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(54) **GUIDING DEVICE FOR A SLIDING DOOR WING**

(57) A guiding device for a sliding door, comprises a chassis and rollers rotatable around axles mounted on supports fastened to the chassis. This is shaped from a single plate and comprises a fixing part (1), a vertical intermediate part (1a), first horizontal support (2), an arm (3), and second horizontal support (4). The fixing part (1) has at least two fixing holes (8) suitable to fix the chassis of the guiding device to the sliding door wing (17) with screws (10), bolts, pins, rivets, etc. First horizontal support (2) is protruding from the fixing part (1), and second horizontal support (4) is protruding from an arm (3) having vertically oriented cross-section and which is joined to the fixing part (1) through vertical intermediate part (1a) protruding from the fixing part (1). The arm (3) has a bow-shaped segment between vertical intermediate part (1a) and second horizontal support (4) to ensure resiliency of the arm (3). Both rollers (6, 7) are horizontal and are mounted on vertical axles (5) on, respectively, first horizontal support (2), and second horizontal support (4). The plate of the chassis is made of a material having Young's modulus ranging from 160 to 210 GPa, yield strength of 760-800 MPa, preferably 780 MPa for 0.2% elongation, and tensile strength of 1100-1300 MPa, preferably 1180 MPa. This plate can be made of low carbon steel comprising 17.0% of chromium, 6.7% of nickel, and 0.9% of manganese. The fixing part (1) can be fixed to the door wing (17) with use of C-shaped intermediate stiffening washer (16) protecting against delamination of the door wing plate. The guiding device can cooperate equally with upper and bottom guiding rails.

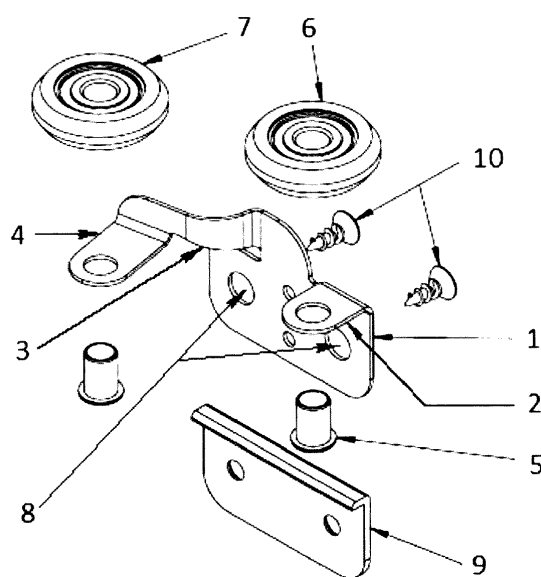


Fig. 2

Description

[0001] The present invention relates to a guiding device for a sliding door, to be placed on the top or bottom of the sliding door wing. The proposed device works with various sliding systems, and allows for smooth guiding and closing of the sliding door. It also serves to stabilize the sliding door wing movement along top or bottom guide rails. The proposed invention can be applied to regular sliding doors as well as to the wings in the pieces of furniture such as cabinets, wardrobes and the like.

[0002] Many inventions have been proposed related to sliding devices designed for the sliding door. Majority of these devices are mounted either externally to the door piece, or in a recess or a slot shaped in upper or lower edge, or a corner of the wing, preferably between the decorative linings.

[0003] Korean patent KR101867038 (B1) describes a bathroom cabinet including a smoothly moving sliding door. A protrusion part is formed on front surfaces of upper, lower, and side plates. Upper and lower guide grooves closely adhered to upper and lower roller devices are formed in the protrusion part of the upper and lower plates. A door insertion groove closely adhered to a side surface of the sliding door is formed in the protrusion part of the side plate. Upper roller device comprises an upper roller including an upper fixed part fixed to the upper part of the sliding door, and a vertical rotating part hinge-coupled to one end of the horizontal fixed part, provided with a spring and having a roller disposed on a top. Resiliency is obtained by making a rotatable joint combined with a spring. Both ends of the spring are fixed to the middle part of the horizontal and vertical rotating parts of the upper roller, respectively. The roller presses the wing downwards by an upper roller which is a guide roller. No horizontal adjustment of the wing relative to the guide rails is possible. A lower roller is fixed to the lower part of the sliding door.

[0004] The invention presented in Japanese patent document JP2017086417 (A) relates to a partition storage unit having a sliding door. A guide roller provided at the tip of an arm member on a short length side is slidably engaged with a rail provided on a front side, while a guide roller provided at the tip of an arm member on a long length side is slidably engaged with a rail member provided on a back side. The bottom roller of the storage unit presses it together with the upper guiding rails upwards, while the upper rollers of the wing only guide the wing in these rails. They provide adjustment only in vertical direction along rotation axis of the guiding rollers. The wing upper rollers are hanged at the bottom sides of rigid brackets mounted to the sliding door which is supported on rollers mounted rigidly at the door wing bottom edge.

[0005] Korean patent document KR20160135545 (A) describes a sliding door frame structure for a built-in wardrobe. A rail recess frame which forms a horizontal facing unit touching the upper panel is installed in an

upper panel of the wardrobe. A plurality of vertical guide units are formed directly under the horizontal facing unit to form a rail recess. Horizontal rollers installed in an upper part of a sliding door via an upper frame are inserted into the rail recesses. Vertical rollers carrying the door wing weight are installed at a lower part of the sliding door via a lower frame and are seated in the protruding rails. The bottom rollers of the wing are mounted to the bent brackets mounted rigidly at the door wing bottom edge. Nothing is mentioned whether the brackets are elastic, so it is supposed they are rigid to ensure necessary stiffness of the device. The brackets are bent rather to hide the bottom rails below the wardrobe front plane.

[0006] Another Korean patent document KR20030045977 (A) discloses a sliding roller structure for cabinet door that comprises a vertical upper roller mounted on an upper end of an inside of a cabinet door, a horizontal bottom roller mounted on a bottom end, an upper guide rail into which the upper roller is inserted to be driven along, wherein the upper guide rail is provided on the upper portion of a main body of a cabinet, and a bottom guide rail into which the bottom roller is inserted to be driven along. The bottom guide rail is provided on the bottom portion of the main body of the cabinet, so that the cabinet door is opened and closed in sliding manner. This invention is similar to that of KR20160135545 (A): the upper and bottom rollers of the wings are mounted to the bent brackets mounted rigidly at the door wings' upper/bottom edges. Again, nothing is mentioned whether the brackets are elastic, so it is supposed they are rigid. The bent brackets hide the bottom rails behind the cabinet front plane.

[0007] Still another Korean patent document KR101654926 (A) discloses a roller rotating device for a sliding door that includes: the guide rails mounted on the upper and bottom surfaces of a furniture main body having a storage space, a sliding door, and a door fixing brackets installed on the upper and lower sides of the sliding door. The roller device further includes: a fixing member fixed to one side of the door fixing bracket, and a rotating member having a roller moving along the guide rail. The upper rollers carry entire weight of the sliding door wing. Elasticity of the mounting secured by the use of two screw springs is only for enabling slight turning of the bracket around vertical axis to prevent its deadlock in the guide turns.

[0008] Japanese invention JP2004100400 (A) provides a sliding door device for a storage fitting such as a sideboard, a book-shelf, or a showcase, which has a guide wheel arranged on the upper portion of the storage fitting and carries out opening/closing movement on a guide rail arranged on the upper portion of a sliding door. The sliding door is prevented from derailing during the opening/closing movement even if a slight manufacturing defect exists in the sliding door or in a fitting body. The sliding door device is formed of the sliding door, a lower bearing member constituting a sliding door frame, a lower guide body composed of a guide, a retaining roll, and a

retaining portion, and a lower guide rail. The guide is detachably mounted on the lower bearing member, and provided with a lower guide wheel which is rotatable on an almost horizontal plane. The retaining roll is mounted on the lower bearing member together with the guide, for rotating on a vertical plane. The retaining portion sets the height of the retaining roll as appropriate. The lower guide rail has an almost gate-shaped cross section, into which the lower guide wheel and the retaining roll are loosely fitted. The height of the roll with respect to the lower guide rail is adjustable by the retaining portion of the lower guide body. Horizontal roller in lower bracket retains position of the sliding wing in horizontal direction, but the bracket is not prone to bending.

[0009] Other Japanese patent document JP2006194027 (A) discloses an upper guide structure of a sliding door, which enables it to move smoothly, even if the mounting height of an upper rail is somewhat uneven. The upper rail has a downward opened lip-channel shape. A runner member comprises: a case part which is attached to a door board, an adjuster part which is ascendably/descendably housed in the case part, and a rail engaging part which is attached above the adjuster part and horizontally turned. The rail engaging part is urged in one direction of rotation via a spring, and a pair of guide rollers, the diameter of which is smaller in dimension than an interval between both lip parts of the upper rail, is attached in almost equidistant positions to sandwich a rotating shaft in between. A recessed groove, which is formed in the peripheral surface of each of the guide rollers, is engaged with the edge of the lip part, so that the rail engaging part can be guided. The runner mechanism consists of two main parts, the upper one i.e. the rail engaging part having two horizontal rollers rotatable around vertical axis having a spring.

[0010] British patent document GB2338018 (A) proposes a wheeled top-guide for rolling movement of a door along a track having a first roller on a first axle in rolling engagement with one wall of a track, and a vertically oriented torsion member connected via a horizontal arm to a second axle and second roller. When the guide is inserted into a track a torque is induced in the torsion rod, said torque maintaining said rollers in firm rolling contact with both side walls of said track. One of these two horizontal rollers is mounted on a rotatable arm with a spring which is external to the roller.

[0011] A problem similar to that resolved in the latter of the above-mentioned documents was challenged in European patent application EP2913467 (A1). According to the invention described therein a sliding door upper runner comprises an angle plate, with two horizontal rollers mounted on horizontal part of this plate. In top view, the contour of the outer circumference of both rollers extends beyond the plate. The rotation axis of one of the rollers is fixed on a tilting arm which is hinged on horizontal part of the plate. The tilting arm is tensioned by a spring mounted on rotation axis of the roller, and comprises a limiter of the arm tilt. The other roller is rotatable

around its own axis fixed to horizontal part of the plate. Each horizontal roller is engaged with one of two opposite vertical walls of the U-shaped guide rail.

[0012] A technical problem of ensuring smooth guiding of the sliding door in the rails has been solved by the above discussed inventions, however the proposed devices are mechanically complex. If the known device is able to adjust its configuration during the wing movement along the rail, this is achieved by combining inflexible elements such as the device body or a tilting arm with flexible parts such as springs.

[0013] New technical problem of reducing complexity of the runner device and improving its durability has been resolved by the proposed invention. While in the known runner devices resiliency was obtained by the usage of additional parts like springs fabricated from material of significantly different properties when compared to the materials used for manufacturing of rigid parts, in the here proposed invention, contrary to the direction followed by earlier solutions, the material used for making rigid and flexible elements is the same. Flexibility has been obtained by accurate combination of the elastic part shape with the material properties. The choice was made to secure both sufficient stiffness of the device body, and sufficient elasticity of the elastic arm protruding from the body of the runner device.

[0014] According to the invention, a guiding device for a sliding door comprises a chassis and rollers rotatable around axles mounted on supports fastened to the chassis. The chassis is shaped from a single, metallic or plastic, or composite plate, and comprises a fixing part suitable to be fixed to the door wing, a vertical intermediate part, first horizontal support of first roller axle, an arm, and second horizontal support of second roller axle. The fixing part has at least two fixing holes for screws, bolts, pins, or rivets that immobilize the device on the door wing. First horizontal support is protruding from the fixing part, while second horizontal support is protruding from the arm having vertically oriented cross-section. This means that the part of the plate the arm is shaped from is vertical and perpendicular to second horizontal support. The arm is joined to the fixing part of the plate through vertical intermediate part protruding from the fixing part. The arm has a bow-shaped segment between vertical intermediate part and second horizontal support. This segment ensures resiliency of the arm. First roller is horizontal and is mounted on vertical axle assembled on first horizontal support. Second roller is also horizontal and is assembled on vertical axle that projects from second horizontal support.

[0015] In one embodiment illustrated on the drawings the fixing part is rectangular with rounded edges. It can be shaped in any convenient form, e.g. semicircle, triangle, trapezium, etc. Sharp edges are rounded to prevent injury of the user. The fixing holes shaped in the fixing part of the plate are suitable to install the chassis of the guiding device on the sliding door wing with the use of screws, bolts, pins, or rivets.

[0016] There are two main types of the proposed guiding device. In one type the chassis is fixed to vertical side of the door wing, and therefore the plane of the fixing part is vertical. In the other type of the device the chassis is installed on the top, relatively narrow horizontal surface of the sliding door wing. In this case the plane of the fixing part is horizontal.

[0017] Physical properties of the materials used have been carefully selected. The plate of the chassis is made of a material, be it metal, plastic or composite, having Young's modulus ranging from 160 to 210 GPa, yield strength of 760-800 MPa, preferably 780 MPa for 0.2% elongation, and tensile strength of 1100-1300 MPa, preferably 1180 MPa. In case of composite, a layered structure is recommended, e.g. a metal sheet having both sides covered with plastic layers.

[0018] If metallic material is selected for fabrication of the plate of the chassis, low carbon steel comprising 17.0% of chromium, 6.7% of nickel, and 0.9% of manganese is advised. This low carbon steel may further comprise 0.6% of silica, 0.2% of copper, 0.1% of molybdenum, and 0.1% of carbon.

[0019] The guide rail may be shaped with a plurality of vertical walls. Most common rail is U-shaped to receive one or more guiding devices of one sliding door wing. If two wings are expected to move along the same rail, a double-U-shaped (or W-shaped) guide rail is a common choice. The rail can have even more tracks and be triple-U-shaped and so on.

[0020] The guiding device guides the door wing along the rail and secures its smooth motion provided that the horizontal rollers cooperate with opposite tracks of a U-shaped guide rail. This means that when the guide rail is mounted e.g. in a wardrobe, both rollers are assembled inside the rail, and one roller moves along internal guide wall i.e. the one closer to the inside of the wardrobe, while the other roller moves along external wall of the guide rail, i.e. the one closer to the outside.

[0021] In the above described embodiment, a U-shaped rail or U-shaped segment of the multiple-U-shaped rail is used to guide one sliding door wing. In another embodiment proposed here two parallel door wings can be guided along one U-shaped rail. In this case one guiding device fixed to one wing cooperates with both sides of one wall of the rail, and the other guiding device fixed to the other wing - with both sides of second wall of the U-shaped rail. This means that horizontal rollers of one device cooperate with opposite sides of the wall of U-shaped rail so that this wall is located between the rollers being a track for both. The guide rail can be multiple-U-shaped and then the horizontal rollers of each device guiding one door wing cooperate with opposite sides of the same vertical wall of the U-shaped segment. For example, three sliding door wings can be guided along a W-shaped rail.

[0022] In case of the guiding device mounted on the top horizontal surface of the door wing the fixing part is fixed to the door wing with use of C-shaped intermediate

stiffening washer protecting against delamination of the door wing plate.

[0023] The guiding device in one embodiment is adapted to cooperate with top guide rail, while in another embodiment it is adapted to cooperate with bottom guide rail. The difference is in that in the former case the rollers, their axles and supports, as well as the arm and intermediate part are positioned above both the fixing part and the top surface of the door wing, whereas in the latter case they are positioned below the fixing part and the bottom surface of the door wing.

[0024] Preferred embodiments of invented guiding device are shown on the drawings, where:

Fig. 1 shows top perspective view of the guiding device fixable to the top side of the door wing;

Fig. 2 shows exploded top perspective view of the device;

Fig. 3 shows top view of the device where two horizontal rollers cooperate with opposite tracks of the guide rail;

Fig. 4 shows top view of the device where horizontal rollers cooperate with opposite sides of the same track of the guide rail;

Fig. 5 shows side view of the device;

Fig. 6 shows top perspective view of the chassis of the device fixable to the top side of the door wing;

Fig. 7 shows bottom perspective view of the chassis of the device fixable to the bottom side of the door wing;

Fig. 8 shows top perspective view of the chassis of the device fixable to the top edge of the door wing;

Fig. 9 shows bottom perspective view of a section of complete sliding door system with two guiding devices placed in a double-U rail;

Fig. 10 shows top perspective view of a section of two frames of the sliding door wings with two guiding devices; and

Fig. 11 shows top perspective view of the guiding devices a) side-fixable, b) top-fixable, and c) top-fixable but with use of C-shaped intermediate stiffening washer.

[0025] According to preferred embodiment of claimed invention, the guiding device for a sliding door, comprises a chassis and rollers rotatable around axles mounted on supports fastened to the chassis. The chassis is shaped from a single steel plate and comprises a rectangular

fixing part 1, a vertical intermediate part 1a that protrudes from the fixing part 1, first horizontal support 2, an arm 3, and second horizontal support 4. The fixing part 1 has at least two fixing holes 8 suitable to fix the chassis of the guiding device to the sliding door wing 17 with screws 10, or bolts, or pins, or rivets. All edges of the plate are rounded.

[0026] First horizontal support 2 is protruding from the fixing part 1, and second horizontal support 4 is protruding from an arm 3 having vertically oriented cross-section and which is joined to the fixing part 1 through vertical intermediate part 1a protruding from the fixing part 1. The arm 3 has a bow-shaped segment between vertical intermediate part 1a and second horizontal support 4 to ensure resiliency of the arm 3. First roller 6 is horizontal and is mounted on vertical axle 5 on first horizontal support 2, and second roller 7 is horizontal as well, and is mounted on vertical axle 5 on second horizontal support 4.

[0027] In one version of the guiding device the plane of the fixing part 1 is vertical, while in another version this plane is horizontal.

[0028] The plate of the chassis is made of low carbon steel having Young's modulus of 180-200 GPa, yield strength of 780 MPa for 0.2% elongation, and tensile strength of 1180 MPa. The steel used comprises 17.0% of chromium, 6.7% of nickel, 0.9% of manganese, 0.6% of silica, 0.2% of copper, 0.1% of molybdenum, and 0.1% of carbon. All percentage values include a tolerance of +/- 1%.

[0029] In one embodiment of the guiding device the horizontal rollers 6 and 7 cooperate with opposite tracks 18 of a U-shaped guide rail. In another embodiment the horizontal rollers 6 and 7 cooperate with opposite tracks 18 of a U-shaped segment of a multiple-U-shaped guide rail 11. Still in another embodiment the horizontal rollers 6 and 7 cooperate with opposite sides of the same track 18 of the guide rail.

[0030] If the board of the door wing 17 is prone to delamination it is advised to fix the guiding device with use of C-shaped intermediate stiffening washer 16. It can be used with horizontal fixing part 1 which is screwed to the board at its top surface. In this case the washer counteracts tearing forces leading to delamination of the door wing plate and keeps the board edges in place. When used with vertical fixing part 1 which is screwed to vertical surface of the board the C-shaped intermediate stiffening washer 16 must have one wall enlarged to fit the fixing part 1 and to be screwed together. Also, both side walls of C-shaped intermediate stiffening washer 16 can be enlarged which is advised in case of the door wings made of mineral or organic glass, ceramics, and the like fragile materials.

[0031] The preferred embodiment of the guiding device cooperates with top guide rail, but it can be easily adapted to cooperate with bottom guide rail. In most arrangements it is sufficient to turn both the rail and the guiding device upside down, because the guiding device

does not bear the door wing weight.

[0032] A complete system may further comprise masking strips 12, 13, 14 and 15 that cover the rails and the door board edges. These strips can be shaped as grips of the door wings.

Claims

1. A guiding device for a sliding door, comprising a chassis and rollers rotatable around axles mounted on supports fastened to the chassis, **characterized in that** the chassis is shaped from a single plate and comprises a fixing part (1), a vertical intermediate part (1a), first horizontal support (2), an arm (3), and second horizontal support (4), wherein the fixing part (1) has at least two fixing holes (8), and first horizontal support (2) is protruding from the fixing part (1), and second horizontal support (4) is protruding from an arm (3) having vertically oriented cross-section and which is joined to the fixing part (1) through vertical intermediate part (1a) protruding from the fixing part (1), and wherein the arm (3) has a bow-shaped segment between vertical intermediate part (1a) and second horizontal support (4) to ensure resiliency of the arm (3), and **in that** first roller (6) is horizontal and is mounted on vertical axle (5) on first horizontal support (2), and second roller (7) is horizontal and is mounted on vertical axle (5) on second horizontal support (4).
2. A guiding device according to claim 1, **characterized in that** the fixing part (1) is rectangular with rounded edges.
3. A guiding device according to claim 1 or 2, **characterized in that** the fixing holes (8) are suitable to fix the chassis of the guiding device to the sliding door wing (17) with screws (10), or bolts, or pins, or rivets.
4. A guiding device according to any of claims 1 to 3, **characterized in that** the plane of the fixing part (1) is vertical.
5. A guiding device according to any of claims 1 to 3, **characterized in that** the plane of the fixing part (1) is horizontal.
6. A guiding device according to any of claims 1 to 5, **characterized in that** the plate of the chassis is made of a material having Young's modulus ranging from 160 to 210 GPa, yield strength of 760-800 MPa, preferably 780 MPa for 0.2% elongation, and tensile strength of 1100-1300 MPa, preferably 1180 MPa.
7. A guiding device according to any of claims 1 to 6, **characterized in that** the plate of the chassis is made of low carbon steel comprising 17.0% of chro-

mium, 6.7% of nickel, and 0.9% of manganese.

8. A guiding device according to claim 7, **characterized in that** the plate of the chassis is made of low carbon steel further comprising 0.6% of silica, 0.2% of copper, 0.1% of molybdenum, and 0.1% of carbon. 5
9. A guiding device according to any of claims 1 to 8, **characterized in that** the horizontal rollers (6, 7) cooperate with opposite tracks (18) of a U-shaped guide rail. 10
10. A guiding device according to any of claims 1 to 8, **characterized in that** the horizontal rollers (6, 7) cooperate with opposite tracks (18) of a U-shaped segment of a multiple-U-shaped guide rail (11). 15
11. A guiding device according to any of claims 1 to 8, **characterized in that** the horizontal rollers (6, 7) cooperate with opposite sides of the same track (18) of the guide rail. 20
12. A guiding device according to any of claims 1 to 11, **characterized in that** the fixing part (1) is fixed to the door wing (17) with use of C-shaped intermediate stiffening washer (16) protecting against delamination of the door wing plate. 25
13. A guiding device according to any of claims 1 to 12, **characterized in that** it is adapted to cooperate with top guide rail. 30
14. A guiding device according to any of claims 1 to 12, **characterized in that** it is adapted to cooperate with bottom guide rail. 35

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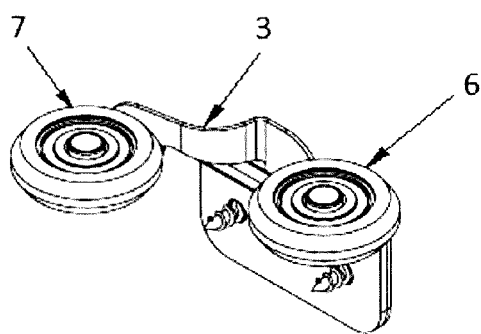


Fig. 1

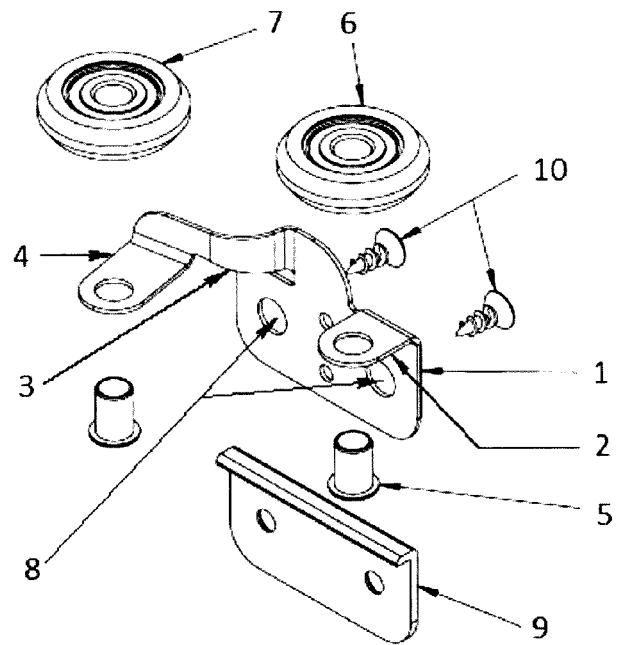


Fig. 2

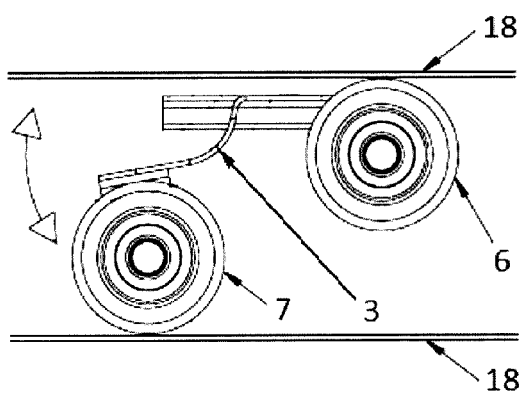


Fig. 3

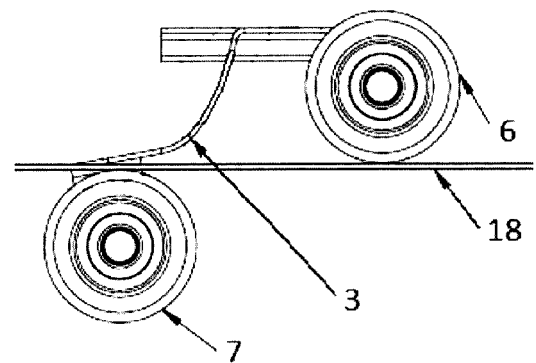


Fig. 4

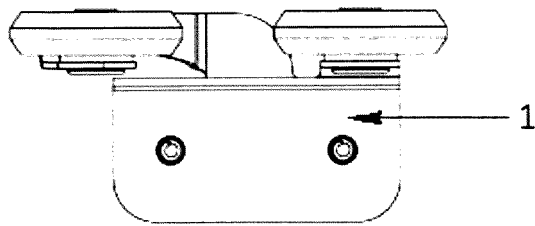


Fig. 5

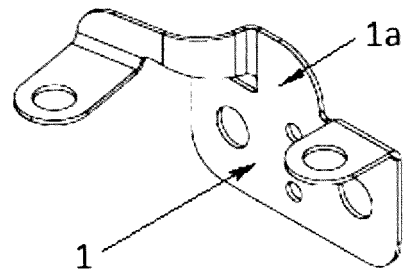


Fig. 6

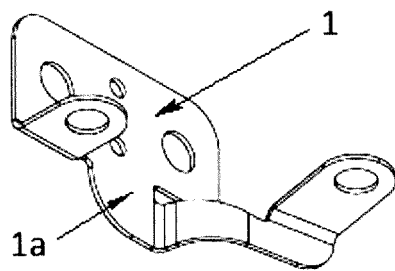


Fig. 7

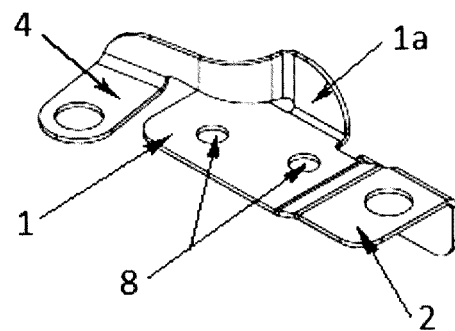


Fig. 8

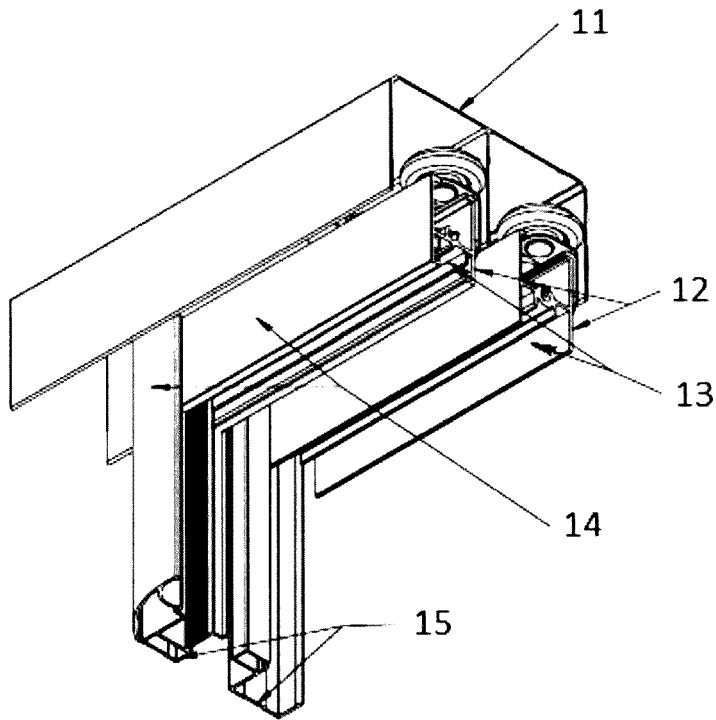


Fig. 9

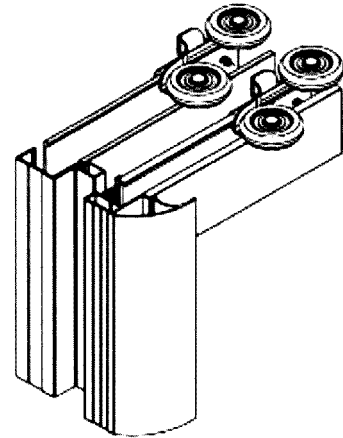


Fig. 10

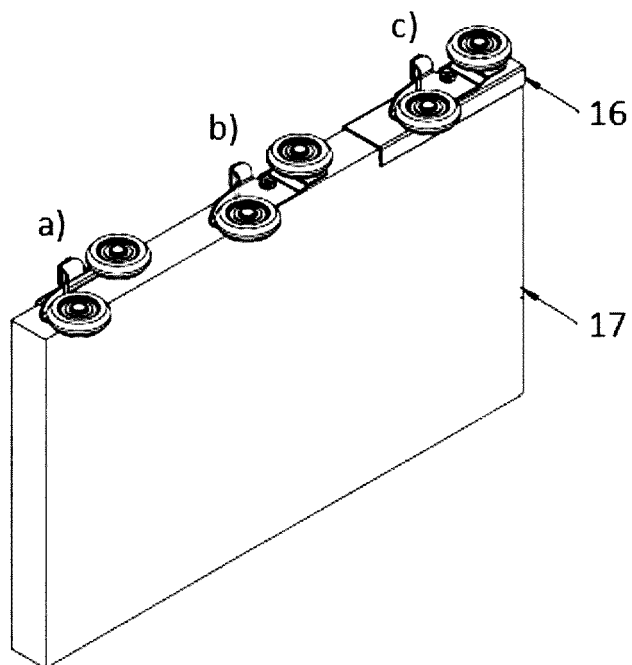


Fig. 11



EUROPEAN SEARCH REPORT

Application Number
EP 19 46 0065

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			E05D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 12 May 2020	Examiner Klemke, Beate
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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