(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 037 316 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
29.06.2016 Bulletin 2016/26

(51) Int Cl.:
B61D 19/00 *(2006.01)* ***E05D 15/10*** *(2006.01)*

(21) Application number: **14200074.4**

(22) Date of filing: **23.12.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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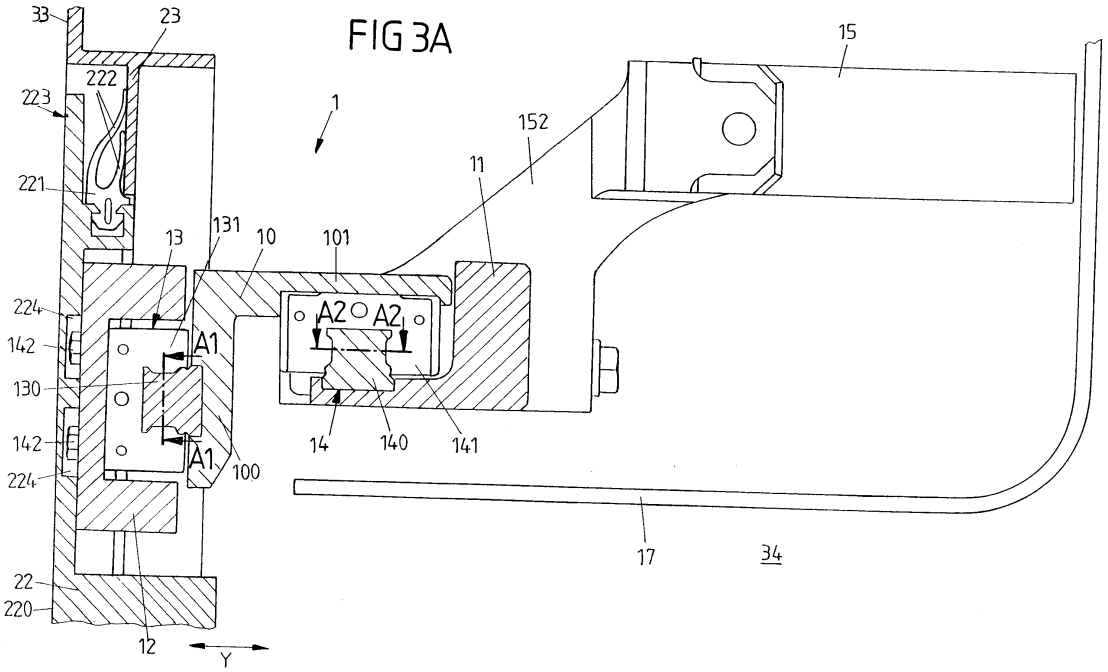
(54) **Door guiding device for a door of a wagon**

(57) The invention relates to a door guiding device for a door (2) of a wagon (3), being displaceable, in the mounted condition, along a plug axis (Y) substantially vertical to the plane of a door panel (22) mounted to the door guiding device (1, 1'), between a retracted position and an extended position, and comprising a door panel mount (12; 12'; 12"), which is connectable with the door panel (22), a drive carriage (10; 10') slidably supporting the door panel mount (12; 12'; 12") by means of a first linear guiding device (13; 13'), and a carrier (11; 11') slidably supporting the drive carriage (10; 10') by means of a second linear guiding device (14; 14'). It is provided that in the extended position of the door guiding device (1; 1'), one of the first and second linear guiding devices (13, 14; 13', 14') is located outside an interior (34) of the wagon (3) defined by an outer surface (33) of the wagon (3), while the other one of the first and second linear guiding devices (13, 14; 13', 14') is at least partially located inside of the interior (34) of the wagon (3).

FIG 3A



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Description

[0001] The invention relates to a door guiding device for a door of a wagon according to claim 1, to a door for a wagon according to claim 14 and to a wagon according to claim 15.

[0002] Door guiding devices are used for guiding a displacement of door panels between an opened and a closed position in order to open or close the door. In particular, door guiding devices are used for guiding door panels of sliding doors or sliding plug doors. Therein, the door guiding device is usually arranged on an upper part of the door, i.e. on an upper part of a door frame.

[0003] When the available space and in particular the available height for the installation of a door with a door guiding device is limited, as often the case for doors in wagons of mass transportation vehicles, there is a need to construct the door guiding device as small, particularly as flat as possible for efficiently using the available space and/or height for the door opening.

[0004] DE 698 10 380 T2 relates to a door guiding device for sliding plug doors of vehicles having a telescopic guiding with a support bar and an intermediate rail being displaceable with respect to the support bar. The intermediate rail is also displaceably connected with a door panel. Rollers serve for a linear guiding in each case. The support bar has a generally U-shaped form and encloses the intermediate rail. When the door guiding device assumes an opened position wherein a door panel is displaced to clear a door frame, the support bar together with the intermediate rail accommodated therein is located outside of an interior of the vehicle in order to allow the door panel to be displaced with respect to the door opening, the interior of the vehicle being defined by its outer surface. On the other hand, when the door guiding device assumes a closed position, both the support bar and the intermediate rail together with their linear guiding means are located in the interior of the vehicle.

[0005] A disadvantage of the known door guiding device is that the door guiding device and in particular the arrangement of the roller guidings requires much installation space, in particular a large installation height. When the available space and particularly the available height is limited, e.g. due to the height of the vehicle in which the door guiding device is mounted, the height of the door opening is limited due to the space consumed by the door guiding device. Low door openings reduce the comfort for passengers boarding and alighting the vehicle through the door.

[0006] The object of the invention is to provide a door guiding device for a door of a wagon, which requires less installation height in the door opening.

[0007] Said object is achieved by a door guiding device, having the features of claim 1.

[0008] Such a door guiding device for a door of a wagon, when being mounted in a wagon, is displaceable along a plug axis substantially vertical to the plane of a door panel mounted to the door guiding device, between a retracted position and an extended position. The door guiding device comprises a door panel mount, which is connectable with a door panel, a drive carriage slidably supporting the door panel mount by means of a first linear guiding device and a carrier slidably supporting the drive carriage by means of a second linear guiding device. It is provided that in the extended position of the door guiding device, one of the first and second linear guiding devices is located outside an interior of the wagon defined by an outer surface of the wagon, whereas the other one of the first and second linear guiding devices is at least partially located inside of the interior of the wagon.

[0009] Due to this arrangement, the required installation height in the door opening may be reduced, because as a consequence the first and second linear guiding devices may be arranged spaced apart to one another, in contrast to one linear guiding device enclosing the other guiding device. The first and second linear guiding devices may be connected to one another via a structural element such as the drive carriage.

[0010] The door guiding device may e.g. be used in doors having two door panels or in doors having only one door panel. The door guiding device may generally be used for guiding a door panel of a door, independent on where the door is mounted. In particular, the door guiding device may be used for guiding a door panel of a door of a wagon of a mass transportation vehicle, such as a bus, a subway, metro or railway train, an airplane, a cable car, a street car or the like; however, it may also be used e.g. in a car, in an elevator etc. Furthermore, the door guiding device may particularly be used in a sliding plug door.

[0011] For effecting a displacement of the door guiding device along the plug axis and for effecting a relative displacement of the door panel mount and the drive carriage, as well as of the drive carriage and the carrier, the door guiding device may comprise one or more actuators, in particular one or more motors, e.g. electric motors and form a drive mechanism for the door or be part of such drive mechanism.

[0012] In the retracted position of the door guiding device, the first and the second linear guiding devices may be both located within the interior of the wagon and the door panel may by arranged flush with an adjacent outer surface of the wagon. In the extended position, the door panel may be displaced substantially in parallel to the adjacent outer surface of the wagon in order to clear a door opening.

[0013] In particular it may be provided that in the extended position of the door guiding device, the first linear guiding device is located outside of the interior of the wagon and the second linear guiding device is at least partially located within the interior of the wagon. More particular, in the extended position of the door guiding device, the second linear guiding device may be substantially or entirely located within the interior of the wagon. This arrangement may be a result of the design of the drive carriage.

[0014] The door panel mount may be slidably displaceable with respect to the drive carriage substantially along a wagon axis, wherein the wagon axis is aligned substantially vertical to the plug axis (and/or substantially along the longitudinal axis of the wagon, i.e. the axis of main extension of the wagon). Alternatively or additionally, also the drive carriage may be slidably displaceable with respect to the carrier substantially along the wagon axis. In particular, the door panel mount, the drive carriage and the carrier together may act as a telescope. For displacing the door panel between an opened position, wherein a door opening of the door is free to be passed by a person such as a passenger of the vehicle, and a closed position, wherein the door panel covers the door opening, the drive carriage may be displaceable along the wagon axis.

[0015] It may be provided that in the mounted condition, the width of the second linear guiding device along the plug axis is greater than the height of the second linear guiding device along a third axis vertical to the plug axis and the wagon axis. In other words, the elongate second linear guiding device may substantially be designed flat. Also the first linear guiding device may be designed substantially flat; however, the first linear guiding device may be arranged such that its width along the plug axis is smaller than its height along the third axis.

[0016] The first and second linear guiding devices may be of a similar design and be arranged in parallel and oriented at an angle to one another. In particular, the first and second linear guiding devices may be arranged substantially vertical with respect to one another. Moreover, the first and second linear guiding devices may include like parts and/or be of substantially the same design.

[0017] Each of the first and second linear guiding devices may comprise at least two rows of rolling elements, each row of rolling elements being oriented substantially along the wagon axis. Rolling elements may e.g. be designed as rollers, balls, wheels etc. The door guiding device may be designed such that at least one row of rolling elements of the second linear guiding device is located within the interior of the wagon when the door guiding device assumes the extended position.

[0018] One row of rolling elements comprises at least two rolling elements. A linear guiding device may also comprise more than two rows of rolling elements, e.g. three rows of rolling elements. Moreover, a linear guiding device may also comprise rolling elements which are not aligned in a row.

[0019] At least two rows of rolling elements of the first linear guiding device may be arranged at least partially in parallel and spaced apart, thereby defining a first plane, and at least two rows of rolling elements of the second linear guiding device may be arranged at least partially in parallel and spaced apart, thereby defining a second plane. Therein, the first and second planes may be oriented at a finite angle with respect to one another. In particular, the first and second planes may be oriented substantially vertical to one another. On the other hand, the first and second planes may also be oriented substantially in parallel to one another.

[0020] By using linear guiding devices for slideably, i.e. displaceably supporting the door panel mount on the drive carriage and the drive carriage on the guide rail, the door guiding device may be designed particularly flat and requiring only little installation space. Depending on the design of the door guiding device, especially the arrangement of the linear guiding devices such that the rows of rolling elements are aligned substantially parallel to one another, while the first and second planes defined by each two rows of rolling elements are oriented substantially vertical to one another may contribute to a construction and installation of the door guiding device which only requires a small part of the available height for the door.

[0021] In particular, one or both linear guiding devices may be designed as a linear ball bearing guide or as a recirculating ball bearing guide. It is of course also possible to design one of the first and second linear guiding devices as a linear ball bearing guide and the other one as a recirculating ball bearing guide. The linear guiding devices may have an elongate form and extend substantially along the wagon axis.

[0022] The drive carriage may comprise a first portion which is connected with the first linear guiding device and a second portion which is connected with the second linear guiding device. The first and second portions of the drive carriage each may have an elongate planar shape and be oriented substantially vertical to one another, such that the drive carriage may have the shape of an L as seen towards an end face along the main extension of the drive carriage. The drive carriage may also at least partially have a cross section with an L shape, wherein one leg of the L shape is formed by the first portion of the drive carriage and the other leg of the L shape is formed by the second portion of the drive carriage.

[0023] At least one of the first and second linear guiding devices may comprise a rail track engaging or being engaged by a track carriage, wherein the track carriage is displaceable along the rail track. Each row of rolling elements of the first and/or second linear guiding device may be arranged in contact with the track carriage and the rail track of the respective linear guiding device. Each two rows of rolling elements of one of the first and second linear guiding devices, defining the first or second planes, respectively, may be contacting opposing surfaces of the track carriage and/or the rail track.

[0024] The door guiding device may comprise at least one support wheel engaging or engaged by the rail track of at least one of the first and second linear guiding devices. Such a support wheel may act as a support of the door panel against being pivoted within its main plane of extension, e.g. when a force which is undesired but may occur in use is exerted on the door panel and/or the door guiding device. The support wheel may be arranged on the drive carriage.

[0025] According to another aspect of the invention, a door for a wagon is provided, comprising at least one door guiding device according to any embodiment and aspect described herein as well as to any combination of aspects and/or embodiments described herein.

[0026] According to another aspect of the invention, a wagon is provided, comprising at least one door guiding device according to any embodiment and aspect described herein as well as to any combination of aspects and/or embodiments described herein.

[0027] Additional features and aspects of the invention will be explained in more detail in the following description of exemplary embodiments with reference to the accompanying figures, wherein:

Fig. 1 shows a mass transportation vehicle comprising several sliding plug doors,

Fig. 2A shows an upper part of a door panel with a door guiding device in a perspective view from above,

Fig. 2B shows the upper part of the door panel with the door guiding device of Fig. 2A in a perspective view from below,

Fig. 3A shows a cross-sectional view of the door panel and the door guiding device of Fig. 2A and 2B in a retracted position,

Fig. 3B shows the cross-sectional view of the door panel and the door guiding device of Fig. 3A in an extended position,

Fig. 4A shows a cross-sectional view of the door panel connected with another embodiment of a door guiding device in a retracted position,

Fig. 4B shows the cross-sectional view of the door panel and the door guiding device of Fig. 4A in an extended position,

Fig. 5 shows a part of the door panel mounted on a door panel mount,

Fig. 6A shows a second linear guiding device of the door guiding device of Fig. 2A-3B in a perspective view, and

Fig. 6B shows the second linear guiding device of Fig. 6A in a cross-sectional view.

[0028] Fig. 1 shows a wagon 3 of a mass transportation vehicle comprising a wagon body 31, wagon windows 32 and several doors 2. The doors 2 of the wagon 3 each comprise two door panels 22 with each one door window 21, enclosed by a door frame 23. The doors 2 will be described in greater detail with reference to the following figures.

[0029] The wagon 3 of Fig. 1 is a wagon 3 of a mass transportation vehicle, in particular of a metro train, and serves as an example for all other mass transportation vehicles, such as railway trains, busses, airplanes, cable cars, street cars, and others. The axis of main extension of the wagon 3 is denoted as wagon axis X.

[0030] Mass transportation vehicles, such as the mass transportation vehicle having a wagon 3 as shown in Fig. 1, are boarded and alighted through doors. Often, sliding plug doors are used for such vehicles, such as the doors 2 in Fig. 1. However, the doors 2 may also be designed as other types of doors, such as e.g. plug doors, swing doors, slide doors etc.

[0031] When being in a closed position, many sliding plug doors of mass transportation vehicle wagons, as the doors 2 of the wagon 3 in Fig. 1, do not project from an outer surface 33 of the wagon body 31. When the doors 2 are moved in an opened position, this movement may be mainly divided in two parts: first the doors 2 are moved outwards, i.e. in a direction substantially vertical to the surfaces of the doors 2. Then, the doors 2 are shifted sideways (substantially along the wagon axis X) in an opened position to clear the door opening. When the doors 2 are being closed, they are moved back from the opened position into the closed position, wherein the same partial movements are executed, just in reversed order. In other embodiments doors may also be mounted such that they do not flush with the side surface of the corresponding wagon body.

[0032] The doors 2 of the wagon 3 comprise a door guiding device 1. The door guiding device 1 only requires a small part of the available height for the door; therefore, the available height for the door 2 in the wagon body 31 is used efficiently and the door opening may be constructed large resulting in a high comfort for passengers passing through the door opening of the door 2.

[0033] There are wagons that only comprise one door. However, usually, wagons 3 of mass transportation vehicles comprise more than one door 2. For example, a wagon 3 may comprise two, three, four or more doors 2 on either side of the wagon 3. Often, doors of wagons 3 of mass transportation vehicles are constructed as double doors. Eventually, the wagons 3 may comprise one or more additional doors for a driver. In some wagons, there are also doors inside the wagon. In some types of mass transportation vehicles, one or more doors connect each two wagons of the vehicles. For all such doors, doors 2 comprising a door guiding device 1 may be used.

[0034] Fig. 2A and 2B show an upper part with an upper edge 223 of a door panel 22 being connected with a plug mechanism 15 by means of a door guiding device 1. The door guiding device 1 comprises a drive carriage 10 connecting the door panel 22 with a carrier 11. The carrier 11 is mounted on the plug mechanism 15 which serves for displacing the door guiding device 1 and thus also the door panel 22 (and the other door panel of the door 2, which is not shown in Fig. 2A-2B) along a plug axis Y

between a retracted position and an extended position. The plug axis Y extends substantially vertical to the plane of the door panel 22, i.e. substantially vertical to the wagon axis X.

[0035] The plug mechanism 15 comprises two plug arms 154, each having a guide rail 151 and an oblique portion 152 and is connected with one of the longitudinal ends of the carrier 11 by means of fastening elements 153. In Fig. 2A and 2B one of the two plug arms 154 of the plug mechanism 15 is visible. When being displaced between the retracted and the extended position, the guide rails 151 slide along corresponding parts mounted on the wagon 3. The displacement is effected by means of a corresponding drive mechanism which is not shown in the figures. The plug arms 154 may at least partially support the door guiding device 1 and the door panel 22 connected therewith. In particular, the plug arms 154 may carry the bulk of the weight of the door guiding device 1 and the door panel 22.

[0036] The oblique portion 152 extends between the part of the plug arm 154 forming the guide rail 151 and the part of the plug arm 154 being connected with the carrier 11 and extends, in the mounted condition, from the guide rail 151 towards the carrier 11, wherein the guide rail 151 is located above the carrier 11. This design allows to support and guide the door guiding device 1 together with the door panel 22 in a region above the door opening, in particular above an upper part of the door frame 23. Therefore, the plug mechanism 15 consumes only little installation space. Of course, the plug arm 154 and the whole plug mechanism 15 could also be designed differently.

[0037] As best seen in Fig. 2A, the drive carriage 10 comprises a first portion 100 having a substantially planar, elongate shape and being arranged in parallel with the plane of the door panel 22. Furthermore, the drive carriage 10 comprises a second portion 101, which is also of a planar, elongate shape but oriented substantially vertical to the first portion 100 of the drive carriage 10. Both first and second portions 100, 101 of the drive carriage 10 are formed in one piece.

[0038] The door panel 22 is supported on the drive carriage 10 by means of a first linear guiding device 13, of which first linear guiding device 13 only a rail track 130 is visible in Fig. 2A and 2B. The rail track 130 of the first linear guiding device 13 is mounted on the first portion 100 of the drive carriage 10. The drive carriage 10 is supported on the carrier 11 by means of its second portion 101, which is connected with the carrier 11 via a second linear guiding device 14. In Fig. 2A only a rail track 140 of the second linear guiding device 14 is visible, while the other components of the first and second linear guiding devices 13, 14 are shown in the following figures. The rail track 140 of the second linear guiding device 14 is mounted on the carrier 11. Both rail tracks 130, 140 of the first and second linear guiding devices 13, 14 substantially extend along the wagon axis X.

[0039] In direction of the wagon axis X, the first portion 100 of the drive carriage 10 is of approximately double the length as compared to the second portion 101 of the drive carriage 10.

[0040] The door panel 22 comprises several sealing elements 221 for sealing the door panel with respect to the other door panel and the door frame 23 of the door 2.

[0041] A stop portion 24 may be formed adjacent to the edge of the door panel 22 providing a stop for a corresponding stop portion 102 of the drive carriage 10 in order to delimit the way along which the door panel 22 may be displaced with respect to the drive carriage 10.

[0042] Fig. 3A shows a cross-sectional view of the door panel 22 and the door guiding device 1 of Fig. 2A-2B assuming the retracted position. Fig. 3B shows the same parts as Fig. 3A with the door guiding device 1 assuming the extended position.

[0043] Both the first and the second linear guiding devices 13, 14 comprise a track carriage 131, 141 engaging the respective rail track 130, 140 by means of rolling elements which are not visible in Fig. 3A-3B but will be described with reference to Fig. 5 and 6. The rolling elements are arranged such that for each of the first and second linear guiding devices 13, 14, they form two (or more) rows of rolling elements, each pair of rows defining a plane, wherein the rows of rolling elements of the first linear guiding device 13 define a first plane A1 and the rows of rolling elements of the second linear guiding device 14 define a second plane A2. The first and the second planes A1, A2 are oriented substantially vertically with respect to one another.

[0044] The first and second linear guiding devices 13, 14 are both connected with the drive carriage 10 which comprises the first and second portions 100, 101 each being designed substantially flat and oriented substantially vertical to one another and having elongate forms with parallel main extension directions.

[0045] The vertical arrangement of the first and second linear guiding devices 13, 14 shown in Fig. 2A-3B, however, is only one of various possible arrangements. E.g., instead of having substantially an L-shape in cross section, the drive carriage 10 may also be formed substantially flat (and may either be oriented substantially vertical or horizontal or even oblique) such that both linear guiding devices 13, 14 may be substantially aligned in parallel. Moreover, the linear guiding devices 13, 14 may be connected with the drive carriage 10 on either side of the drive carriage 10. The orientation of the linear guiding devices 13, 14 may also be chosen in dependence on the actual design of the linear guiding devices used in the door guiding device 1. Of course, the drive carriage 10 could alternatively also be designed in another different shape, e.g. with a U-shape in cross section.

[0046] In Fig. 3A and 3B the rail track 130 of the first linear guiding device 13 is attached to the drive carriage 10 and the track carriage 131 of the first linear guiding device 13 is attached to the door panel mount 12, whereas for the second linear guiding device 14, the rail track 140 is attached to the carrier 11 and the track carriage

141 is attached to the drive carriage 10. However, one or both of the first and second linear guiding devices 13, 14 could also be mounted the other way around, such that e.g. the rail track 130 of the first linear guiding device 13 is attached to the door panel mount 12 and the corresponding track carriage 131 is attached to the drive carriage 10. Likewise, alternatively or additionally the rail track 140 of the second linear guiding device 14 may also be attached to the drive carriage 10 with the track carriage 141 being attached to the carrier 11.

[0047] Of course the first and/or second linear guiding devices 13, 14 may also comprise more than one track carriage 131, 141, e.g. two track carriages 131, 141, e.g. for increasing the stability of the first and/or second linear guiding device 13, 14.

[0048] In Fig. 3A and 3B the track carriage 131 of the first linear guiding device 13 is fastened to the door panel mount 12 by means of fastening elements 142 in the form of screws. The door panel 22 has depressions 224 for accommodating the screw heads of the fastening elements 142. The door panel 22 is fixed to the door panel mount 12 by suitable means not shown in the figures.

[0049] The door panels 22 of the door 2 (of which one door panel 22 is partly visible in Fig. 3A and 3B) are enclosed by the door frame 23. In the region of its upper edge 223 (and in other regions) the door panel 22 comprises a sealing element 221 with sealing lips 222 for sealing the door opening when the door 2 is closed, such as in Fig. 3A.

[0050] Fig. 3A and 3B show the door guiding device 1 together with a door panel 22, in a state mounted in the wagon 3. The outer surface 33 of the wagon 3 illustrated in the figures defines an interior space 34 of the wagon. As best seen in Fig. 3A, in the closed state of the door 2 (with the door guiding device 1 assuming the retracted position) an outer surface 220 of the door panel is flush with the adjacent outer surface 33 of the wagon. Alternatively, in its closed state, the door panel 22 may also be located such that its outer surface 220 is located within the interior space 34 of the wagon or protrude from the outer surface 33 of the wagon 3.

[0051] In the retracted position of the door guiding device 1, as seen in Fig. 3A, both the first and second linear guiding devices 13, 14 are located within the interior space 34 of the wagon. On the other hand, in the extended position of the door guiding device 1, as seen in Fig. 3B, the first linear guiding device 13 is located outside of the interior space 34 of the wagon 3, whereas the second linear guiding device 14 still is located within the interior space 34 of the wagon 3. In other words, the first and second linear guiding devices 13, 14 are spaced from each other along the plug axis Y. The way of travel of the door guiding device 1 between the retracted and the extended position is long enough to displace the first linear guiding device 13 outside the interior space 34 of the wagon 3 but not long enough to displace the second linear guiding device 14 out of the interior space 34 of the wagon 3. Due to this arrangement of the linear guiding devices 13, 14, not being mounted one on top of the other or one accommodating the other, the door guiding device 1 may be constructed particularly flat (especially in the region of the door frame 23), allowing for an increased height of the door opening (and/or a decreased height of the wagon 3). The door guiding device 1 (and eventually also other parts of the door system) is at least partly covered by a cover 17 from below.

[0052] From Fig. 3A and 3B, where also the plug mechanism 15 can be seen, it becomes clear that due to the oblique portion 152 of the plug arm 154 the support of the door guiding device 1 is effected at an increased height with respect to the carrier, so that corresponding components may be arranged high in the wall/ceiling of the wagon 3.

[0053] Fig. 4A and 4B show a cross-sectional view of the door panel 22 connected with another embodiment of a door guiding device 1' in a retracted position (Fig. 4A) and in an extended position (Fig. 4B). For parts having like reference signs as parts shown in the previous figures, it is referred to the corresponding description above.

[0054] In the retracted position of the door guiding device 1' mounted in a wagon 3 as shown in Fig. 4A, both a first and a second linear guiding device 13', 14' of the door guiding device 1' are located in an interior space 34 of the wagon 3. The interior space 34 of the wagon 3 is defined by its outer surface 33. In the retracted position an outer surface 220 of the door panel 22 is aligned with the outer surface 33 of the wagon 3.

[0055] In the extended position of the door guiding device 1' as shown in Fig. 4B, the first linear guiding device 13' is located outside of the wagon 3, i.e. not within the interior space 34, while the second linear guiding device 14' is substantially still located in the interior space 34 of the wagon.

[0056] Fig. 4A and 4B also show a possible embodiment of a plug mechanism 15' having rollers 150 (on both sides of a carrier 11' of the door guiding device 1') being guided in guide rails 161 of mounting brackets 16. The mounting brackets 16 are fastened to the wagon 3 by means of corresponding fastening elements 160. The guide rails 161 allow for the rollers 150 of the plug mechanism 15 to displace along the plug axis Y and thus allow for a displacement of the door guiding device 1' between its retracted and its extended position.

[0057] The first and second linear guiding devices 13', 14' are of a similar design and arranged in parallel to one another extending substantially along the wagon axis X (i.e., the axis of sight in Fig. 4A and 4B), wherein one is rotated by about 90 degrees with respect to the other about the wagon axis X (of course also other angles are possible, e.g. 45 degrees). Parts of the first and second linear guiding devices 13', 14' each may define a plane A1, A2, wherein these planes A1, A2 extend substantially along the wagon axis X and are oriented substantially vertical to one another. A drive carriage 10' connecting a door panel mount 12' for mounting the door panel 22

with the carrier 11' by means of the first and second linear guiding devices 13', 14' is substantially formed with an L-shape in cross section.

[0058] The first and second linear guiding devices 13', 14' may be designed as any suitable linear guiding device, e.g. as a roller guiding, a linear ball bearing guide, a recirculating ball bearing guide or a sliding guide.

[0059] As can be seen in Fig. 3A-4B, in both embodiments of the door guiding device 1; 1', while in the retracted positions of the door guiding devices 1; 1', both first and second linear guiding devices 13, 14; 13', 14' are located within the interior space 34 of the wagon 3, while in the extended positions of the door guiding devices 1; 1', the first linear guiding devices 13; 13' are located outside of the interior space 34 of the wagon 3 and the second linear guiding devices 14; 14' are located inside the interior space 34 of the wagon 3. This may lead to the circumstance that, when displacing the door guiding device 1; 1' from the retracted position into the extended position, the second linear guiding device 14; 14' is not moved further than the location where the outer surface 220 of the door panel 22 is positioned when the door guiding device 1; 1' assumes the retracted position.

[0060] Fig. 5 shows an upper edge of the door panel 22 mounted on an associated door panel mount 12" which may alternatively be used with any of the door guiding devices 1; 1' described above. For parts having like reference signs as parts shown in the previous figures, it is referred to the corresponding description above.

[0061] A track carriage 131" designed as a recirculating ball bearing guide is mounted on an opposite side of the door panel mount 12" with respect to the door panel 22. This track carriage 131" comprises a plurality of rolling elements 132 in the form of balls, which are arranged in two visible rows 133 of rolling elements 132, which rows 133 are aligned in parallel to each other and substantially in parallel to the wagon axis X (in the mounted state of the door panel mount 12"). The track carriage 131" may be engaged by a rail track of a first linear guiding device of a door panel mount 1; 1', mounted on a corresponding drive carriage (not shown in Fig. 5) comprising one track for each row 133 of rolling elements 132. When the track carriage 131" is inserted in the rail track, it is slidably connected therewith.

[0062] The door panel 22 may be opened and closed by driving the door panel mount 12" along the wagon axis X by means of a driving mechanism not shown in Fig. 5.

[0063] The door panel 22 is provided with several sealing elements 221 for a tight closure with another door panel 22 and a frame (both not shown in Fig. 5) of the door 2.

[0064] Fig. 5 also shows a support wheel 18 being rotatably fixed on the door panel mount 12". This support wheel 18 is arranged such as to engage the same rail track as the track carriage 131", thereby providing additional stability of the door guiding device. In particular an undesired pivoting of the door panel 22 may be prevented by means of such a support wheel 18, because part of a force exerted on the door 2, in particular on the door panel 22 may be absorbed by the support wheel 18. The support wheel 18 may be disposed adjacent to the track carriage 131" or spaced apart therefrom.

[0065] Of course any linear guiding device 13, 14; 13', 14' described herein may also comprise one or more of such support wheels 18. If a linear guiding device 13, 14; 13', 14' is designed such that a track carriage encloses a rail track, two support wheels 18 may be arranged on opposite sides of the rail track.

[0066] Fig. 6A and 6B show the second linear guiding device 14 of the door guiding device 1 according to Fig. 2A-3B in a perspective view (Fig. 6A) and in a cross-sectional view (Fig. 6B).

[0067] As can be seen in Fig. 6A and 6B, the track carriage 141 engages the rail track 140 by enclosing it partially. The track carriage 141 is slidably displaceable along the rail track 140 and is designed as a recirculating ball bearing guide comprising in total eight rows 133 of rolling elements 132 in the form of balls. Four (inner) rows 133 of rolling elements 132 are contacting both the track carriage 141 and the rail track 140, each two on opposing sides of the rail track 140, and four (outer) rows 133 serve for the recirculation of the rolling elements 132. Of course, the second linear guiding device 14 may also comprise more or less than eight rows 133 of rolling elements 132, e.g. four, twelve or sixteen.

[0068] Each two rows 133 of rolling elements 132 arranged directly opposite the rail track 140 may define a plane, denoted as second plane A2.

[0069] The design of the linear guiding device according to Fig. 6A and 6B may also be used for the first linear guiding device in the door guiding device 1 according to Fig. 2A-3B and also for the first and/or second linear guiding devices 13', 14' of the door guiding device 1' according to Fig. 4A and 4B.

[0070] For effecting a displacement of the door guiding device 1; 1' along the plug axis Y and for effecting a relative displacement of the door panel mount 12; 12'; 12" and the drive carriage 10; 10' as well as of the drive carriage 10; 10' and the carrier 11; 11', the door guiding device may comprise one or more actuators, in particular one or more motors, e.g. electric motors.

List of reference numerals:

[0071]

1, 1'	door guiding device
10, 10'	drive carriage
100, 100'	first portion
101, 101'	second portion
102	stop portion
11, 11'	carrier
12, 12', 12"	door panel mount
13, 13'	first linear guiding device
130	rail track

131, 131"	track carriage
132	rolling element
133	row of rolling elements
14, 14'	second linear guiding device
140	rail track
141	track carriage
142	fastening element
15, 15'	plug mechanism
150	roller
151	guide rail
152	oblique portion
153	fastening element
154	plug arm
16	mounting bracket
160	fastening element
161	guide rail
17	cover
18	support wheel
2	door
21	door window
22	door panel
220	outer surface
221	sealing element
222	sealing lip
223	upper edge
224	depression
23	door frame
24	stop portion
3	wagon
31	wagon body
32	wagon window
33	outer surface
34	interior space
A1	first plane
A2	second plane
X	wagon axis
Y	plug axis

Claims

1. A door guiding device for a door (2) of a wagon (3), the door (2) being displaceable, in the mounted condition, along a plug axis (Y) substantially vertical to the plane of a door panel (22) mounted to the door guiding device (1, 1'), between a retracted position and an extended position, and comprising:

- a door panel mount (12; 12'; 12"), which is connectable with the door panel (22),
- a drive carriage (10; 10') slidably supporting the door panel mount (12; 12'; 12") by means of a first linear guiding device (13; 13'), and
- a carrier (11; 11') slidably supporting the drive carriage (10; 10') by means of a second linear guiding device (14; 14'),

characterized in that

in the extended position of the door guiding device (1; 1'), one of the first and second linear guiding devices (13, 14; 13', 14') is located outside an interior (34) of the wagon (3) defined by an outer surface (33) of the wagon (3), while the other one of the first and second linear guiding devices (13, 14; 13', 14') is at least partially located inside of the interior (34) of the wagon (3).

2. The door guiding device according to claim 1, **characterized in that**, in the retracted position of the door guiding device (1; 1'), the first and the second linear guiding devices (13, 14; 13', 14') are located within the interior (34) of the wagon (3).

3. The door guiding device according to claim 1 or 2, **characterized in that** that in the extended position of the door guiding device (1; 1'), the first linear guiding device (13; 13') is located outside the interior (34) of the wagon (3) and the second linear guiding device (14; 14') is at least partially located inside of the interior (34) of the wagon (3).

4. The door guiding device according to claim 3, **characterized in that** in the extended position of the door guiding device (1; 1'), the second linear guiding device (14; 14') is entirely located within the interior (34) of the wagon (3).

5. The door guiding device according to any of the preceding claims, **characterized in that** the door panel mount (12; 12'; 12") is slidably displaceable with respect to the drive carriage (10; 10') substantially along a wagon axis (X) substantially vertical to the plug axis (Y) and **in that** the drive carriage (10; 10') is slidably displaceable with respect to the carrier (11; 11') also substantially along the wagon axis (X).

6. The door guiding device according to any of the preceding claims, **characterized in that**, in the mounted condition, the width of the second linear guiding device (14; 14') along the plug axis (Y) is greater than the height of the second linear guiding device (14; 14') along an axis vertical to the plug axis (Y) and the wagon axis (X).

7. The door guiding device according to any of the preceding claims, **characterized in that** the first and second linear guiding devices (13, 14; 13', 14') are of at least similar design and arranged substantially in parallel and oriented at an angle to one another, in particular substantially a vertical angle.

8. The door guiding device according to any of the preceding claims, **characterized in that** the first and second linear guiding devices (13, 14; 13', 14') each comprise at least two rows (133) of rolling elements (132) oriented substantially along the wagon axis

(X), wherein in the extended position of the door guiding device (1; 1'), at least one row (133) of rolling elements (132) of the second linear guiding device (14; 14') is located within the interior (34) of the wagon (3).

9. The door guiding device according to claim 8, **characterized in that** at least two rows (133) of rolling elements (132) of the first linear guiding device (13; 13') are at least partially arranged in parallel and spaced apart defining a first plane (A1), and at least two rows (133) of rolling elements (132) of the second linear guiding device (14; 14') are at least partially arranged in parallel and spaced apart defining a second plane (A2), wherein the first and second planes (A1, A2) are oriented substantially vertical to one another.

10. The door guiding device according to any of the preceding claims, **characterized in that** at least one of the first and second linear guiding devices (13, 14; 13', 14') is designed as a linear ball bearing guide or as a recirculating ball bearing guide.

11. The door guiding device according to any of the preceding claims, **characterized in that** the drive carriage (10; 10') has a first portion (100; 100') connected with the first linear guiding device (13; 13') and a second portion (101; 101') connected with the second linear guiding device (14; 14').

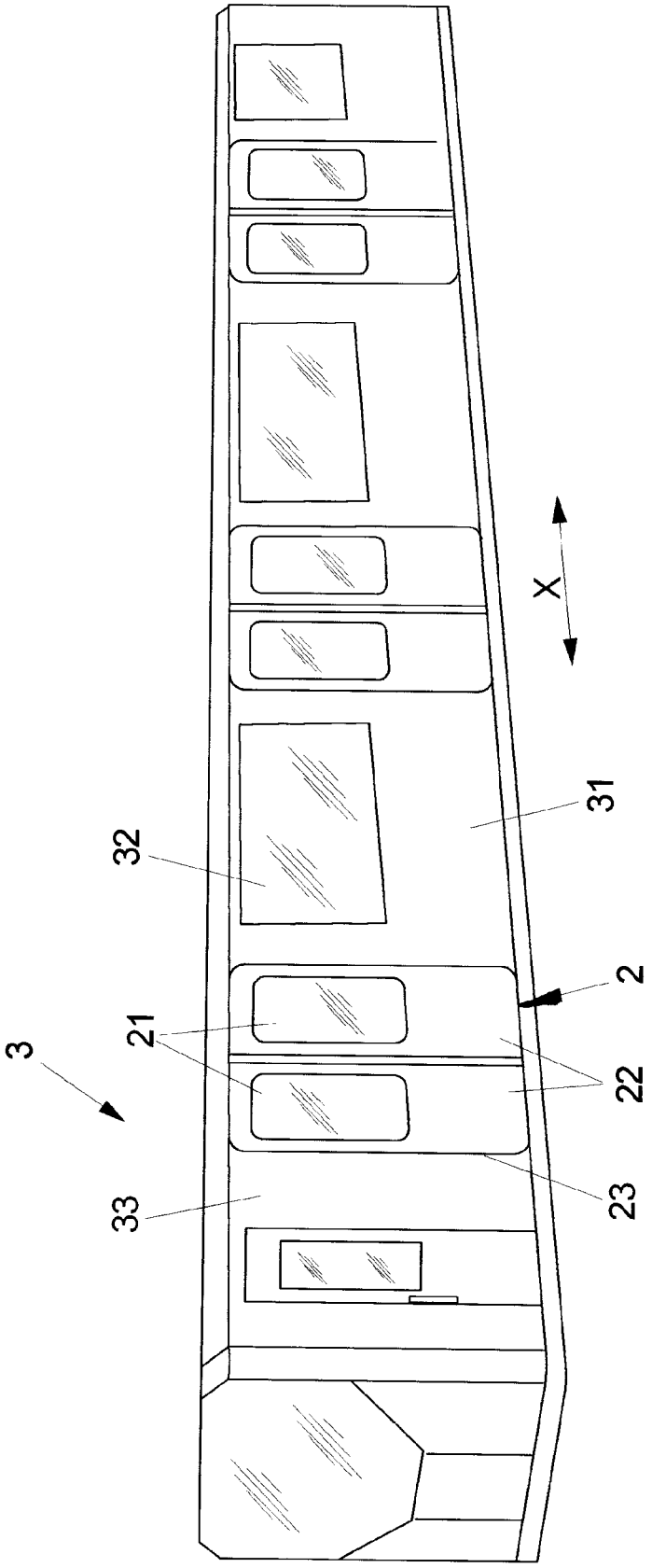
12. The door guiding device according to any of the preceding claims, **characterized in that** at least one of the first and second linear guiding devices (13, 14; 13', 14') comprises a rail track (130, 140) engaging or engaged by a track carriage (131, 141; 131") being displaceable along the rail track (130, 140).

13. The door guiding device according to claim 12, **characterized in that** at least one of the first and second linear guiding devices (13, 14; 13', 14') comprises at least one support wheel (18) engaging or engaged by the rail track (130, 140).

14. A door for a wagon (3), comprising at least one door guiding device (1, 1') according to any of the preceding claims.

15. A wagon (3), comprising at least one door guiding device (1, 1') according to any of claims 1 to 13.

FIG 1



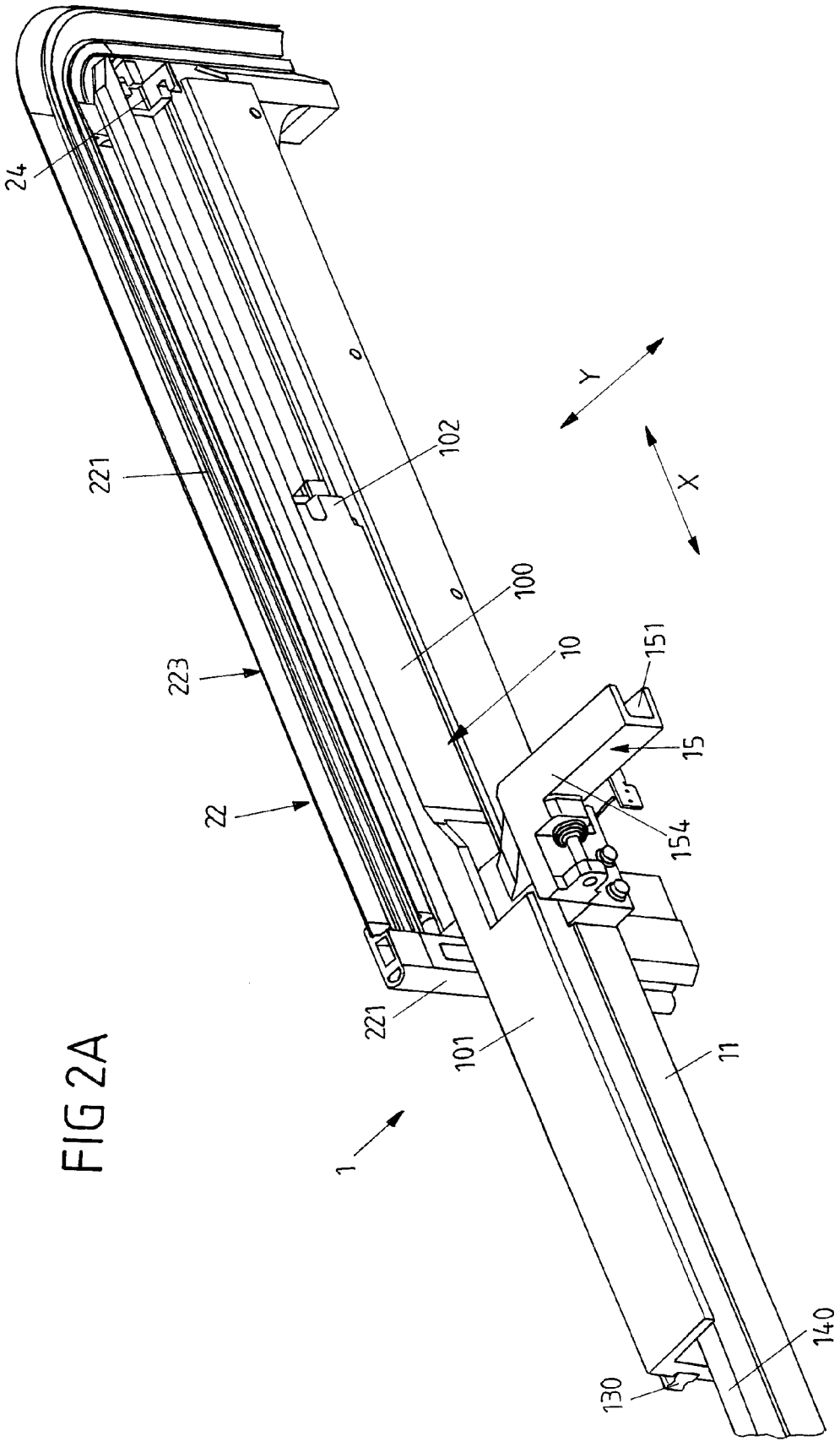


FIG 2A

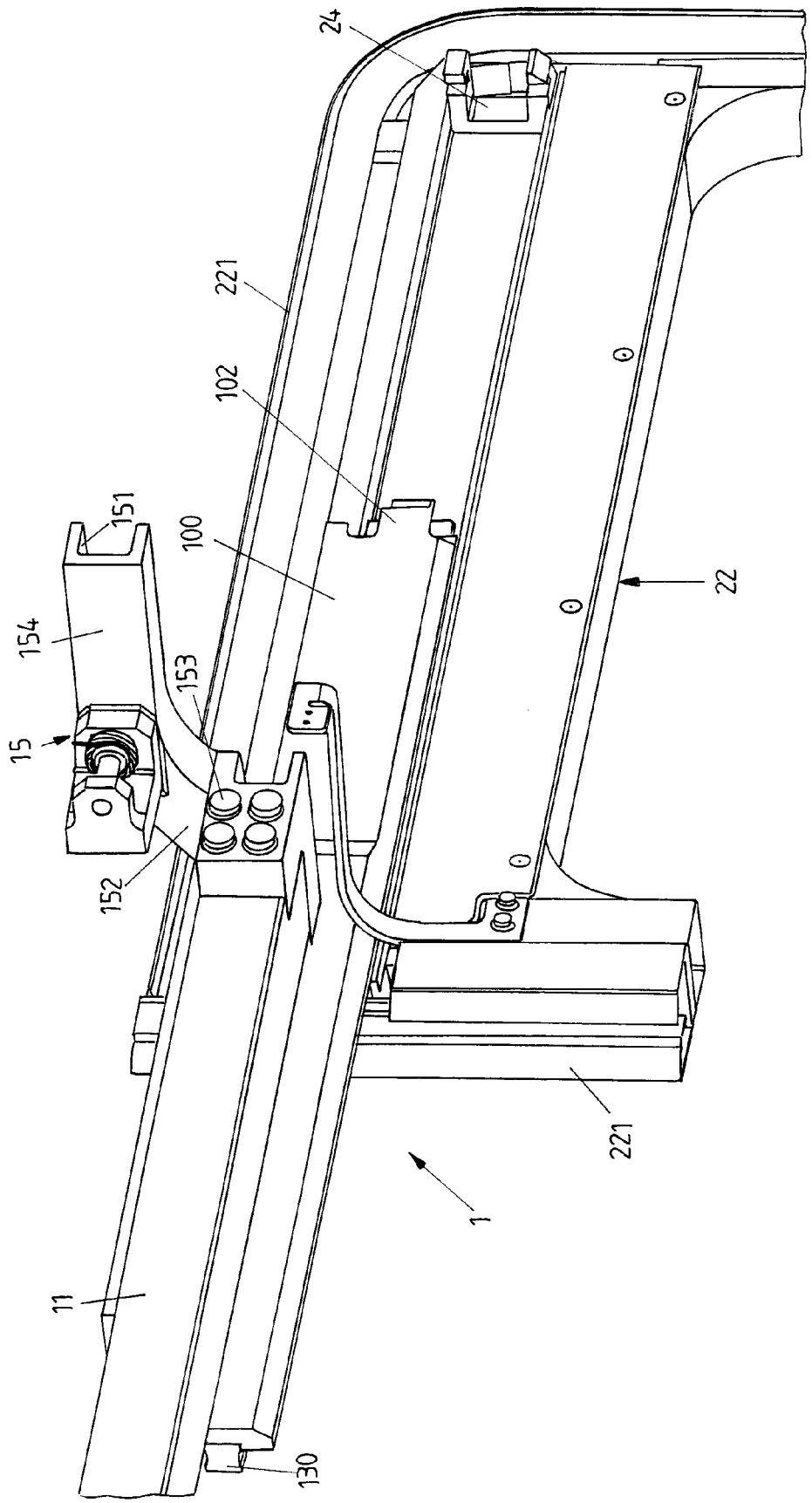


FIG 2B

FIG 3A

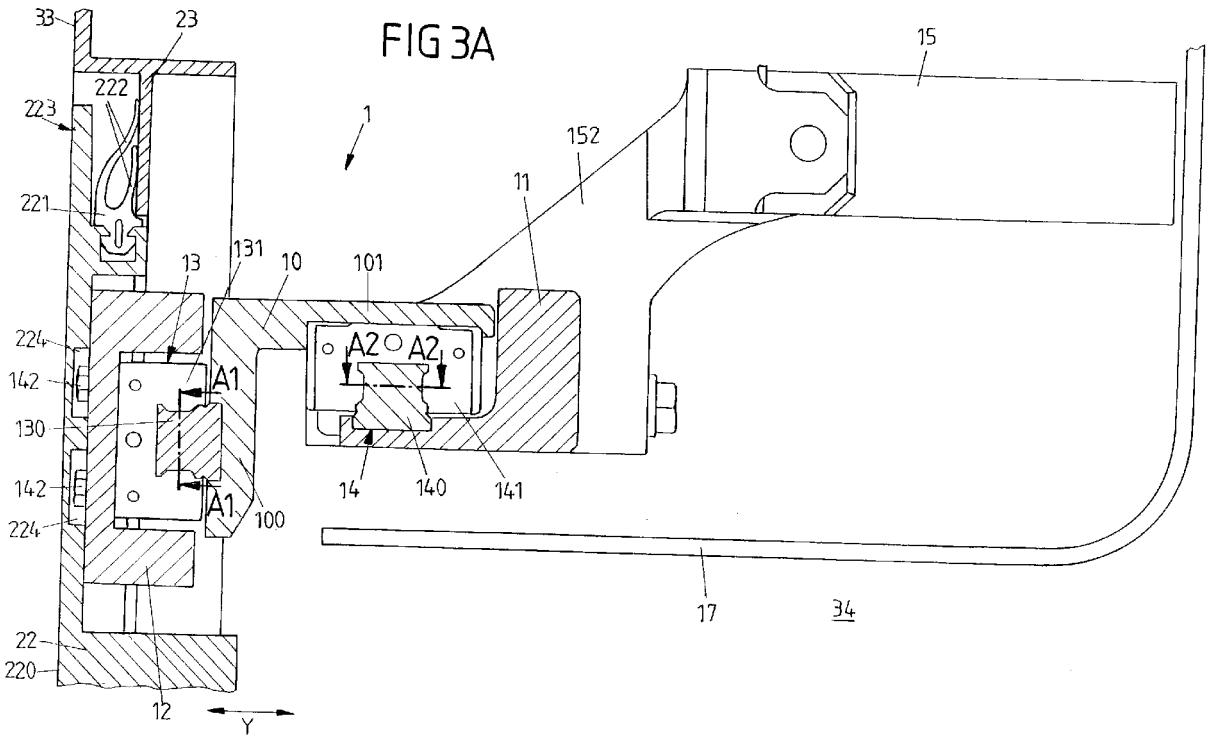
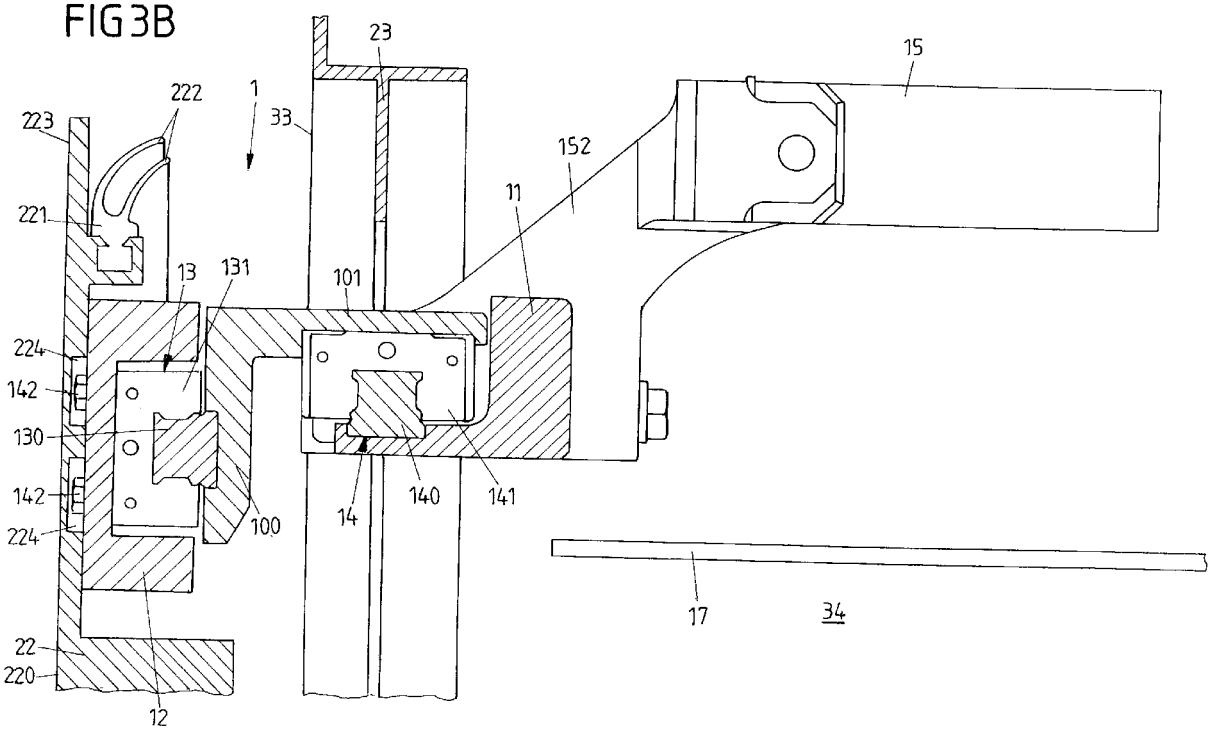

33
23
222
223
221
1
152
15
11
13
131
10
101
224
142
130
142
224
A1
A1
A2
A2
14
140
141
100
17
34
22
220
12
Y

FIG 3B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33
152
11
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101
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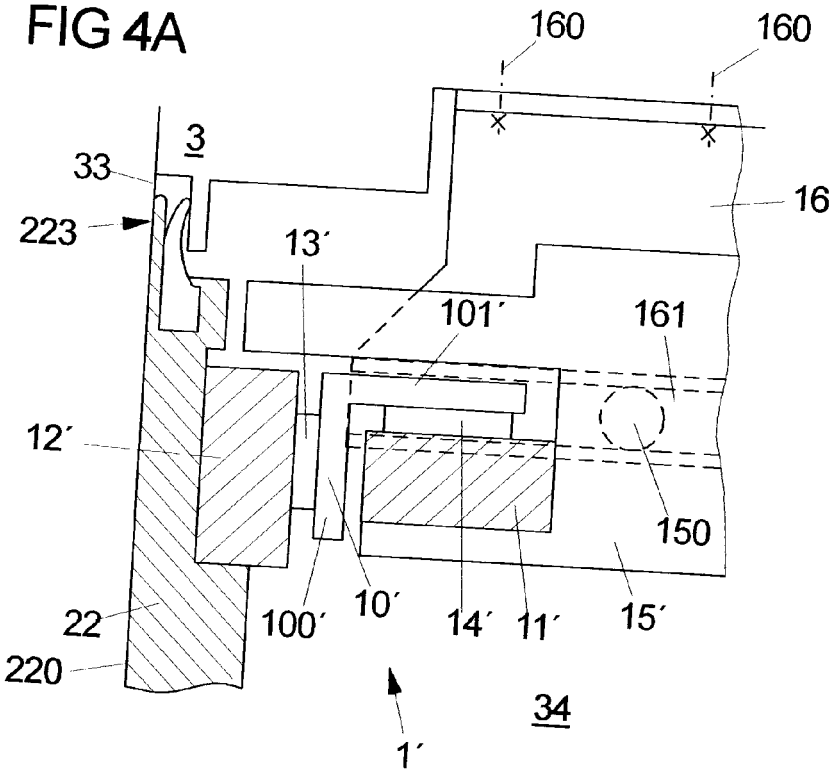
140
141
17
34
22
220
12

FIG 4A


160
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3
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12´
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14´
11´
15´
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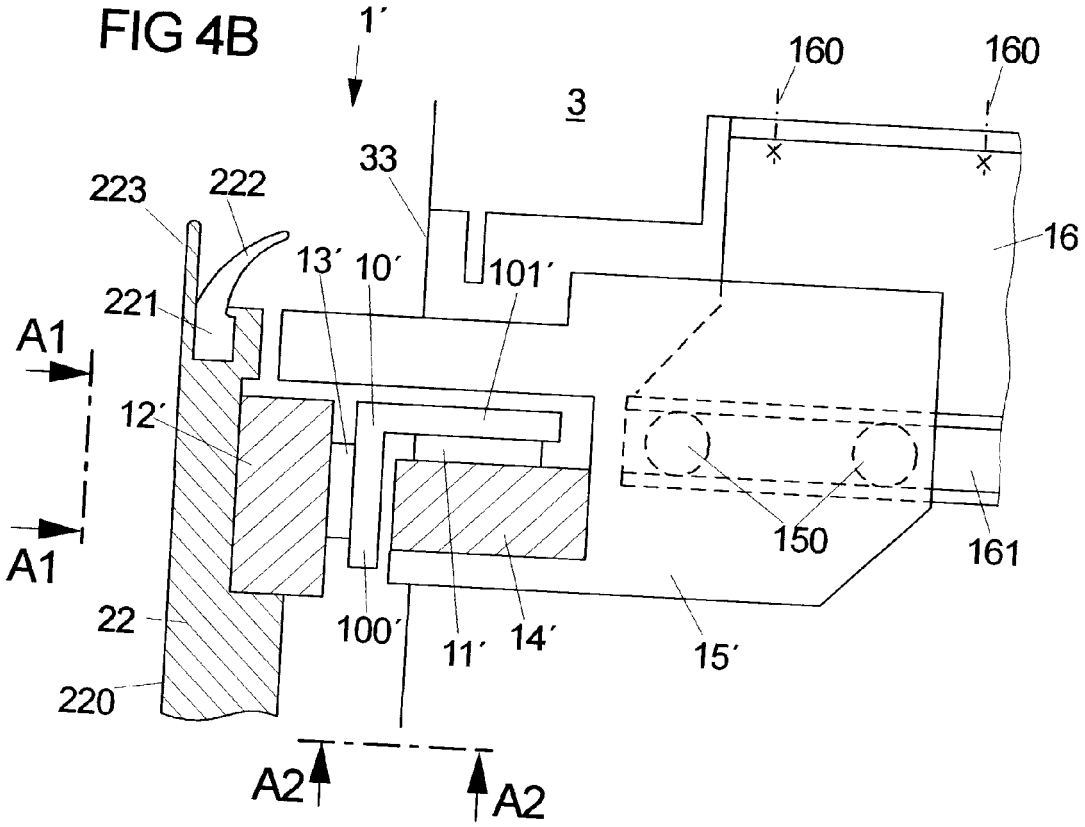
34
1´

FIG 4B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15´
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A2
A2

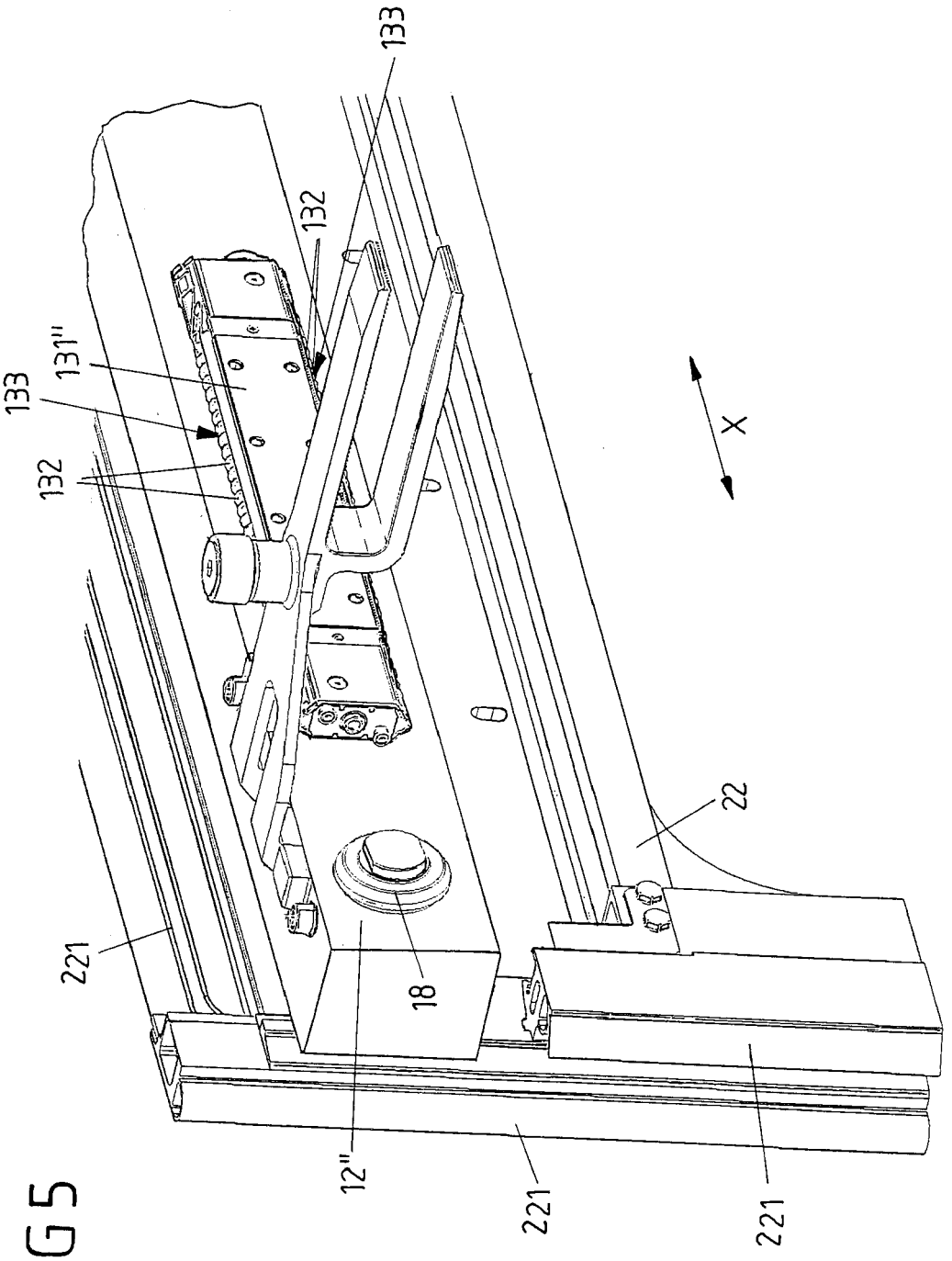


FIG 5

FIG 6A

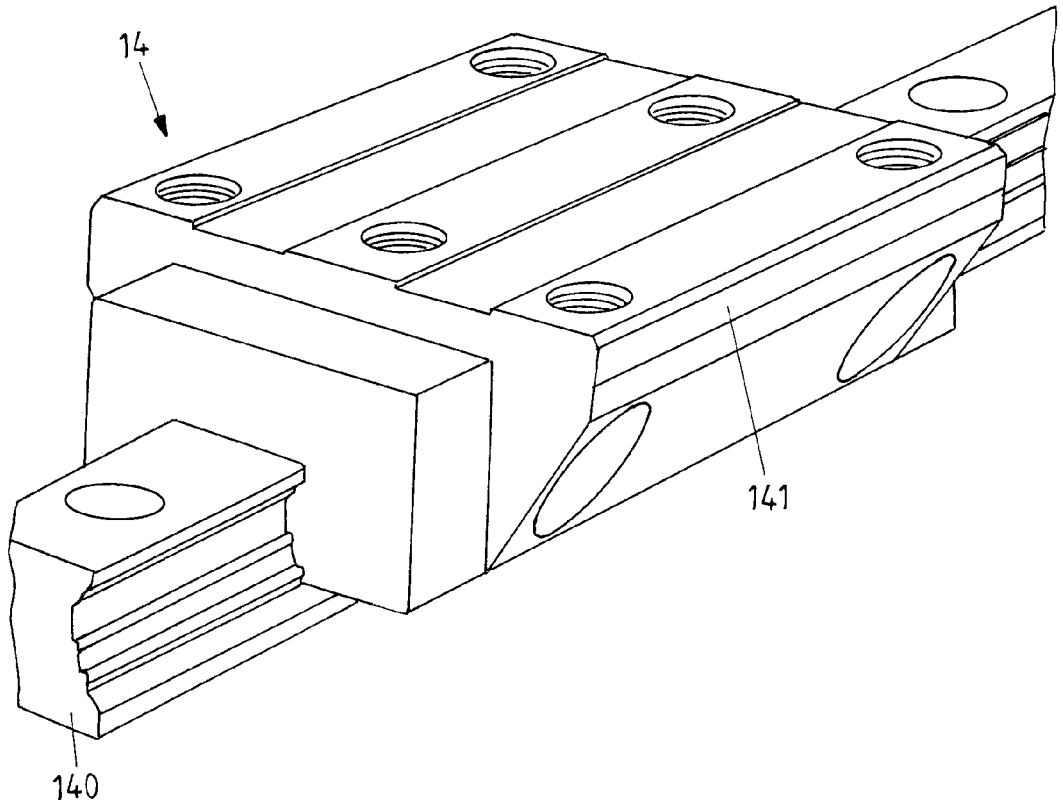
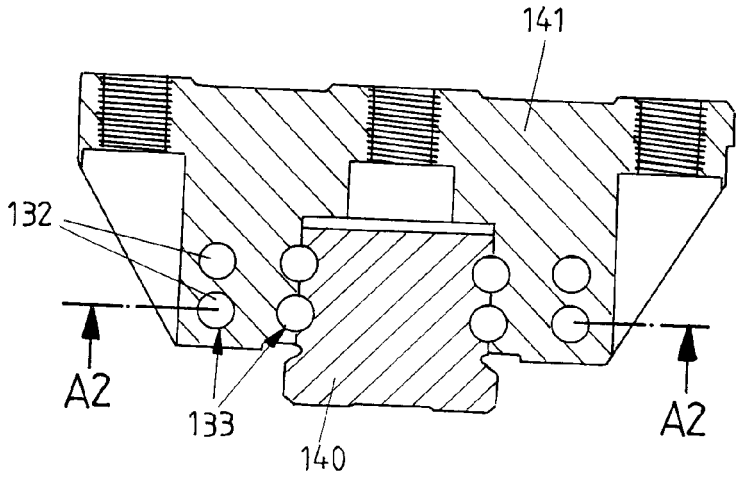


FIG 6B



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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 June 2015	Schultze, Yves

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