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(54) **SLIDING DOOR RAIL ASSEMBLY**

SCHIENENANORDNUNG EINER SCHIEBETÜR

ENSEMBLE DE RAIL D'UNE PORTE COULISSANTE

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(72) Inventor: **VAN VELUWEN, Danny**

7122 MP Aalten (NL)

(30) Priority: **17.07.2015 NL 2015184**

(74) Representative: **V.O.**

P.O. Box 87930

Carnegieplein 5

2508 DH Den Haag (NL)

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(73) Proprietor: **Metaflex Doors Europe B.V.**

7122 MP Aalten (NL)

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Description

[0001] The invention relates to a sliding door rail assembly comprising a guide rail and at least one sliding assembly movable along the guide rail, wherein the guide rail comprises a support surface, and at least one activating member, wherein the sliding assembly comprises a first part provided with at least one sliding element which is movable along said support surface, and a second part to which a door panel, configured to close an opening in a wall, is attachable, wherein said second part is connected to said first part via a connecting mechanism and wherein said second part is movable with respect to said first part through a suspension mechanism, wherein an axis of said suspension mechanism and a plane of said opening in a wall include an angle, for example an angle in the range of 30°-60°.

[0002] Such systems, which can be used to hermetically close conditioned spaces, for example room-sized freezers, or operating rooms in hospitals, are generally known, for example from the Dutch patent NL2011353 by the same applicant, the content of which is incorporated in the present patent application in its entirety by reference. Therein, a sliding assembly, to which a door panel is attached, comprises a wedge-shaped member that is configured to cooperate with another wedge-shaped member, attached to a guide rail. During contact between both wedge-shaped members, the door panel can be moved towards an opening in a wall to close it. Upon release of one wedge-shaped member from the other, the door panel can be moved away from the opening.

[0003] Also, US 5301468 describes a sliding door wherein an upward elastic force of elastic suspensions constantly acts on a door body. A driving wheel strikes on a tapered section of a lower rail surface to cause the door body to be pressed on the floor against an upward elastic force of the suspensions. When sliding the door body to an open position, the driving wheel is moved from the tapered section and the door body is raised from the floor, while being moved obliquely upward and outward due to the bracket assemblies and the inclination angle. In US 5301468, the driving wheel is located in-between two bracket assemblies that support rolling wheels.

[0004] A problem with such prior art systems is that a relatively large force is needed to slide the sliding assembly on the guide rail and to bring the door panel to a closing position in which it closes an opening in a wall. Another problem is that the sliding assemblies of these prior art systems do not always slide well or precisely enough along the guide rail. Also the lack of compactness of the sliding assemblies can be a problem. Furthermore, they are not easy to install due to their rather complicated structure.

[0005] It is an aim of the present invention to solve or alleviate one or more of the above-mentioned problems. Particularly, the invention aims at providing an improved sliding door rail assembly wherein relatively little force is

needed to slide the sliding assembly on the guide rail and to bring a sliding door coupled to such a sliding door rail assembly to a position closing an opening in a wall. It is also an object of the invention to provide a relatively compact sliding door rail assembly, which has a relatively simple construction and is easy to install.

[0006] To this aim, there is provided a sliding door rail assembly characterized by the features of claim 1.

[0007] This allows an relatively easy construction of a relatively compact sliding door rail assembly, for which relatively little force is needed to slide the sliding assembly on the guide rail and to bring a sliding door coupled to such a sliding door rail assembly to a position closing an opening in a wall. This also implies that in an automated version of a sliding door rail assembly, any required electric driving power can be significantly reduced, which leads to an important saving of energy and reduction of costs.

[0008] In a preferred embodiment, a second surface of said guide rail is tilted with respect to the support surface of said guide rail such that said second surface is parallel to said axis of said suspension mechanism. The second surface includes or is provided with two activating members.

[0009] In this way, the force exerted on the contact member by an activating member connected to said second surface extends in parallel with the axis of the suspension mechanism thus allowing an improved force distribution and transfer.

[0010] Preferably, an axis of said suspension mechanism and a plane of said opening in a wall include an angle of about 45°, which further improves the force distribution and transfer between the contact member and the suspension mechanism.

[0011] In a more preferred embodiment, said connecting mechanism comprises at least one substantially solid guiding block configured to receive and hold connecting means. The guiding block highly improves the precision in the movement of the second part of the sliding assembly with respect to the first part of the sliding assembly and minimizes possible play in comparison to a conventional bolt and screw system. The block can be made in one piece. The block can be made of metal, steel, fibre reinforced plastic, or another rigid material.

[0012] In a still more preferred embodiment, the connecting means comprise at least two linear bearings. They improve the stability of the sliding assembly and ensure an accurate movement of the second part of the sliding assembly with respect to the first part of the sliding assembly along said axis of the suspension mechanism.

[0013] Advantageously, to further improve the precision of the movement of the second part with respect to the first part of the sliding assembly, said connecting mechanism comprises at least two guiding blocks, wherein a first guiding block is connected to the first part of the sliding assembly, and wherein a second guiding block is connected to the second part of the sliding assembly.

[0014] It is preferred that the connecting mechanism comprises a second set of at least one connecting means arranged to connect said second guiding block, said second part of the sliding assembly, said first part of the sliding assembly and said first guiding block. These connecting means ensure a solid connections between the different parts of the sliding assembly.

[0015] More preferably, the connecting mechanism extends in a plane in parallel with said axis of said suspension mechanism, which allows a favourable distribution of forces.

[0016] The axis around which said contact member is rotatable extends normally with respect to said axis of said suspension mechanism. Such normal positioning of the contact member enables the force exerted on the contact member by an activating member to be efficiently transferred into a movement of the second part of the sliding assembly in parallel with the suspension mechanism.

[0017] Said contact member is mounted at an axial position that is associated with one of a plurality of activating members, which allows contact between a contact member of the sliding assembly and an activating member on the guide rail.

[0018] The assembly includes two activating members and two sliding assemblies such that each activating member is only contactable by the contact member of a single sliding assembly. It allows the passage of a contact member of a first sliding assembly over a second activating member on the guide rail without contacting it.

[0019] In a more preferred embodiment, a sliding door rail assembly comprises a plurality of sliding assemblies, and a plurality of activating members. A first sliding assembly is a head-end sliding assembly mounted closest to the opening in a wall. A first activating member is configured to cooperate with said head-end sliding assembly. A last sliding assembly is a tail-end sliding assembly mounted furthest from the opening in a wall. A last activating member is configured to cooperate with said tail-end sliding assembly. Each contact member is mounted at an axial position that is associated with one of a plurality of activating members, such that an axial position of a contact member increases from the head-end sliding assembly to the tail-end sliding assembly. All the above-mentioned features aim at avoiding an obstruction of the sliding assembly due to contact of a contact member with a non-corresponding activating member, and thus at allowing a full opening of a sliding door mounted on a sliding door rail assembly according to the present invention.

[0020] In a more preferred embodiment, the suspension mechanism comprises a tightening device and at least one, preferably two, for example four, suspension devices, of which a first end is connected to said tightening device and a second end is connected to the first part of the sliding assembly. In another advantageous embodiment, the suspension mechanism comprises at least two tightening devices and at least one, preferably two, for example four, suspension devices, of which a

first end is connected to a first tightening device and a second end is connected to a second tightening device in contact with the first part of the sliding assembly. The at least one tightening device being a separate piece, it becomes relatively easy to adapt a sliding assembly to another type of door panel, for example to a heavier door panel, by adding a second tightening device. The present invention thus provides a relatively simple and modular construction of a sliding door rail assembly, which is easy to install.

[0021] It is preferred that the suspension device comprises a spring mechanism, for example at least one of a tension spring, a compression spring, a gas spring, a hydraulic spring, at least two magnets opposing similar or opposite poles. The suspension device causes a door panel, which is attached to the sliding door rail assembly, to be suspended on the sliding assembly when the sliding assembly is not in contact with an activating member, which facilitates opening of the door panel.

[0022] Preferably, said suspension device is compressible from a first initial length to a second compressed length, wherein during compression of the suspension device upon contact of the contact member with the at least one activating member, energy is stored in said suspension device, wherein upon release of the contact member from the at least one activating member, the stored energy enables return of the suspension device to the first initial length. Such a suspension device allows the suspension of a door panel, which is attached to the sliding door rail assembly, when the sliding assembly is not in contact with an activating member, in a compact way.

[0023] Advantageously, the tightening device comprises at least one, preferably two, for example four, adjusting members arranged to adjust a stiffness of said at least one suspension device. The adjusting members allow an adaptation of an installed sliding door rail assembly to another door panel, for example a lighter or heavier door panel. They can be readily accessed, which improves the relatively easy installation of the sliding door rail assembly.

[0024] More preferably, the tightening device comprises a tightening plate arranged to connect the suspension mechanism to the connecting mechanism. The tightening plate helps to improve the modularity, and hence the relatively easy installation, of the invention.

[0025] It is preferred that a plane extending through the support surface of the guide rail extends substantially perpendicular to the plane of the opening in a wall. This feature facilitates a stable sliding movement of the sliding assembly over the guide rail.

[0026] In an advantageous embodiment, a cross-section of the support surface of said guide rail comprises a convex arc of a circle having a radius r . Preferably, said sliding element comprises a contact surface of which a cross-section includes a concave arc of a circle having a radius R . More preferably, said radius r of said cross-sectional circle's arc of the support surface of said guide

rail is smaller than said radius R of said cross-sectional circle's arc of said concave contact surface of the at least one sliding element. These features intend to improve the grip, and the stable sliding, of the sliding assembly over the rail guide in a sliding door rail assembly according to the invention. Moreover, weight is better distributed leading to less wear of the sliding element and the rail guide. Furthermore, a convex guide rail better prevents the accumulation of dust on the rail guide.

[0027] In a preferred embodiment, the at least one activating member comprises a wedge shaped activating member, wherein a height of a side of the wedge shaped activating member facing a sliding assembly is smaller than a height of a side of the wedge shaped activating member facing away from the sliding assembly. Such an activating member is easy to make, and ensures a smooth contact between an activating member and a contact member. Moreover, a same wedge shaped activating member can be mounted on a rail guide in the desired direction which is adaptable to the closing direction of a sliding door attachable to the sliding door rail assembly.

[0028] Preferably, said at least one activating member comprises a blocking member, of which a height is at least equal or higher than a radius of a rotatable contact member. This is to ensure that a sliding assembly cannot slide over and pass an activating member with which it is configured to cooperate.

[0029] According to another aspect of the invention, there is provided a sliding door rail assembly, characterized by the features of claim 25, leading to the above-mentioned advantages.

[0030] The present invention will be further elucidated with reference to figures of exemplary embodiments. Therein, corresponding elements are designated with corresponding reference signs.

Figures 1a and 1b show a perspective view of a sliding door panel attached to a sliding door rail assembly of an example according to the invention;

Figure 2a and 2b show, respectively, a back view and a side view of a sliding assembly of the system shown in Figure 1;

Figure 3 shows a front view of the sliding assembly as shown in Figures 2a and 2b;

Figure 4 shows an exploded view of the assembly of Figures 2a and 2b;

Figures 5a and 5b show perspective, opened-up views of part of the sliding assembly of Figures 2a and 2b;

Figures 6a and 6b show side views of the sliding assembly in Figures 2a and 2b;

Figure 7a and 7b show, respectively, a back view and a side view of a second example of the first embodiment of the sliding assembly as in Figures 2a and 2b;

Figure 8 shows a perspective view of a second embodiment of a sliding assembly;

Figure 9 shows a back view of a third embodiment of a sliding assembly;

Figure 10 shows an exploded view of the sliding assembly of Figure 9;

Figures 11a and 11b show a side view of a sliding door rail assembly according to an embodiment of the invention;

Figures 12a and 12b show a front view of an upper part of a sliding door panel attached to a sliding door rail assembly according to the invention; and

Figures 13a and 13b show a perspective view of a sliding assembly and an activating member.

[0031] Figures 1a and 1b show a perspective view of a sliding door panel 9 attached to a sliding door rail assembly of an example according to the invention. The sliding door rail assembly comprises a guide rail 1 and at least one, and in this case two, sliding assemblies 2 movable along the guide rail 1. The guide rail 1 comprises a support surface 3, a second surface 4, and at least one, in this case two, activating members 5 connected to said second surface 4. The door panel 9 is configured to close an opening 22 in a wall, preferably hermetically, for example an access to a conditioned space, for example a room-sized freezer, or an operating room in a hospital. The door can be brought from a first, opened position (Figure 1a) to a second, closed position (Figure 1b) and back to said first opened position manually, or via an automated driving system, well-known by a person skilled in the art.

[0032] Figures 2a and 2b show, respectively, a back view (facing the guide rail 1), and a side view of a sliding assembly 2 of the system shown in Figure 1. Figure 3 shows a front view (facing away from the guide rail 1) of the sliding assembly as shown in Figures 2a and 2b. Figure 4 shows an exploded view of the assembly of Figures 2a and 2b. The sliding assembly 2 comprises a first part 6 provided with at least one sliding element 7, which is movable along said support surface 3. The sliding element 7 may for example be a wheel that can rotate on the guide rail 1, or any other gliding element. The sliding assembly 2 also comprises a second part 8 to which a door panel 9 is attachable, for example via appropriate connecting means 23 (see Figure 3). The second part 8 is connected to said first part 6 via a connecting mechanism 10. Said second part 8 is movable with respect to said first part 6 through a suspension mechanism 11. An axis X of said suspension mechanism 11 (i.e. an axis of movement of the second part 8) and a plane of an opening 22 in a wall include an angle α , for example in the range of 30°-60°, or more preferably, of substantially 45°. Preferably, the connecting mechanism 10 extends in a plane in parallel with said axis X of said suspension mechanism 11, thus showing the same angle of inclination α with respect to the opening 22 in a wall. In order to support this angle of inclination α , both the first part 6 and the second part 8 can be shaped in a way that they comprise a main plate 6' and 8', wherein a main plate 6' of said

first part 6 is perpendicular to a main plate 8' of said second part 8, and an inclined plate part 6" and 8", wherein the inclined plate part 8" is inclined by an angle α with respect to the main plate 8' for the second part 8, and wherein the inclined plate part 6" is inclined by an angle of $90^\circ - \alpha$ with respect to the main plate 6' for the first part 6 (see Figures 2b and 4).

[0033] The second part 8 of the at least one sliding assembly 2 is provided with a rotatable contact member 12 (e.g. a wheel or a roller), that is configured to cooperate with the at least one activating member 5 such that the second part 8 of the sliding assembly 2 moves along the axis X of the suspension mechanism 11 when the contact member 12 rolls along the activating member 5. Due to the inclination angle α of the suspension mechanism 11, the door panel 9 can make an oblique movement towards and away from said opening 22 in a wall. Preferably, the contact member 12 is mounted at an axial position D that is associated with one of a plurality of activating members 5. An axis Y around which said contact member 12 is rotatable preferably extends normally with respect to said axis X of said suspension mechanism 11.

[0034] The suspension mechanism 11 preferably comprises a tightening device 15 and at least one, preferably two as in Figures 2-6, for example four as in Figures 9-10, suspension devices 16, of which a first end 17 is connected to said tightening device 15 and a second end 18 is connected to the first part 6 of the sliding assembly 2, for example to the inclined plate part 6". The suspension device 16 may comprise at least one spring mechanism, for example one of a tension spring, a compression spring (Figures 2-4), a gas spring, a hydraulic spring, or at least two magnets opposing similar or opposite poles. Said tightening device 15 may also comprise at least one, preferably two (Figures 2-4), for example four, adjusting members 19 arranged to adjust a stiffness of said at least one suspension device 16. These adjusting members 19 handily face away from the rail guide, as becomes clear from the front view in Figure 3, which facilitates fine-tuning once the sliding door rail assembly has been mounted to a wall. The tightening device 15 can further comprise a tightening plate 20 arranged to connect the suspension mechanism 11 to the connecting mechanism 10. The size of this tightening plate 20 can be adapted to the number of suspension devices 16, as will be shown in more detail in Figures 9-10.

[0035] The connecting mechanism 10 can comprise at least one guiding block 13 configured to receive and hold connecting means 14. Preferably, said connecting means 14 comprise at least two (parallel) linear bearings 26. These linear bearings 26 are preferably mounted next to each other, in parallel with, and possibly in between, the suspension devices 16. Alternatively, there may also be only one bearing 26. Preferably, said connecting mechanism 10 comprises at least two guiding blocks 13a, 13b. A first guiding block 13a can be connected to the first part 6 of the sliding assembly 2, for example to the inclined plate part 6". A second guiding block 13b can be

connected to the second part 8 of the sliding assembly 2, for example to the inclined plate part 8".

[0036] Figures 5a and 5b show perspective, opened-up views of part of the sliding assembly of Figures 2a and 2b. The connecting mechanism 10 comprises a second set of at least one connecting means 14b arranged to connect said second guiding block 13b, said second part 8 of the sliding assembly 2, said first part 6 of the sliding assembly 2 and said first guiding block 13a. Preferably, a set of at least two connecting means 14, connecting the tightening plate 20 to the first guiding block 13a, and a second set of at least two connecting means 14b as described above ensure a solid connections between the above-mentioned components. Advantageously, a connecting means 14 of a first set extends in line with a connecting means 14b of a second set, and still more advantageously, all connecting means 14, 14b extend in a same plane in parallel with, and are each individually in parallel with, the axis X of the suspension mechanism 11.

[0037] Figures 6a and 6b show side views of the sliding assembly in Figures 2a and 2b. The suspension device 16 of the sliding device 2 in Figure 6a is compressible from a first initial length L to a second compressed length 1 (Figure 6b). During compression of the suspension device 16 upon contact of the contact member 12 with the at least one activating member 5 (invisible in Figure 6), energy is stored in said suspension device 16, wherein upon release of the contact member 12 from the at least one activating member 5, the stored energy enables return of the suspension device 16 to the first initial length L. The suspension force of the suspension device 16 being slightly higher than the weight of a door panel 9, attached to the second part 8, for example to the main plate 8', of the sliding assembly 2, said door panel 9 can thus be suspended to the suspension mechanism 11 and allow easy sliding of the sliding assembly 2 along the guide rail 1. Upon contact of the contact member 12 with an activating member 5 on the guide rail 1, the contact member 12 and the second part 8 of the sliding assembly are pushed obliquely downwards under compression of the suspension device 16, so that a door panel 9 attached to said second part 8 undergoes a corresponding oblique movement, for example towards an opening 22 in a wall to close said opening. The energy stored in the compressed suspension device 16 can then serve to overcome the weight of the door panel 9 and suspend the door panel 9 again in an upward and oblique movement of the second part 8 towards the first part 6 of the sliding assembly 2 once contact between the contact member 12 and an activating member 5 is broken due to the sliding assembly 2 moving away from said activating member 5.

[0038] Figure 7a and 7b show, respectively, a back view and a side view of a second example 2b of the first embodiment of the sliding example as in Figures 2a and 2b. A same door panel 9 can be mounted to the sliding assemblies 2 and 2b of respectively Figures 2 and 7 simultaneously, wherein the sliding assemblies 2 and 2b

can be located at a distance from each other measured along the guide rail 1, preferably near the edges of the door panel 9, for example as shown in Figure 1, preferably with the sliding assembly 2 being closest to an opening 22 in a wall. It is then preferred that the second sliding assembly 2b comprises a contact member 12b which is mounted at an axial position D2 that is associated with one of a plurality of activating members, such that the axial position D2 of the contact member 12b is different from the axial position D of contact member 12 in Figure 2b.

[0039] Figure 8 shows a perspective view of a second embodiment of a sliding assembly 2'. The first embodiment of Figures 2-7 can for example be used in combination with a door panel of approximately 1-120 kg, whereas the second embodiment of Figure 8 can be used in combination with a door panel of approximately 120-180 kg. The sliding assembly 2' comprises two sliding elements 7, two wheels in this case, instead of one sliding element as in Figures 2-7. The first part 6 of the sliding assembly 2' can be equipped with for example three holes 24 (see also Figures 4 and 10), so that the sliding assembly 2' can easily be adapted from an embodiment with one sliding element 7 (Figures 2-7) centrally positioned on the first part 6 to an embodiment with two sliding elements 7 (Figure 8) spaced apart on the first part 6, when this is needed, for example to be used in combination with a heavier door panel, to better distribute forces on the guide rail 1 and improve a stable sliding of a sliding assembly 2 on the guide rail 1.

[0040] Figure 9 shows a back view of a third embodiment of a sliding assembly 2", for use in combination with still heavier door panels than the embodiment of Figure 8, for example for door panels in a range of approximately 180-300 kg. Figure 10 shows an exploded view of the sliding assembly of Figure 9. The suspension mechanism 11 may then comprise at least two tightening devices 15a and 15b and at least one, preferably two, for example four as in this case, suspension devices 16, of which a first end 17 is connected to a first tightening device 15a and a second end 18 is connected to a second tightening device 15b in contact with the first part 6 of the sliding assembly 2". The second tightening device 15b can be mounted on the inclined plate part 6" to enable the connection of more than two suspension devices 16. The tightening plate 20 of the first tightening device 15 (Figure 4) can be replaced by a larger tightening plate forming the first tightening device 15a (Figure 10) enabling the connection of more than two suspension devices 16. The possibility to adapt an embodiment of the sliding mechanism into another embodiment by adding and/or replacing a minimum of pieces (sliding element 7, tightening device 15, 15a, 15b) makes it a modular assembly, simplifying its fabrication and mounting. The tightening device 15a preferably comprises at least one, preferably two, for example four as in this case, adjusting members 19 arranged to adjust a stiffness of said at least one, in this case four, suspension devices 16. The adjusting

members 19 face away from the guide rail 1 allowing easy access to these adjusting members 19 by a technician needing to fine-tune them.

[0041] Figure 11a and 11b show a side view of a sliding door rail assembly according to an embodiment of the invention, comprising a sliding assembly 2b corresponding to the embodiment of Figures 7a and 7b. The sliding assembly 2b can slide along the rail guide 1 from a first position (Figure 11a) without contact between the contact member 12b of the sliding assembly 2b and the activating member 5b to a second position (Figure 11b) when the second part 8 of the sliding assembly 2 moves along the axis X of the suspension mechanism 11 when the contact member 12 rolls along the activating member 5, such that a door panel 9 is obliquely moved towards an opening 22 in a wall. In a preferred embodiment a second surface 4 of said guide rail 1 is tilted with respect to the support surface 3 of said guide rail 1 such that said second surface 4 is parallel to the axis X of the suspension mechanism 11. The second surface 4 includes or is provided with the at least one activating member 5.

[0042] The contact member 12b is preferably mounted at an axial position D2 that is associated with the activating member 5b. If the sliding door rail assembly further comprises at least a second sliding assembly 2, for example the embodiment of Figures 2-6, comprising a contact member 12 which is mounted at a different axial position D that is associated with the activating member 5, then each activating member 5, 5b is only contactable by the contact member 12, 12b of a single sliding assembly 2, 2b.

[0043] Advantageously, a plane extending through the support surface 3 of the guide rail 1 extends substantially perpendicular to the plane of an opening 22 in a wall. A cross-section of the support surface 3 of said guide rail 1 may preferably comprise a convex arc of a circle having a radius r. A sliding element 7 preferably also comprises a contact surface 21 of which a cross-section includes a concave arc of a circle having a radius R. It is favourable for a better distribution of forces on the guide rail that radius r of said cross-sectional circle's arc of the support surface 3 of said guide rail 1 is smaller than said radius R of said cross-sectional circle's arc of said concave contact surface 21 of the at least one sliding element 7.

[0044] Figures 12a and 12b show a front view of an upper part of a sliding door panel 9 attached to a sliding door rail assembly according to the invention. The door panel 9 can slide along the guide rail 1 from a first position (Figure 12a) with an opening 22 in a wall, to a second position (Figure 12b), wherein the door panel 9 can, for example hermetically, close said opening 22 in the wall. The door panel 9 is attached to two sliding assemblies 2', 2'b, sliding assemblies as for example in the embodiment of Figure 8, via appropriate connecting means 23. The two sliding assemblies 2', 2'b can be mounted on the door panel 9 at a distance from each other measured along the guide rail, preferably near the edges of the door panel 9, wherein sliding assembly 2'b is a tail-end sliding

assembly, being furthest from the opening 22 in the wall, and sliding assembly 2' a head-end sliding assembly, being closest to the opening 22 in the wall. In order to be able to adapt the sliding door rail assembly to a still larger range of weights of sliding door panels 9 and to larger openings 22 in a wall, the door panel 9 can also be attached to a plurality of (more than two) sliding assemblies, spaced apart along the guide rail comprising a plurality of activating members, wherein the number of activating members corresponds to the number of sliding assemblies. It is then preferred that an axial position D of a contact member increases from the head-end sliding assembly 2' to the tail-end sliding assembly 2'b. In consequence, a distance d between an activating member 5 and the second surface of the rail guide 1 measured in a direction perpendicular to said second surface 4, decreases from the activating member 5 cooperating with the head-end sliding assembly 2 to the activating member 5b cooperating with the tail-end sliding assembly 2b.

[0045] Figures 13a and 13b show a perspective view of a sliding assembly and an activating member. The depicted sliding assembly 2' corresponds again to the embodiment of Figure 8. The activating member 5 comprises a wedge-shaped activating member, wherein a height h of a side of the wedge-shaped activating member facing a sliding assembly 2' is smaller than a height H of a side of the wedge-shaped activating member facing away from the sliding assembly 2'. The height h preferably is as low as possible to ensure a smooth contact between the contact member 12 and the activating member 5. The wedge-shaped activating member may also include a blocking member 25, of which a height H" is at least equal or higher than a radius R" of a contact member 12, such that a sliding assembly 2 cannot slide over an activating member 5. This optional blocking member 25 can be combined with, or replaced by, another type of blocking mounted near an edge of the guide rail 1, to block the door panel 9 rather than a sliding assembly.

[0046] It should be clear to the person skilled in the art that the invention is not limited to the embodiments described above. Many alternatives are possible within the scope of protection as formulated in the claims hereafter.

[0047] For example, the sliding element can also be a wheel with a convex cross-section sliding in a concave rail guide, or a flat wheel sliding on a flat rail guide, or a wheel with any other polygonal cross-section sliding on a rail guide with a corresponding cross-section.

[0048] Also, in an aspect of the invention, it has been found that good results (providing efficient, low-noise operation of the assembly) can be achieved independently of the feature of the second part of said at least one sliding assembly comprising a rotatable contact member (configured to cooperate with the at least one activating member such, that the second part of the sliding assembly moves along the axis of the suspension mechanism when the contact member rolls along the activating member), by using the following feature:

that the radius of said cross-sectional circle's arc of the

support surface 3 of said guide rail 1 is smaller than the radius of said cross-sectional circle's arc of said concave contact surface of the at least one sliding element 7.

Claims

1. Sliding door rail assembly for a sliding door panel, comprising a guide rail (1) and two sliding assemblies (2) movable along the guide rail (1), wherein the guide rail (1) comprises a support surface (3) and two activating members (5), wherein each sliding assembly (2) comprises a first part (6) provided with at least one sliding element (7) which is movable along said support surface (3), and a second part (8) to which the sliding door panel (9), configured to close an opening in a wall, is attachable, wherein said second part (8) is connected to said first part (6) via a connecting mechanism (10) and wherein said second part (8) is movable with respect to said first part (6) through a suspension mechanism (11), wherein an axis (X) of said suspension mechanism (11) and a plane of said opening in a wall include an angle (a), for example an angle in the range of 30°-60°, wherein said second part (8) of each sliding assembly (2) comprises a rotatable contact member (12) that is configured to cooperate with a respective activating member (5) the second part (8) of the sliding assembly (2) moves along the axis (X) of the suspension mechanism (11) when the contact member (12) rolls along the activating member (5), **characterized in that** the axis (Y) around which said contact member (12) is rotatable extends normally with respect to said axis (X) of said suspension mechanism (11), wherein the configuration is such that each activating member (5) is only contactable by the rotatable contact member (12) of a single sliding assembly (2), wherein the guide rail (1) is provided with two spaced-apart activating members (5) located at mutually different positions viewed normally with respect to said suspension mechanism axis (X), wherein each rotatable contact member (12) is mounted at an axial position (D) that is associated with one of the plurality of activating members (5).
2. Sliding door rail assembly according to claim 1, wherein a second surface (4) of said guide rail (1) is tilted with respect to the support surface (3) of said guide rail (1) such that said second surface (4) is parallel to said axis (X) of said suspension mechanism (11), wherein the second surface (4) includes or is provided with the at least one activating member (5).
3. Sliding door rail assembly according to any of the preceding claims, wherein an axis (X) of said suspension mechanism (11) and a plane of said opening

in a wall include an angle (α) of about 45° .

4. Sliding door rail assembly according to any of the preceding claims, wherein said connecting mechanism (10) comprises at least one substantially solid guiding block (13) configured to receive and hold connecting means (14).
5. Sliding door rail assembly according to any of the preceding claims, wherein the connecting means (14) comprise at least two linear bearings (26).
6. Sliding door rail assembly according to any of the preceding claims, wherein said connecting mechanism (10) comprises at least two guiding blocks (13a, 13b), wherein a first guiding block (13a) is connected to the first part (6) of the sliding assembly (2), and wherein a second guiding block (13b) is connected to the second part (8) of the sliding assembly (2).
7. Sliding door rail assembly according to any of the preceding claims, wherein said connecting mechanism (10) extends in a plane in parallel with said axis (X) of said suspension mechanism (11).
8. Sliding door rail assembly according to any of the preceding claims, comprising a plurality of sliding assemblies, and a plurality of activating members, wherein a first sliding assembly is a head-end sliding assembly mounted closest to the opening (22) in a wall, wherein a first activating member is configured to cooperate with said head-end sliding assembly, wherein a last sliding assembly is a tail-end sliding assembly mounted furthest from the opening (22) in a wall, wherein a last activating member is configured to cooperate with said tail-end sliding assembly, wherein each contact member is mounted at an axial position that is associated with one of a plurality of activating members, such that an axial position (D) of a contact member increases from the head-end sliding assembly to the tail-end sliding assembly.
9. Sliding door rail assembly according to any of the preceding claims, wherein the suspension mechanism (11) of at least one sliding assembly (2) comprises at least one tightening device (15) and at least one suspension device (16), preferably two, for example four, suspension devices (16), wherein a first end (17) of said suspension device (16) is connected to a respective tightening device (15) and a second end (18) is connected to the first part (6) of the sliding assembly (2).
10. Sliding door rail assembly according to any of the preceding claims, wherein the suspension mechanism (11) of at least one sliding assembly (2) comprises at least two tightening devices (15a, 15b) and at least one, preferably two, for example four, sus-

pension devices (16), wherein a said suspension device (16) has a first end (17) that is connected to a first tightening device (15a) and a second end (18) that is connected to a second tightening device (15b) that is in contact with the first part (6) of the sliding assembly (2).

11. Sliding door rail assembly according to any of the preceding claims, wherein a said suspension mechanism comprises a spring mechanism (16), for example at least one of a tension spring, a compression spring, a gas spring, a hydraulic spring, at least two magnets opposing similar or opposite poles.
12. Sliding door rail assembly according to any of the preceding claims, wherein a plane extending through the support surface (3) of the guide rail (1) extends substantially perpendicular to the plane of the opening in a wall.
13. Sliding door rail assembly according to any of the preceding claims, wherein said sliding element (7) comprises a contact surface (21) of which a cross-section includes a concave arc of a circle having a radius (R).
14. Sliding door rail assembly according to any of the preceding claims, wherein said at least one activating member (5) comprises a wedge shaped activating member, wherein a height (h) of a side of the wedge shaped activating member facing a sliding assembly (2) is smaller than a height (H) of a side of the wedge shaped activating member facing away from the sliding assembly (2).
15. Sliding door rail assembly according to any of the preceding claims, wherein said at least one activating member (5) comprises a blocking member (24), of which a height (H") is at least equal or higher than a radius (R") of a contact member (12).

Patentansprüche

1. Schiebetürschienenanordnung für eine Schiebetürplatte, umfassend eine Führungsschiene (1) und zwei entlang der Führungsschiene (1) bewegbare Schiebeanordnungen (2), wobei die Führungsschiene (1) eine Tragfläche (3) und zwei Betätigungselemente (5) umfasst, wobei jede Schiebeanordnung (2) einen ersten Teil (6) umfasst, der mit wenigstens einem Schiebeelement (7) versehen ist, das entlang der Tragfläche (3) bewegbar ist, und einen zweiten Teil (8), an den die Schiebetürplatte (9) angebracht werden kann, die konfiguriert ist, um eine Öffnung in einer Wand zu verschließen, wobei der zweite Teil (8) über einen Verbindungsmechanismus (10) mit dem ersten Teil (6) verbunden ist und wobei der

- zweite Teil (8) in Bezug auf den ersten Teil (6) durch einen Aufhängungsmechanismus (11) bewegbar ist, wobei eine Achse (X) des Aufhängungsmechanismus (11) und eine Ebene der Öffnung in einer Wand einen Winkel (α) aufweisen, beispielsweise einen Winkel im Bereich von 30° bis 60°, wobei der zweite Teil (8) jeder Schiebeanordnung (2) ein drehbares Kontaktelement (12) umfasst, das konfiguriert ist, um mit einem jeweiligen Betätigungselement (5) zusammenzuwirken, so dass sich der zweite Teil (8) der Schiebeanordnung (2) entlang der Achse (X) des Aufhängungsmechanismus (11) bewegt, wenn das Kontaktelement (12) entlang des Betätigungselements (5) rollt, **dadurch gekennzeichnet, dass** die Achse (Y), um die das Kontaktelement (12) drehbar ist, sich normal in Bezug auf die Achse (X) des Aufhängungsmechanismus (11) erstreckt, wobei die Konfiguration derart ist, dass jedes Betätigungselement (5) nur durch das drehbare Kontaktelement (12) einer einzelnen Schiebeanordnung (2) kontaktierbar ist, wobei die Führungsschiene (1) mit zwei voneinander beabstandeten Betätigungselementen (5) versehen ist, die sich an voneinander verschiedenen Positionen, wenn man sie normal betrachtet, in Bezug auf die Aufhängungsmechanismusachse (X) befinden, wobei jedes drehbare Kontaktelement (12) an einer axialen Position (D) angebracht ist, die einem der mehreren Betätigungselemente (5) zugeordnet ist.
2. Schiebetürschienenanordnung nach Anspruch 1, wobei eine zweite Oberfläche (4) der Führungsschiene (1) in Bezug auf die Tragfläche (3) der Führungsschiene (1) derart geneigt ist, dass die zweite Oberfläche (4) parallel zu der Achse (X) des Aufhängungsmechanismus (11) ist, wobei die zweite Oberfläche (4) das wenigstens ein Betätigungselement (5) enthält oder mit diesem versehen ist.
 3. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei eine Achse (X) des Aufhängungsmechanismus (11) und eine Ebene der Öffnung in einer Wand einen Winkel (α) von etwa 45° einschließen.
 4. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei der Verbindungsmechanismus (10) wenigstens einen im Wesentlichen festen Führungsblock (13) umfasst, der konfiguriert ist, um Verbindungsmittel (14) aufzunehmen und zu halten.
 5. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei die Verbindungsmittel (14) wenigstens zwei Linearlager (26) umfassen.
 6. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei der Verbindungsmechanismus (10) wenigstens zwei Führungsblöcke (13a, 13b) umfasst, wobei ein erster Führungsblock (13a) mit dem ersten Teil (6) der Schiebetürschienenanordnung (2) verbunden ist, und wobei ein zweiter Führungsblock (13b) mit dem zweiten Teil (8) der Schiebeanordnung (2) verbunden ist.
 7. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei sich der Verbindungsmechanismus (10) in einer Ebene parallel zu der Achse (X) des Aufhängungsmechanismus (11) erstreckt.
 8. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, umfassend mehrere Schiebeanordnungen und mehrere Betätigungselemente, wobei eine erste Schiebeanordnung eine kopfseitige Schiebeanordnung ist, die der Öffnung (22) in einer Wand am nächsten ist, wobei ein erstes Betätigungselement konfiguriert ist, um mit der kopfseitigen Schiebeanordnung zusammenzuwirken, wobei eine letzte Schiebeanordnung eine rückseitige Schiebeanordnung ist, die am weitesten von der Öffnung (22) in einer Wand entfernt montiert ist, wobei ein letztes Betätigungselement konfiguriert ist, um mit der rückseitigen Schiebeanordnung zusammenzuwirken, wobei jedes Kontaktelement an einer axialen Position angebracht ist, die einem von mehreren Betätigungselementen zugeordnet ist, so dass eine axiale Position (D) eines Kontaktelements von der kopfseitigen Schiebeanordnung zu der rückseitigen Schiebeanordnung zunimmt.
 9. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei der Aufhängungsmechanismus (11) wenigstens einer Schiebeanordnung (2) wenigstens eine Spannvorrichtung (15) und wenigstens eine Aufhängungsvorrichtung (16) umfasst, vorzugsweise zwei, beispielsweise vier Aufhängevorrichtungen (16), wobei ein erstes Ende (17) der Aufhängevorrichtung (16) mit einer jeweiligen Spannvorrichtung (15) verbunden ist und ein zweites Ende (18) mit dem ersten Teil (6) der Schiebeanordnung (2) verbunden ist.
 10. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei der Aufhängungsmechanismus (11) wenigstens einer Schiebeanordnung (2) wenigstens zwei Spannvorrichtungen (15a, 15b) und wenigstens eine, vorzugsweise zwei, beispielsweise vier, Aufhängevorrichtungen (16) umfasst, wobei die Aufhängevorrichtungen (16) ein erstes Ende (17) aufweisen, das mit einer ersten Spannvorrichtung (15a) verbunden ist, und ein zweites Ende (18), das mit einer zweiten Spannvorrichtung (15b) verbunden ist, die mit dem ersten Teil (6) der Schiebeanordnung (2) in Kontakt steht.

11. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei der Aufhängungsmechanismus einen Federmechanismus (16) umfasst, beispielsweise wenigstens eine Zugfeder, eine Druckfeder, eine Gasfeder, eine Hydraulikfeder oder wenigstens zwei Magnete, die ähnlichen oder entgegengesetzten Polen gegenüberliegen. 5
12. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei sich eine Ebene, die sich durch die Tragfläche (3) der Führungsschiene (1) erstreckt, im Wesentlichen senkrecht zur Ebene der Öffnung in einer Wand erstreckt. 10
13. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei das Schiebeelement (7) eine Kontaktfläche (21) umfasst, deren Querschnitt einen konkaven Kreisbogen mit einem Radius (R) enthält. 15
14. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei das wenigstens eine Betätigungselement (5) ein keilförmiges Betätigungselement umfasst, wobei eine Höhe (h) einer Seite des keilförmigen Betätigungselements, die einer Schiebeanordnung (2) zugewandt ist, kleiner ist als eine Höhe (H) einer Seite des keilförmigen Betätigungselements, das von der Schiebeanordnung (2) abgewandt ist. 20 25
15. Schiebetürschienenanordnung nach einem der vorhergehenden Ansprüche, wobei das wenigstens eine Betätigungselement (5) ein Verriegelungselement (24) umfasst, dessen Höhe (H") wenigstens gleich oder größer als ein Radius (R") eines Kontaktelements (12) ist. 30 35

Revendications

1. Ensemble de rail de porte coulissante pour un panneau de porte coulissante, comprenant un rail de guidage (1) et deux ensembles de coulissement (2) mobiles le long du rail de guidage (1), dans lequel le rail de guidage (1) comprend une surface de support (3) et deux éléments d'activation (5), dans lequel chaque ensemble de coulissement (2) comprend une première partie (6) prévue avec au moins un élément de coulissement (7) qui est mobile le long de ladite seconde surface de support (3), et une seconde partie (8) à laquelle le panneau de porte coulissante (9), configuré pour fermer une ouverture dans une paroi, peut être fixé, dans lequel ladite seconde partie (8) est raccordée à ladite première partie (6) via un mécanisme de raccordement (10) et dans lequel ladite seconde partie (8) est mobile par rapport à ladite première partie (6) par le biais d'un mécanisme de suspension (11), dans lequel un axe 40 45 50 55

(X) dudit mécanisme de suspension (11) et un plan de ladite ouverture dans une paroi comprennent un angle (α), par exemple un angle dans la plage de 30° à 60°, dans lequel ladite seconde partie (8) de chaque ensemble de coulissement (2) comprend un élément de contact rotatif (12) qui est configuré pour coopérer avec un élément d'activation (5) respectif, de sorte que :

la seconde partie (8) de l'ensemble de coulissement (2) se déplace le long de l'axe (X) du mécanisme de suspension (11), lorsque l'élément de contact (12) roule le long de l'élément d'activation (5), **caractérisé en ce que** l'axe (Y) autour duquel ledit élément de contact (12) peut tourner, s'étend normalement par rapport audit axe (X) dudit mécanisme de suspension (11), dans lequel la configuration est telle que chaque élément d'activation (5) peut uniquement être en contact avec l'élément de contact rotatif (12) d'un seul ensemble de coulissement (2), dans lequel le rail de guidage (1) est prévu avec deux éléments d'activation (5) espacés, positionnés dans des positions mutuellement différentes, observés normalement par rapport audit axe de mécanisme de suspension (X), dans lequel chaque élément de contact rotatif (12) est monté dans une position axiale (D) qui est associée à l'un de la pluralité d'éléments d'activation (5).

2. Ensemble de rail de porte coulissante selon la revendication 1, dans lequel une seconde surface (4) dudit rail de guidage (1) est inclinée par rapport à la surface de support (3) dudit rail de guidage (1), de sorte que ladite seconde surface (4) est parallèle audit axe (X) dudit mécanisme de suspension (11), dans lequel la seconde surface (4) comprend ou est prévue avec le au moins un élément d'activation (5). 40
3. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel un axe (X) dudit mécanisme de suspension (11) et un plan de ladite ouverture dans une paroi comprennent un angle (α) d'environ 45°. 45
4. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel ledit mécanisme de raccordement (10) comprend au moins un bloc de guidage (13) sensiblement solide configuré pour recevoir et maintenir des moyens de raccordement (14). 50
5. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel les moyens de raccordement (14) comprennent au moins deux paliers linéaires (26). 55

6. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel ledit mécanisme de raccordement (10) comprend au moins deux blocs de guidage (13a, 13b), dans lequel un premier bloc de guidage (13a) est raccordé à la première partie (6) de l'ensemble de coulissement (2), et dans lequel un second bloc de guidage (13b) est raccordé à la seconde partie (8) de l'ensemble de coulissement (2). 5
7. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel ledit mécanisme de raccordement (10) s'étend dans un plan parallèle audit axe (X) dudit mécanisme de suspension (11). 10
8. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, comprenant une pluralité d'ensembles de coulissement, et une pluralité d'éléments d'activation, dans lequel un premier ensemble de coulissement est un ensemble de coulissement d'extrémité de tête monté le plus à proximité de l'ouverture (22) dans une paroi, dans lequel un premier élément d'activation est configuré pour coopérer avec ledit ensemble de coulissement d'extrémité de tête, dans lequel un dernier ensemble de coulissement est un ensemble de coulissement d'extrémité de queue monté de la manière la plus éloignée de l'ouverture (22) dans une paroi, dans lequel un dernier élément d'activation est configuré pour coopérer avec ledit ensemble de coulissement d'extrémité de queue, dans lequel chaque élément de contact est monté dans une position axiale qui est associée à l'un d'une pluralité d'éléments d'activation, de sorte qu'une position axiale (D) d'un élément de contact augmente de l'ensemble de coulissement d'extrémité de tête à l'ensemble de coulissement d'extrémité de queue. 20
9. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel le mécanisme de suspension (11) d'au moins un ensemble de coulissement (2) comprend au moins un dispositif de serrage (15) et au moins un dispositif de suspension (16), de préférence deux, par exemple quatre dispositifs de suspension (16), dans lequel une première extrémité (17) dudit dispositif de suspension (16) est raccordée à un dispositif de serrage (15) respectif, et une seconde extrémité (18) est raccordée à la première partie (6) de l'ensemble de coulissement (2). 25
10. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel le mécanisme de suspension (11) d'au moins un ensemble de coulissement (2) comprend au moins deux dispositifs de serrage (15a, 15b) et au moins un, de préférence deux, par exemple quatre dispositifs de suspension (16), dans lequel ledit dispositif de suspension (16) a une première extrémité (17) qui est raccordée à un premier dispositif de serrage (15a) et une seconde extrémité (18) qui est raccordée à un second dispositif de serrage (15b) qui est en contact avec la première partie (6) de l'ensemble de coulissement (2). 30
11. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel ledit mécanisme de suspension comprend un mécanisme de ressort (16) par exemple au moins l'un parmi un ressort de tension, un ressort de compression, un ressort pneumatique, un ressort hydraulique, au moins quatre aimants opposés similaires ou à pôles opposés. 35
12. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel un plan s'étendant à travers la surface de support (3) du rail de guidage (1) s'étend de manière sensiblement perpendiculaire au plan de l'ouverture dans une paroi. 40
13. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel ledit élément coulissant (7) comprend une surface de contact (21) dont une section transversale comprend un arc de cercle concave ayant un rayon (R). 45
14. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel ledit au moins un élément d'activation (5) comprend un élément d'activation en forme de cale, dans lequel une hauteur (h) d'un côté de l'élément d'activation en forme de cale faisant face à un ensemble de coulissement (2) est inférieure à une hauteur (H) d'un côté de l'élément d'activation en forme de cale orienté à l'opposé de l'ensemble de coulissement (2). 50
15. Ensemble de rail de porte coulissante selon l'une quelconque des revendications précédentes, dans lequel ledit au moins un élément d'activation (5) comprend un élément de blocage (24) dont une hauteur (H") est au moins égale ou supérieure à un rayon (R") d'un élément de contact (12). 55

Fig. 1a

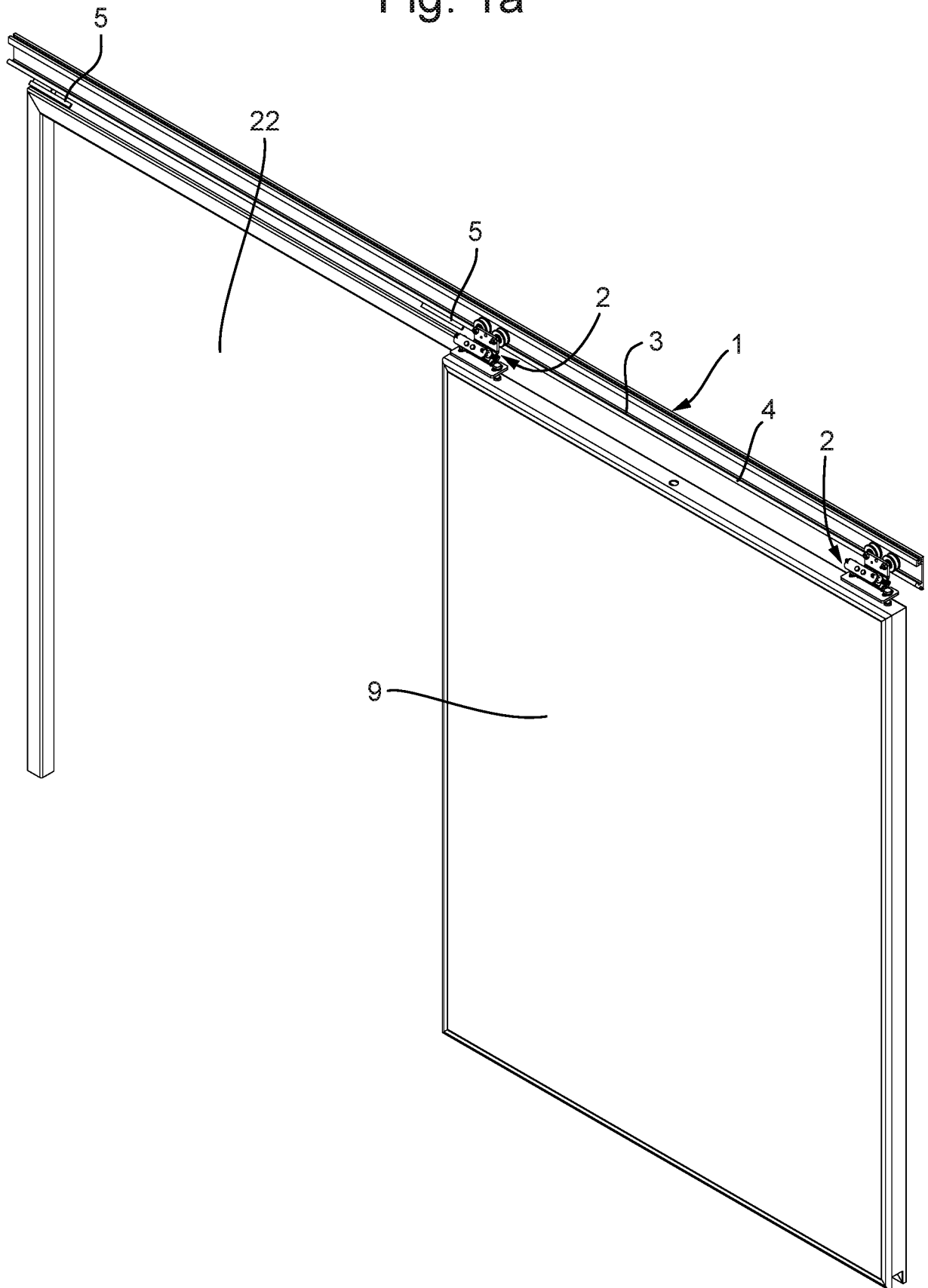


Fig. 1b

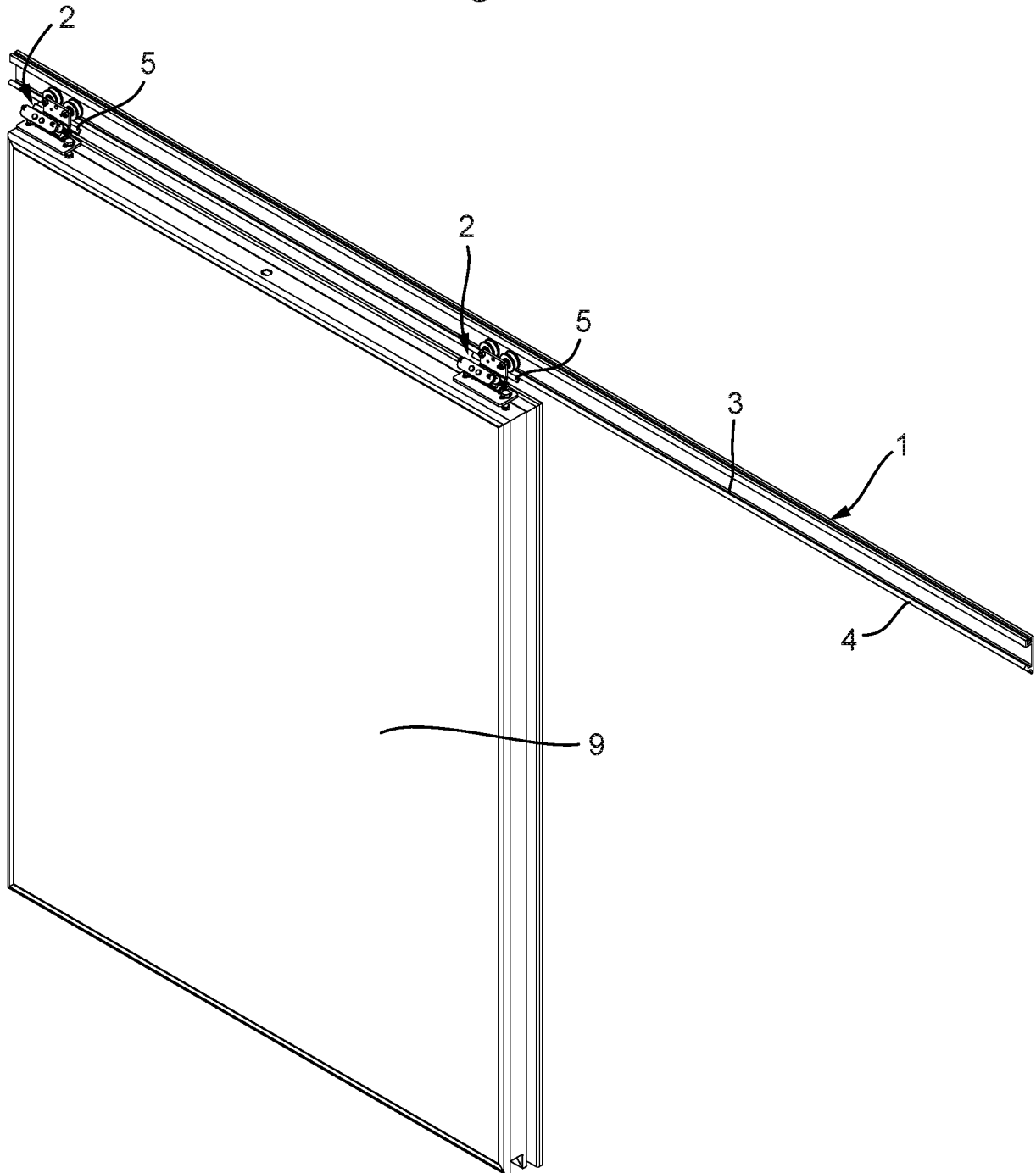


Fig. 2a

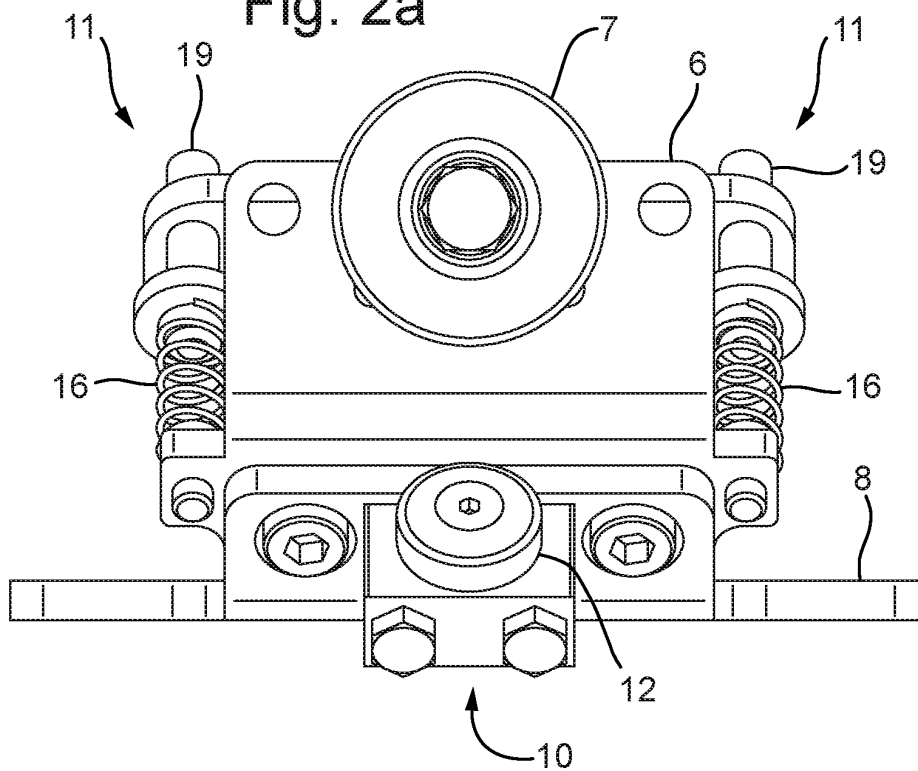


Fig. 2b

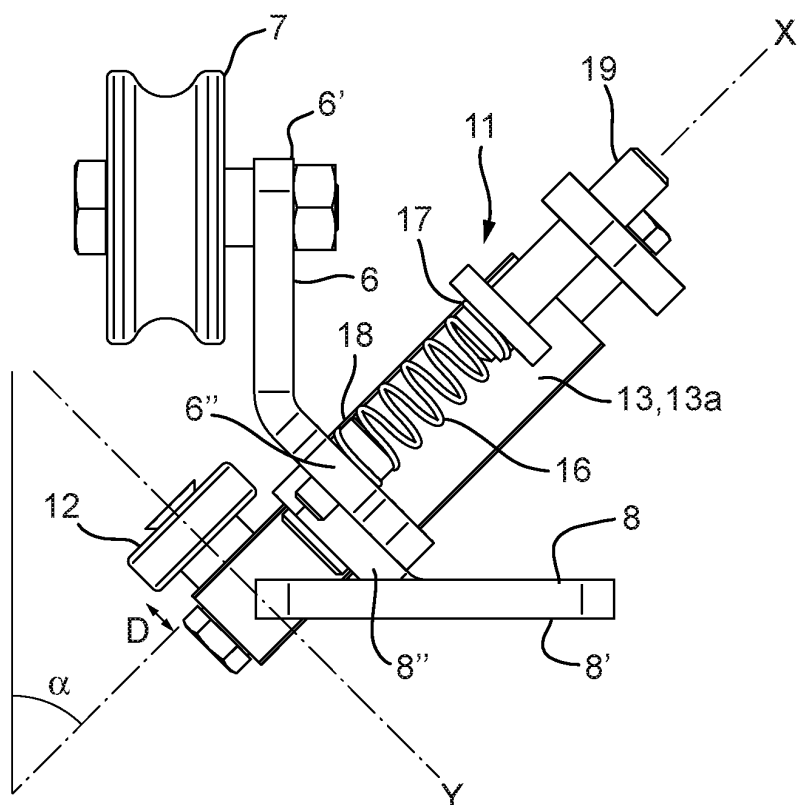


Fig. 3

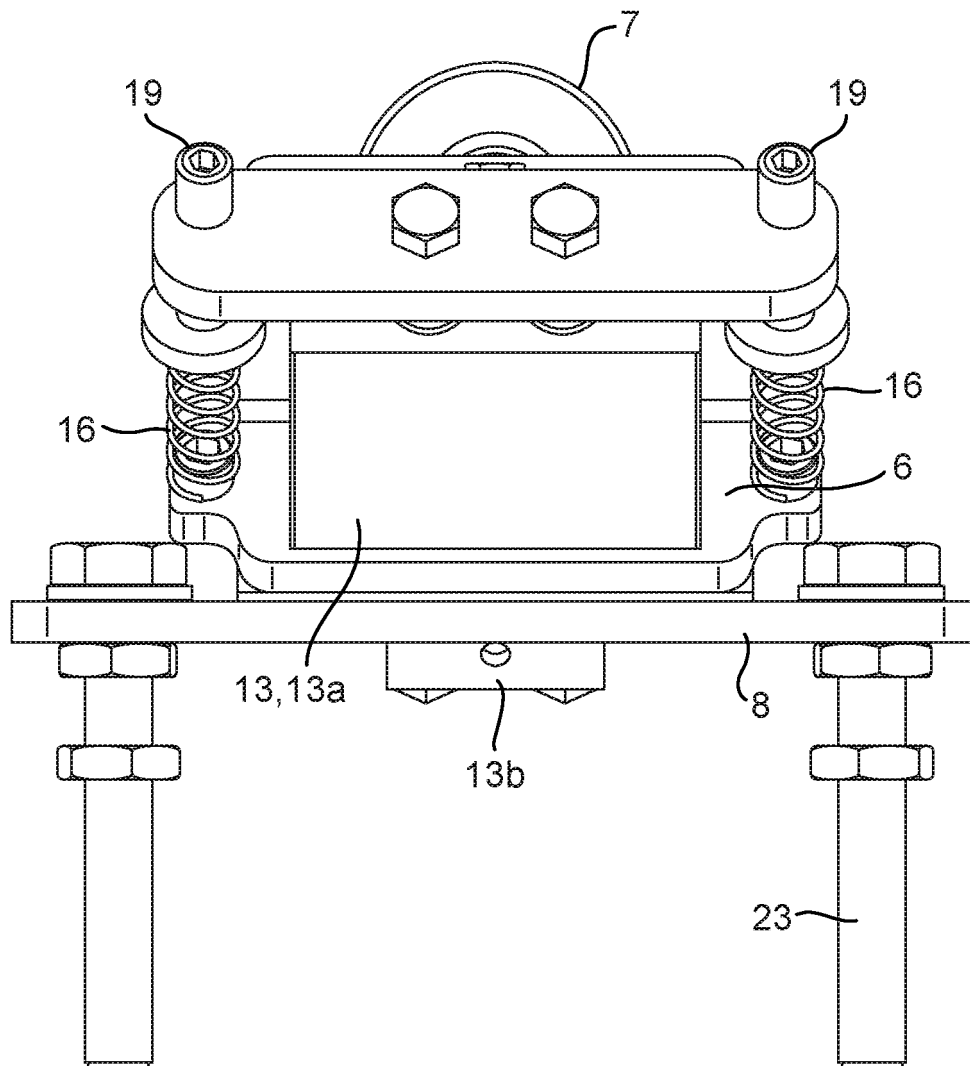


Fig. 4

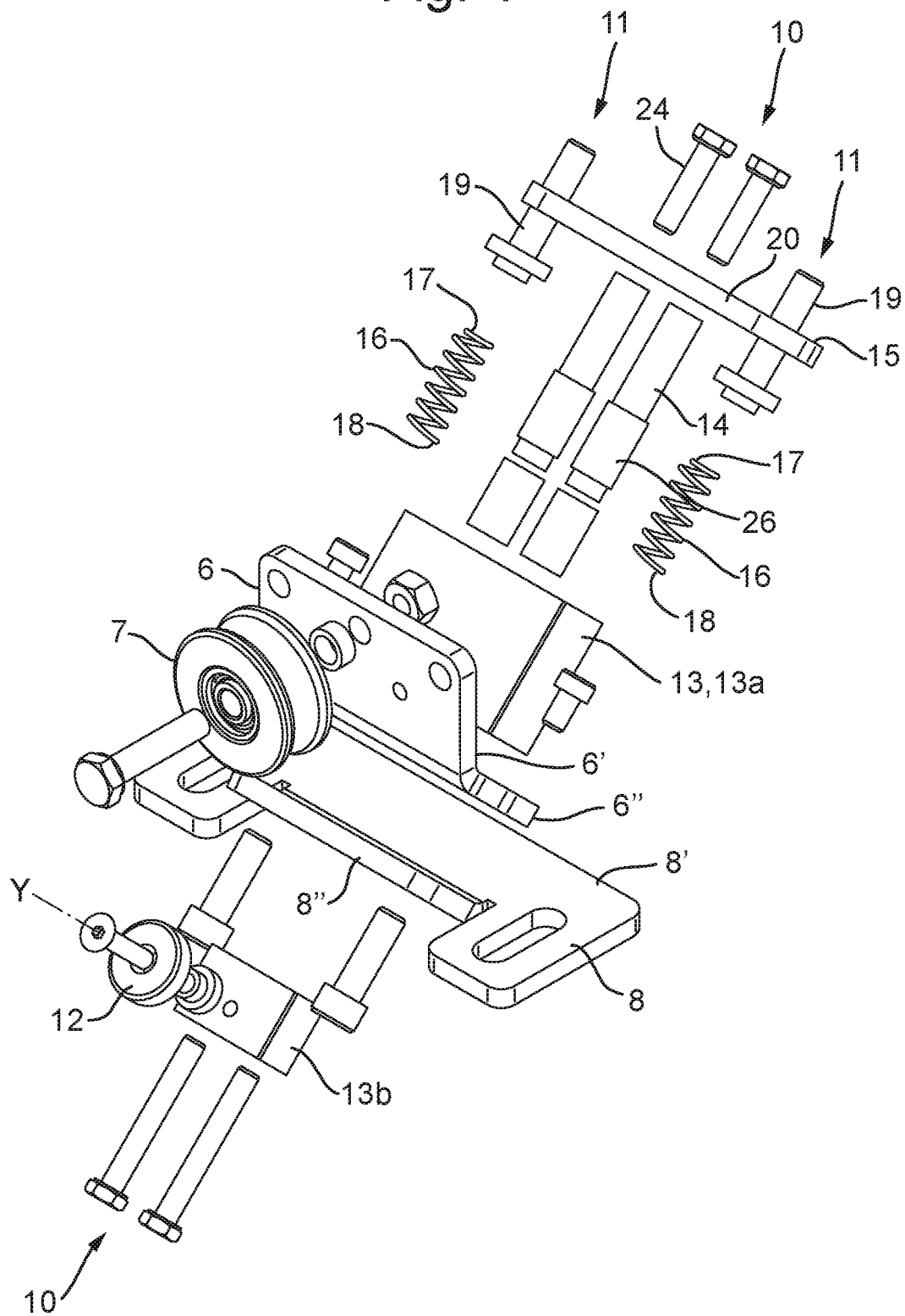


Fig. 5a

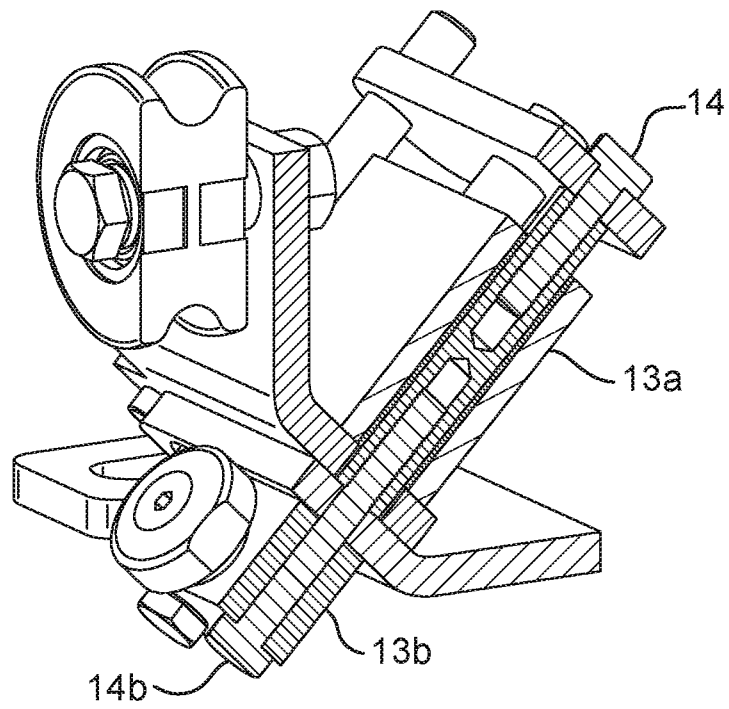


Fig. 5b

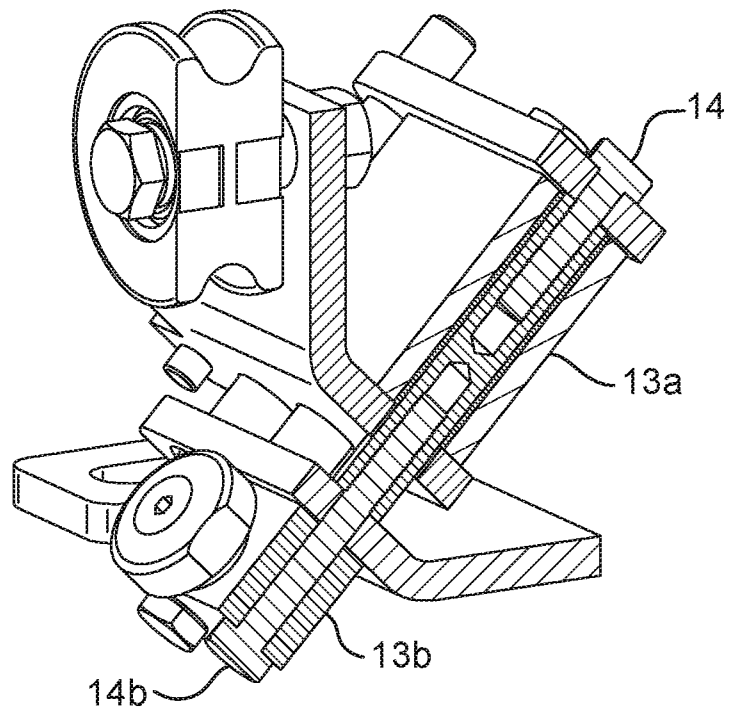


Fig. 6a

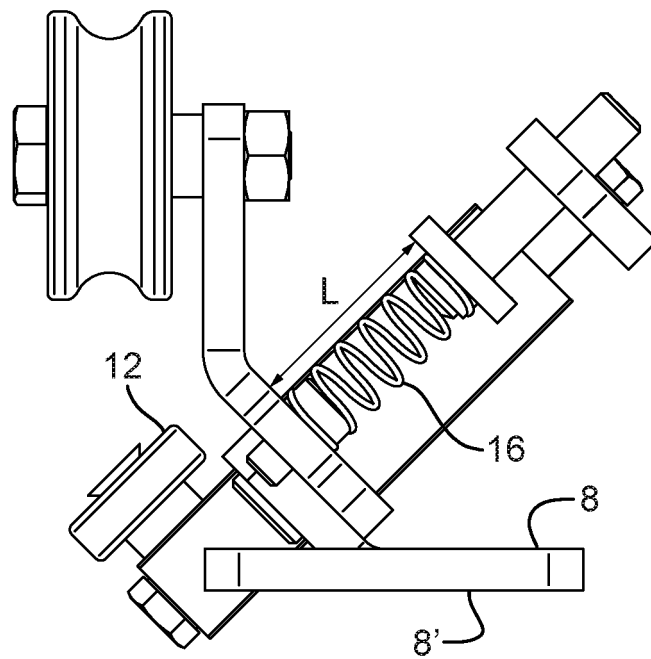


Fig. 6b

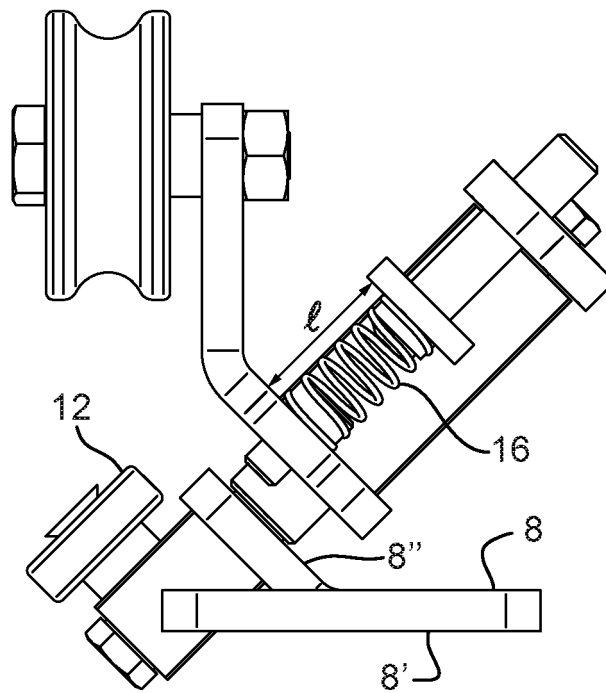


Fig. 7a

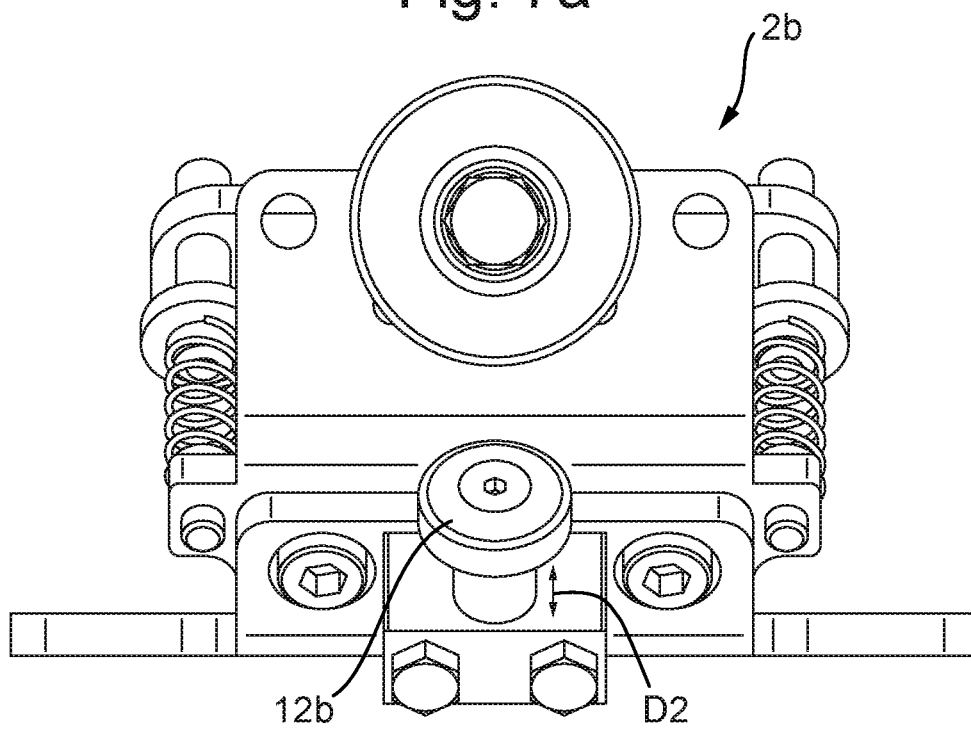


Fig. 7b

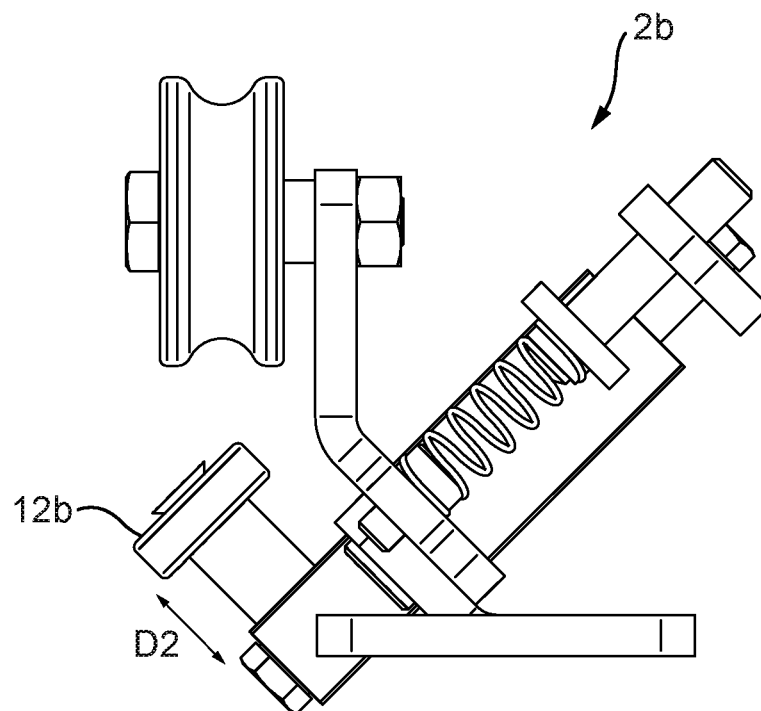


Fig. 8

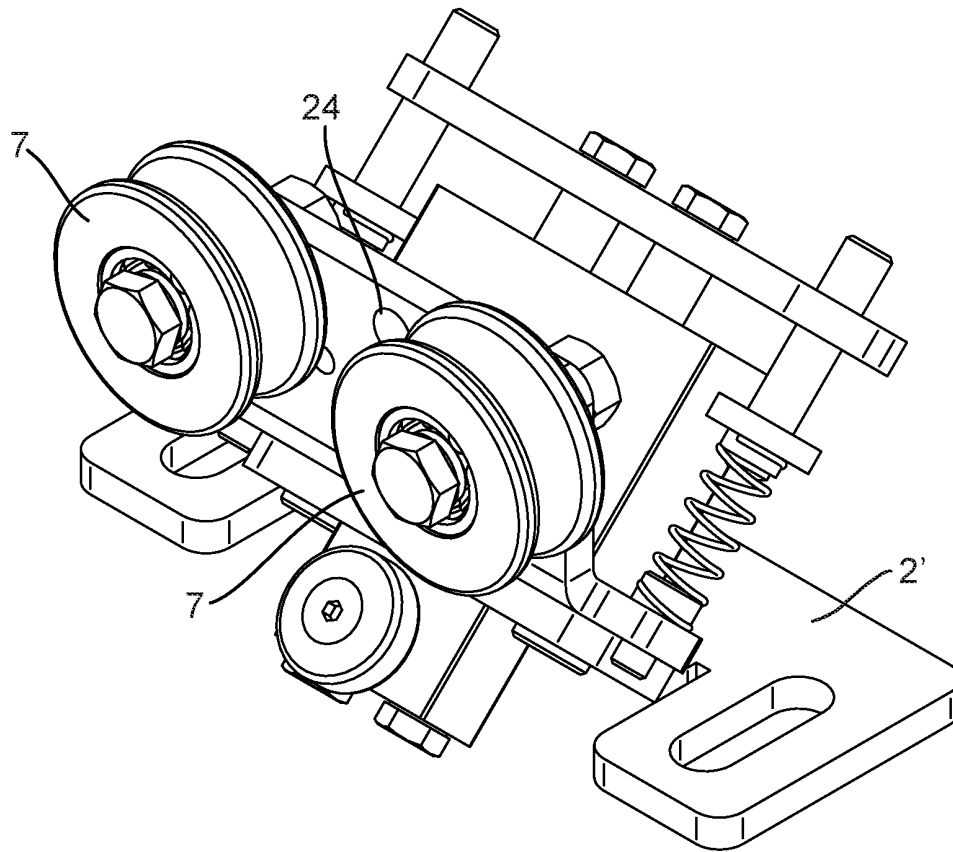


Fig. 9

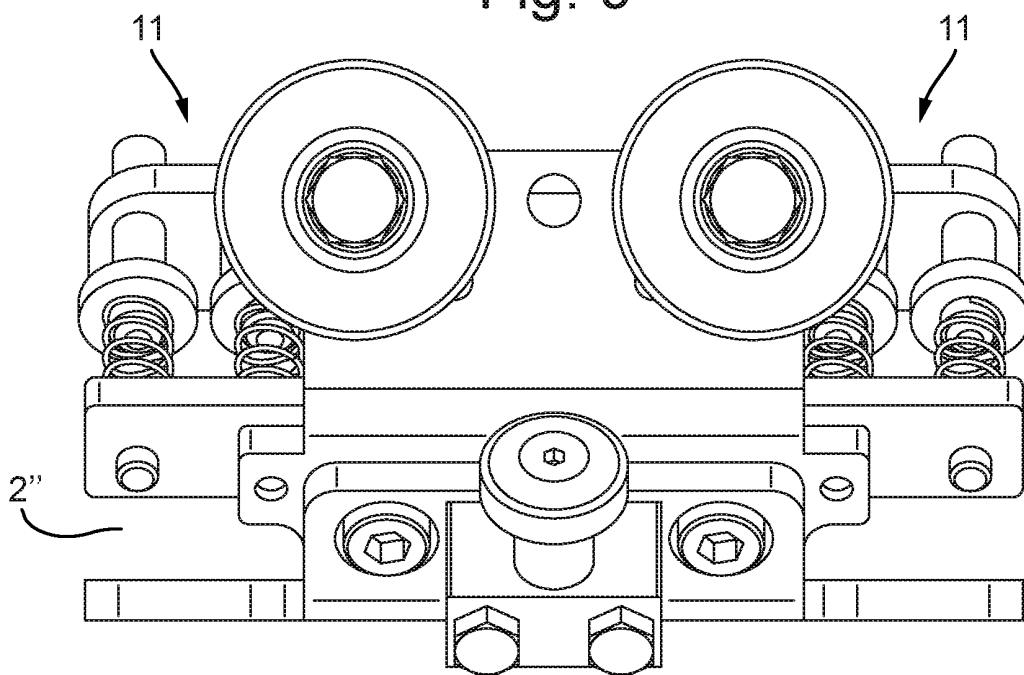


Fig. 10

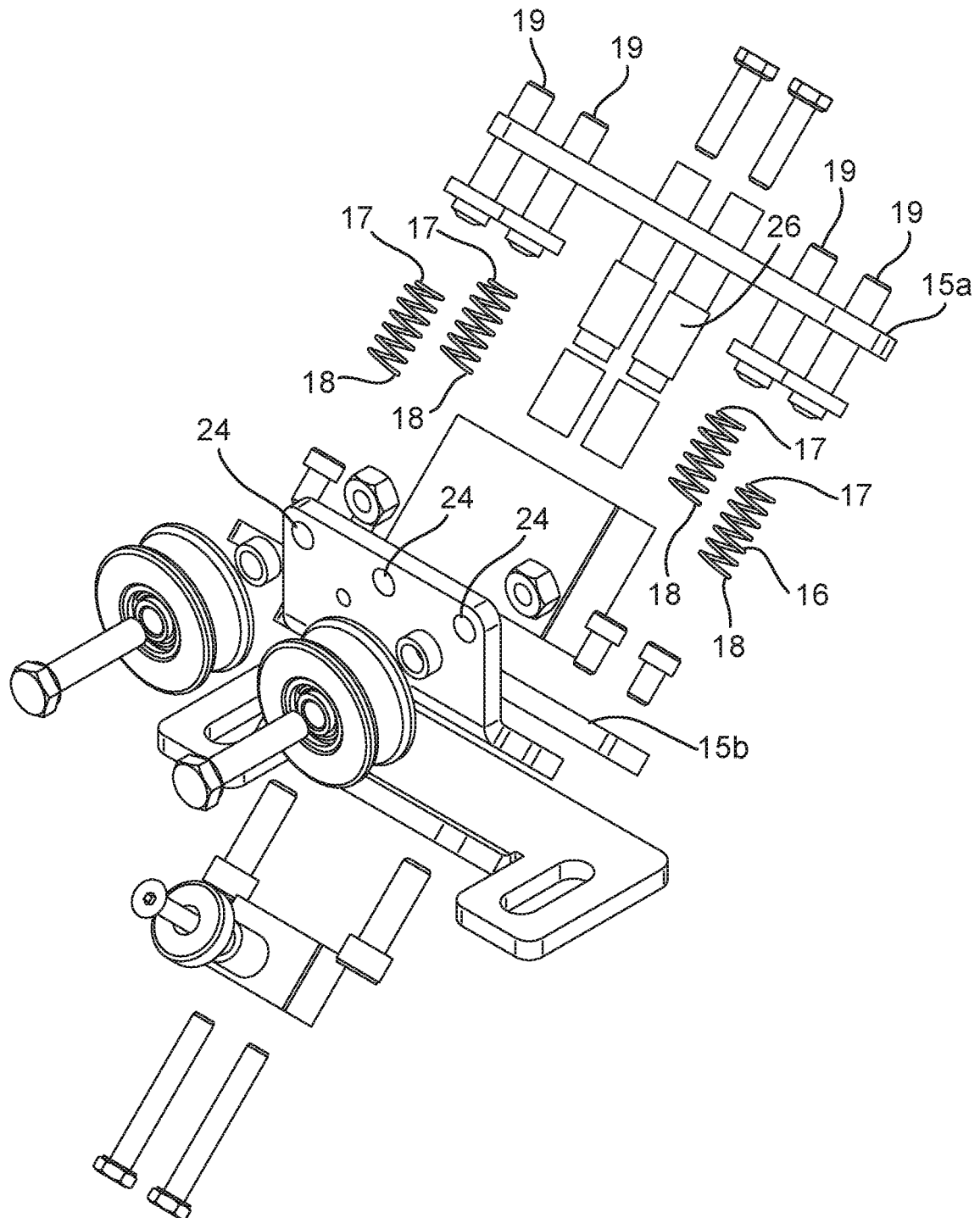


Fig. 11a

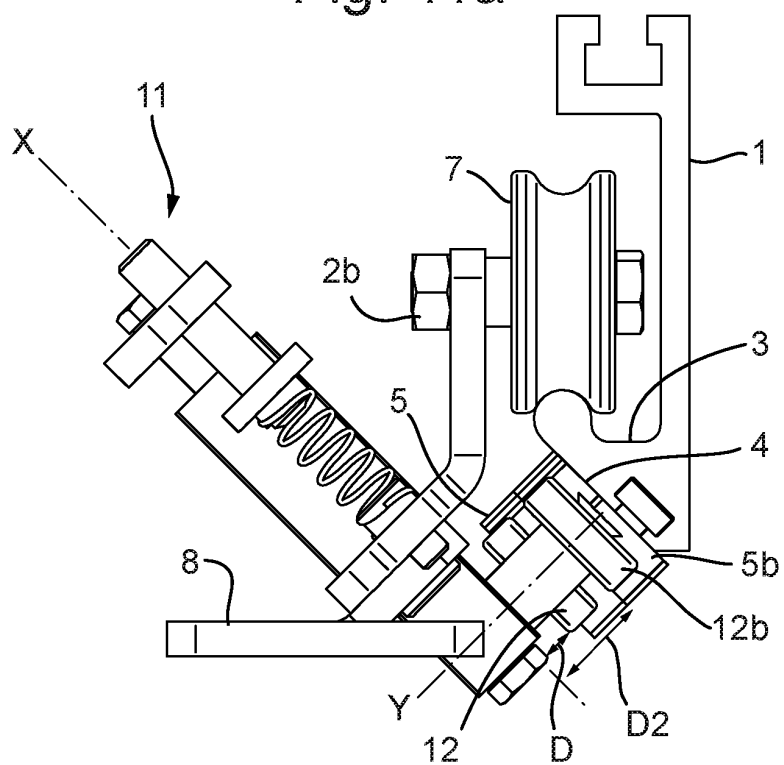


Fig. 11b

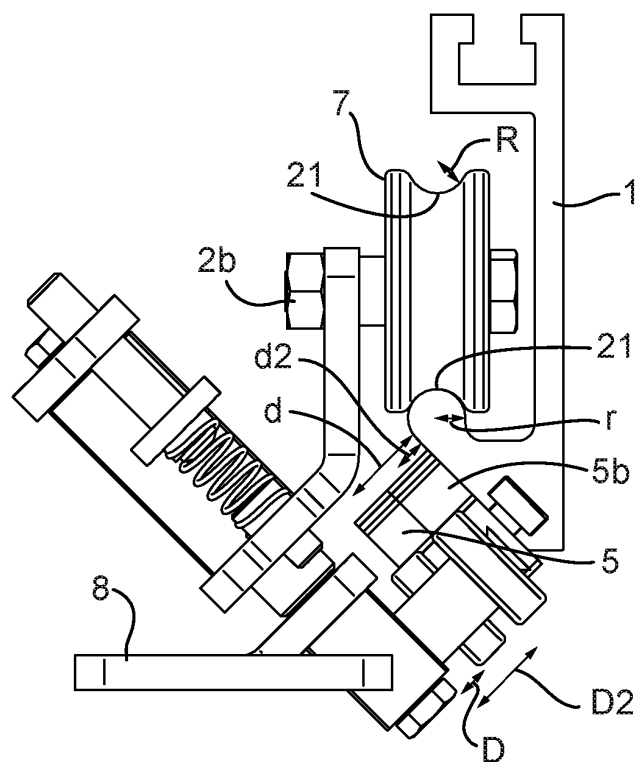


Fig. 12a

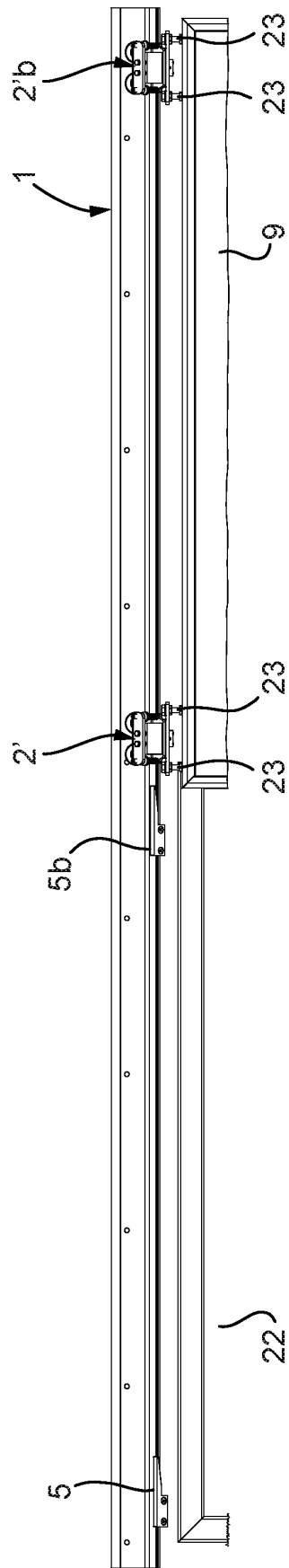


Fig. 12b

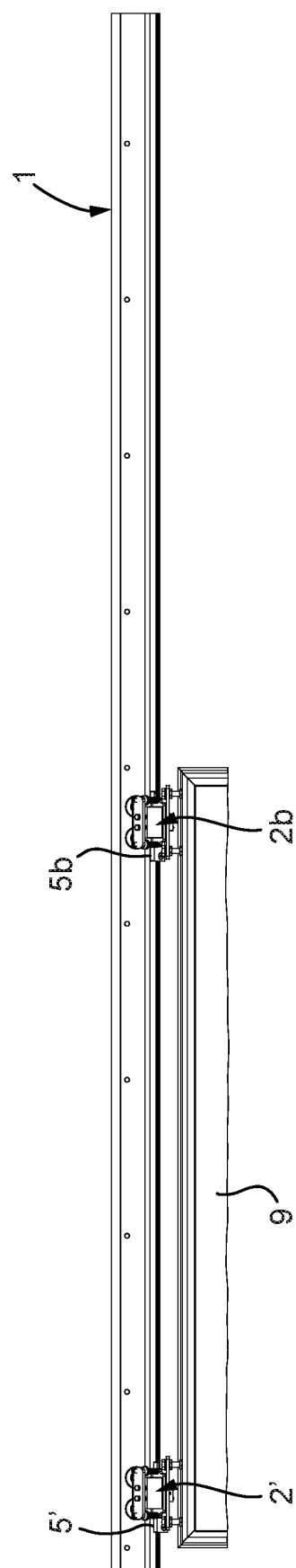


Fig. 13a

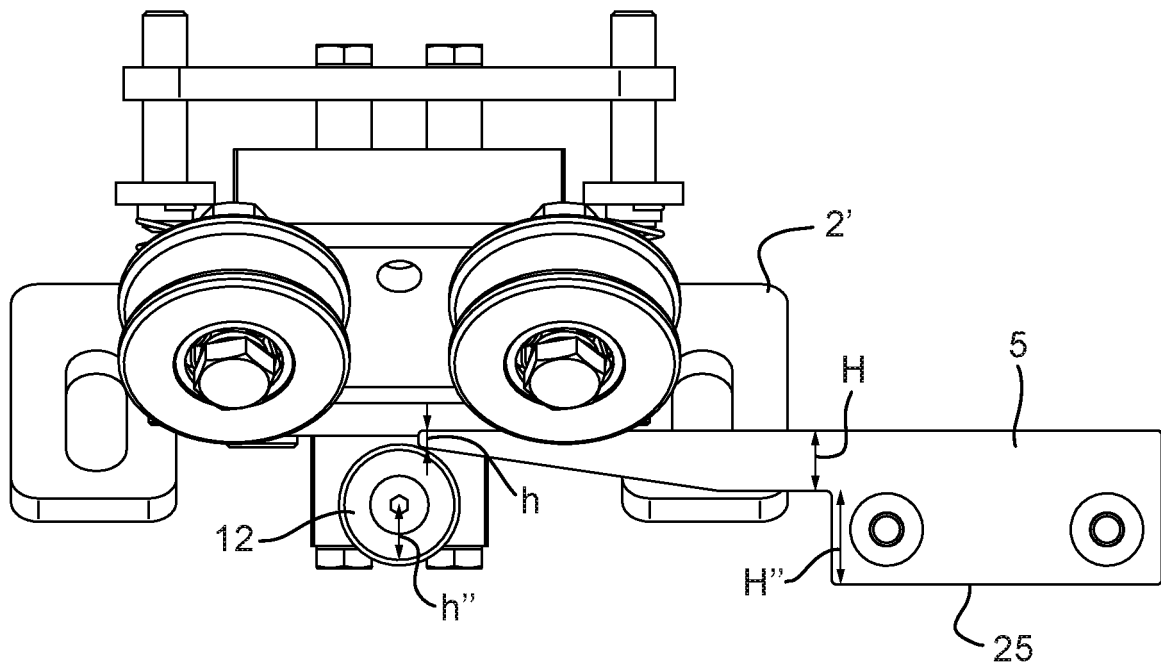
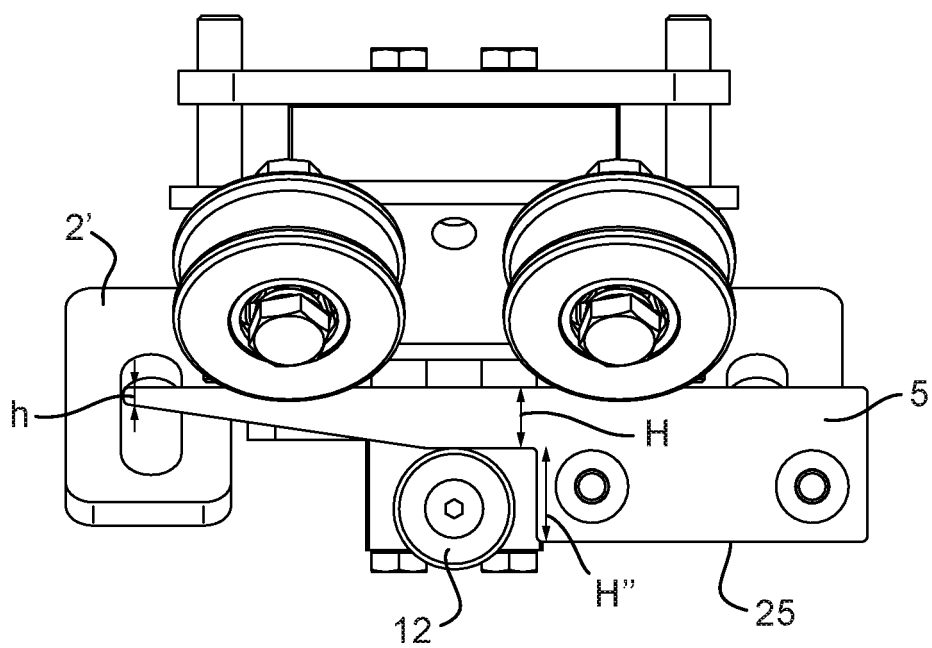


Fig. 13b



REFERENCES CITED IN THE DESCRIPTION

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