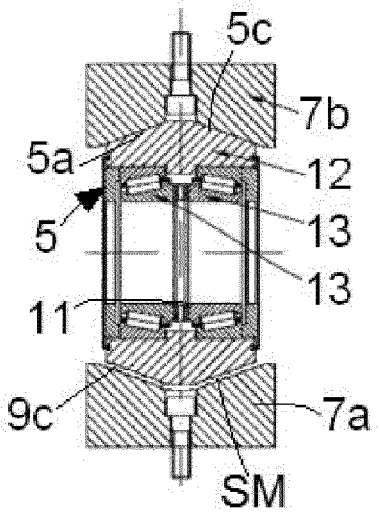


Fig. 23

Fig. 24



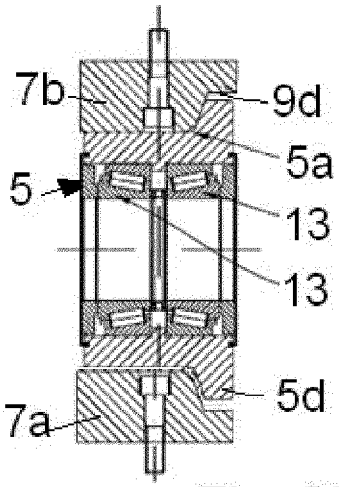
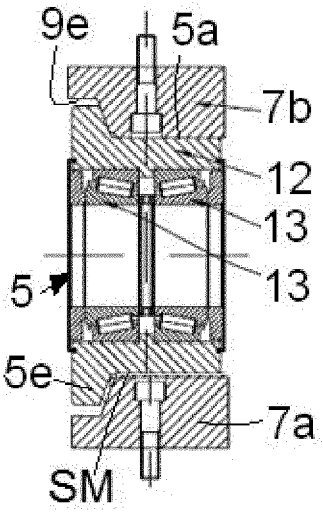


Fig. 25

Fig. 26



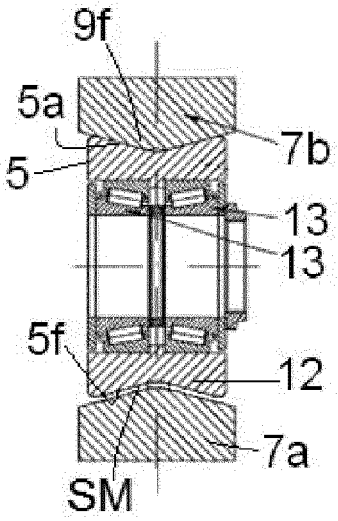
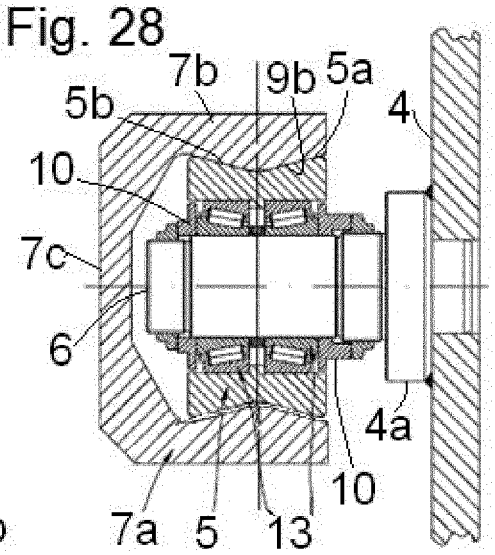


Fig. 27

Fig. 28



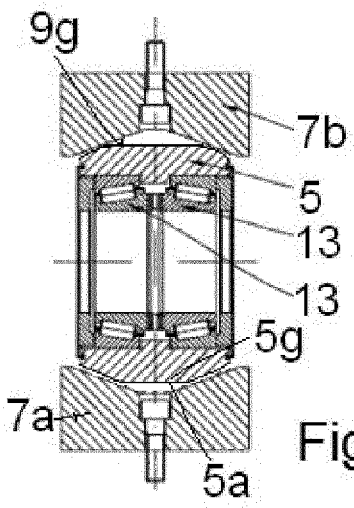


Fig. 29

Fig. 30

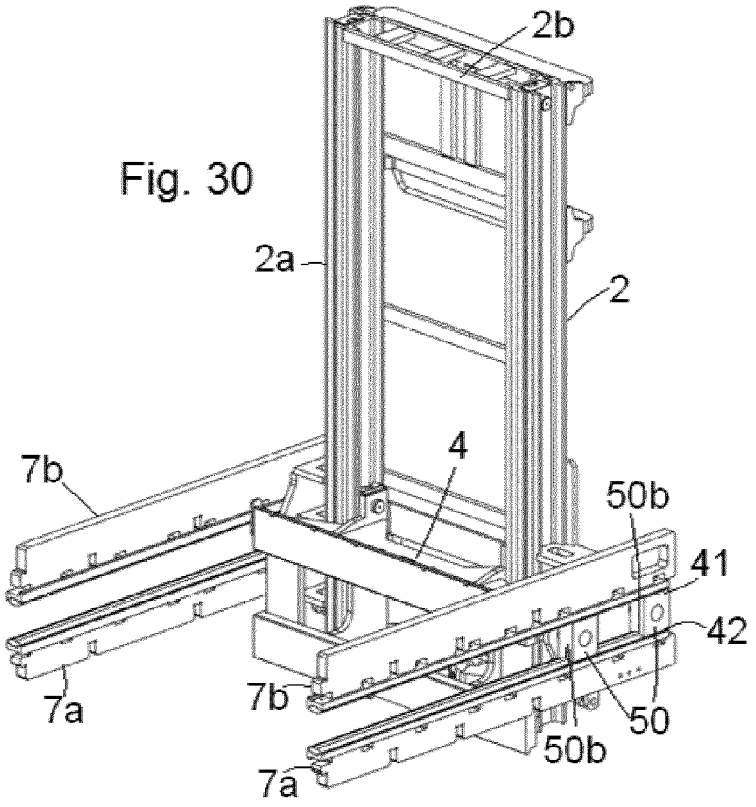

2b
2a
2
4
7b
50b
41
42
7a
7b
50
50b
7a

Fig. 31

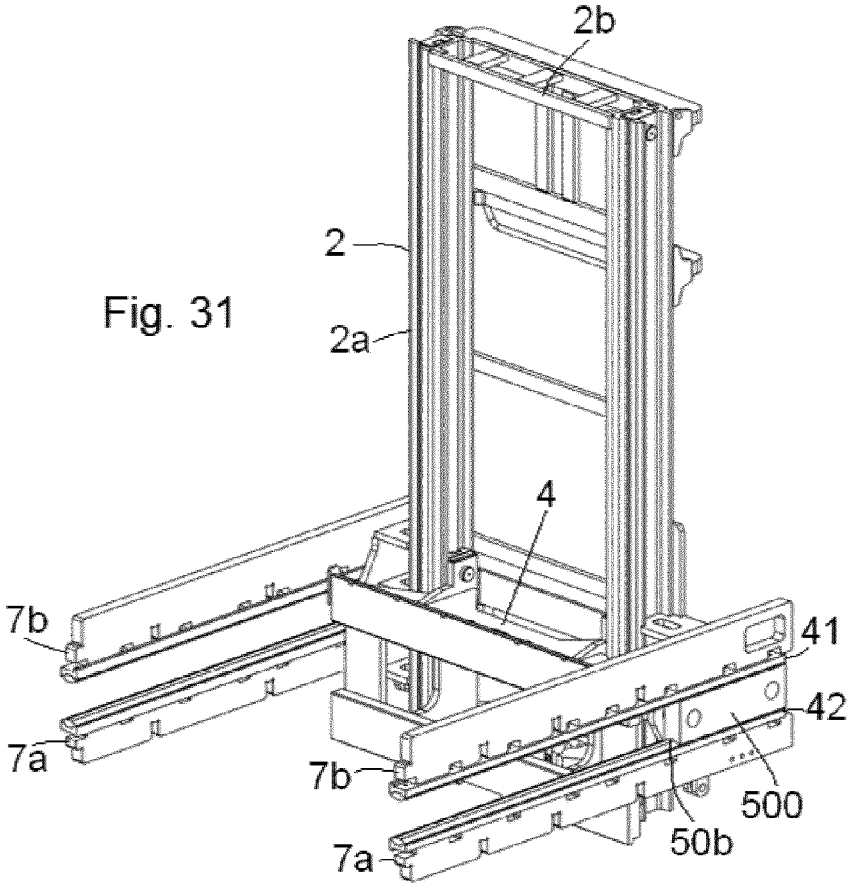

2b
2
2a
4
7b
41
42
7a
7b
500
50b
7a

Fig. 32

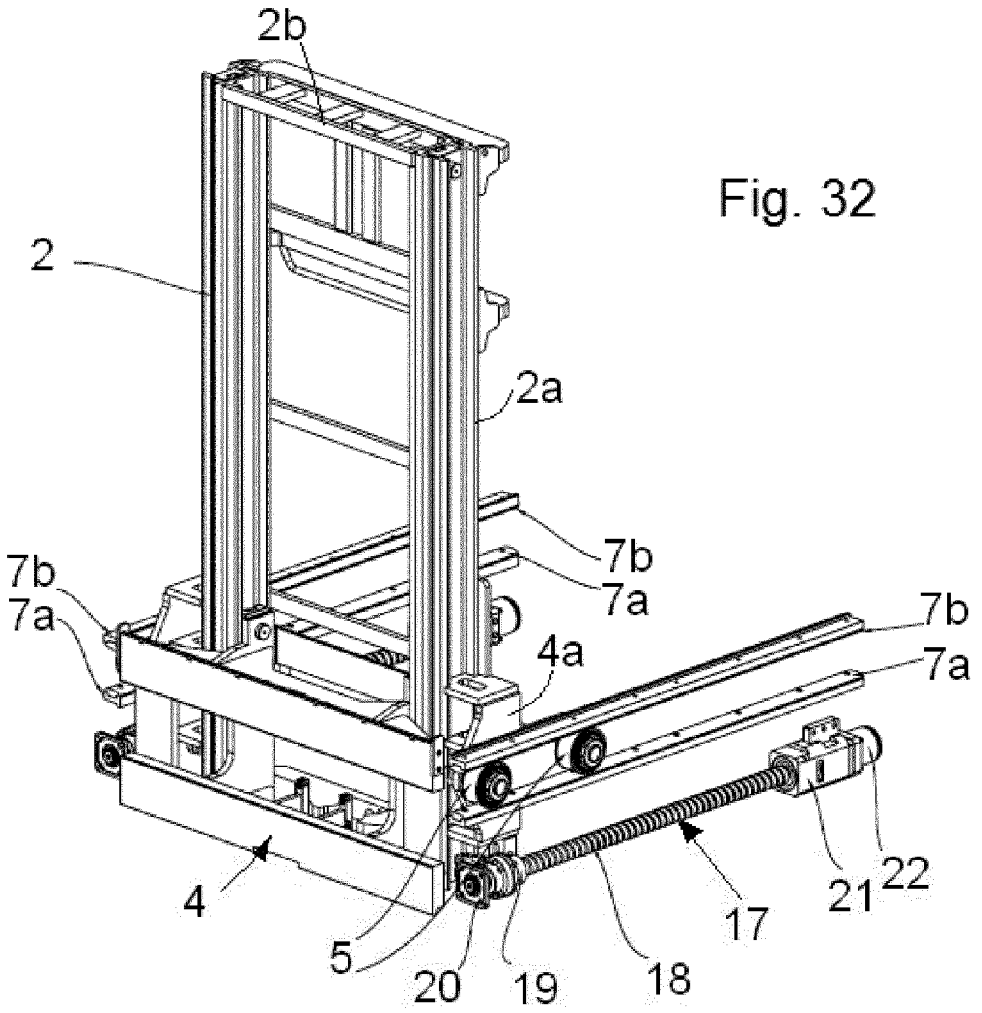
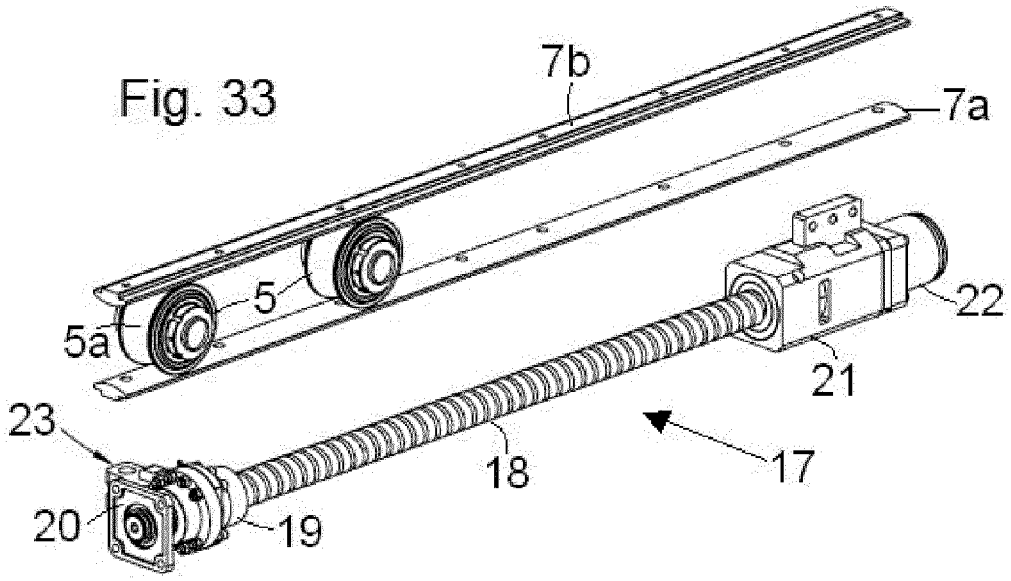

2b
2
2a
7b
7a
7b
7a
7b
7a
4a
4
5
20
19
18
17
21
22

Fig. 33


7b
7a
5
5a
22
21
23
18
17
20
19

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EUROPEAN SEARCH REPORT

Application Number
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Place of search	Date of completion of the search	Examiner
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