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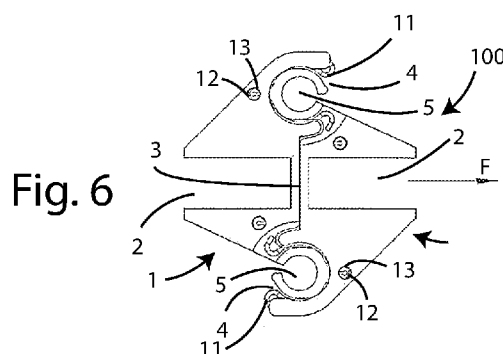
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(54) Title: HINGE FOR FOLDABLE WALL BY PACKING EMPLOYING SAID HINGE



(57) Abstract: Described is a hinge (100), in particular for folding walls by packing comprising a plurality of panels, and sliding along guides, said hinge comprising a first part (1) and a second part (1'), substantially equal to each other, and which can be mirror coupled, each one of said first and second parts (1) having a first base portion and a second portion opposite the first, on the second portion being provided a groove (2) for receiving an edge of one of said panels, on the base portion being provided a central substantially plane portion (3), and on the two sides, respectively, a concave vertical seat (4), and a convex vertical seat (5) having a shape permitting its coupling with the respective concave seat (4) of the other respective part of the hinge (100), said concave (4) and convex (5) seats having radii such to permit a mutual coupling with each other during movement of the respective parts (1), and such as to permit disengagement of the two parts (1) at the predetermined neutral position (0°) and the blocking of the disengagement during the rotation movement of the two parts (1) with a total rotation of up to up to 360°, said hinge (100) providing a seat for a pin which provides for the mounting of coupling accessories with said guides of said wall. The invention also relates to a wall (200; 300) comprising a plurality of wall or door elements (201; 301) coupled by hinge (100).



HINGE FOR FOLDABLE WALL BY PACKING EMPLOYING SAID HINGE

5 This invention relates to an improved hinge to be used on walls, in particular on glass panels, which are foldable by packing.

The invention also relates to a foldable wall by packing employing said hinge.

10 The following description of the hinge according to the invention will be aimed in particular to the application on glass panels foldable by packing, but it shall be understood that the hinge according to the invention can be applied to any other type of wall or dividing element made by means of one or more panels which can be opened by "packing" and can be closed as desired.

15 As it is known, use has been made for many years for closing spaces such as terraces, balconies, patios, etc. of structures made of glass or plastic material which can be opened by packing and which can be closed as desired on the basis of the specific needs, even partially.

20 This type of solution allows, without increasing the residential volume, the usability of an open environment to be improved, closing it as necessary, thus allowing a protection against adverse weather conditions and noise pollution. An improvement in the passive security and the appearance is also obtained.

25 It is also known how, currently, the glass panels foldable by packing mainly consist of panels made of glass or plastic material which can be moved longitudinally along lower and/or upper sliding guides.

During opening, after reaching a predetermined position, the elements can rotate, one at a time, by approximately 90° towards the outside or towards the inside, thereby obtaining the packing.

30 In some solutions, each element of the glass panel consists of hardened glass with a thickness of approximately 10 mm, and the individual elements are coupled to an extruded profile having different shapes and dimensions, with a length greater than the width of the glass by approximately 3-4 mm, by means of structural adhesive or mechanical fastening.

35 The packing of the glass panel is obtained since each of its single elements can rotate by 90°, but this rotation can only occur in a predetermined position.

It is also known how this type of glass panel currently comprises two different types of construction, that is to say, suspended glass panels or glass panels resting on sliding supports.

5 In both cases, the glass panels require two upper profiles to allow the connection to a beam/slab, thereby recovering possible incorrect planarity.

The glass panels foldable by packing of the suspended type have components which enable the glass to be supported and moved by means of components which generally consist of a double independent
10 radial bearing. The other components allow the rotation at the predetermined packing position.

On the other hand, the glass panels foldable by packing of the sliding type comprise the components described with reference to the glass panels of the suspended type but in place of the upper bearings they
15 comprise lower slides resting on the lower guide and on which rests the weight of the structure. In this case, the movement is less fluid than that of the previous system because the slides act by sliding rather than by rolling.

20 In both cases, there is an extruded profile fixed on the floor and/or sill.

Moreover, again for both the solutions, a specific design to be carried out in advance is necessary, which implies the need to select on which side the packing is to be obtained, and whether this must be towards the inside or towards the outside, and whether to use the
25 suspended or supported system.

Special care must also be taken during the assembly phase, especially to ensure that the rotation of the elements takes place during the packing without any particular problems, often due to the passage of time and because of the precarious circumstances for good operation of
30 the accessories.

New systems of suspended glass panels have recently been made which comprise a book-like operation, with the coupling of elements with alternating right and left hinges fixed in turn to the extruded profile. This system does not allow the individual detachment of each of the
35 glazed elements because the hinges act as inseparable mechanical links.

International patent application WO 2006/134242 describes a door which has two portions of door hinged together in a rotational fashion

by a hinge, so as to allow the rotation of one portion of door with respect to the other allowing the swinging movement towards both the inside and the outside of the space to be closed. However, in this solution the portions of door are irremovably coupled together and are not able to rotate up to 180° with respect to each other.

Patent US 4,610,289 relates to a shutter consisting of a plurality of panels coupled together by means of respective hinges. These hinges allow the closing of the panels in a book-like fashion and allow the rotation up to 180° of one panel with respect to the other both towards the inside and towards the outside. However, in this solution the panels irremovably coupled with each other. Moreover, the components of the hinge are not symmetrical with each other, thus being more expensive to produce.

In the light of the above, the need appears clearly evident of being able to provide a hinge which is able to make the installation of panel walls much easier and the operation much more flexible, in particular glass panels which can be opened, regardless of whether they are of the type currently known as sliding or suspended (and which, therefore, with the new solution can be simply identified as offset doors or centred doors).

These and other results are obtained according to this invention by means of a hinge without link pins which allows two wall or door elements to be joined in such a way that they can, as necessary, detach from one another, and rotate both in a clockwise and anticlockwise direction by 180°.

This invention therefore relates specifically to a hinge, in particular for folding walls by packing comprising a plurality of panels, and sliding along guides, said hinge comprising a first and a second part, substantially equal to each other, and which can be mirror coupled, each one of said first and second parts having a first base portion and a second portion opposite the first, on the second portion being provided a groove for receiving an edge of one of said panels, on the base portion being provided a central substantially plane portion, and on the two sides respectively a concave vertical seat, and a convex vertical seat having a shape permitting its coupling with the respective concave seat of the other respective part of the hinge, said concave and convex seats having radiuses such to permit a mutual coupling with each other during movement of the two respective parts, and such as to permit

disengagement of the two parts at the predetermined neutral position and the blocking of the disengagement during the rotation movement of the two parts which can rotate reciprocally from 0° (neutral position) up to 180° in a clockwise direction and from 0° to 180° in a counter-clockwise direction, said hinge providing a seat for a pin which provides for the mounting of coupling accessories with said guides of said wall.

More specifically, according to the invention, each of said first and second parts can have a substantially three-dimensional triangular or trapezoidal shape, on the vertex of said substantially triangular shape or on the small base of said substantially trapezoidal shape being provided said groove, on the base of said substantially triangular shape or on the large base of said substantially trapezoidal shape being provided said central substantially plane portion, and at the two base vertices, respectively, said concave vertical seat and said convex vertical seat.

In other words or alternatively, the object of this invention is a hinge, in particular for folding walls by packing comprising a plurality of panels, and sliding along guides, said hinge comprising a first and a second part, substantially equal to each other, and which can be mirror coupled, each of said first and second parts having a substantially three-dimensional triangular shape, on the vertex of the substantially triangular shape being provided a groove for receiving an edge of one of said panels, on the base of the substantially triangular shape being provided a central substantially plane portion, and at the two vertexes respectively a concave vertical seat, and a convex vertical seat having a shape permitting its coupling with the respective concave seat of the other respective part of the hinge, said hinge being made from plastic material, said concave and convex seats having radiuses such to permit a mutual coupling with each other during movement of the respective parts, and such as to permit the disengagement of the two parts at the predetermined neutral position (0°) and the blocking of the disengagement during the rotation movement of the two parts which can rotate reciprocally from 0° (neutral position) up to 180° in a clockwise direction and from 0° to 180° in a counter-clockwise direction, said hinge providing a seat for a pin which provides for the mounting of coupling accessories with said guides of said wall.

Preferably, according to this invention, seats for springs can be provided on said concave seats, above and/or below.

Again according to the invention, said hinge may be made of any material, preferably plastic, steel, preferably stainless steel, or aluminium.

5 Further, according to the invention, said hinge receives a pin through which a reverse rotation carriage assembly (20; 50) is mounted on said hinge.

Moreover, according to the invention, said hinge receives a pin through which an adjustable and self-adjustable pressure assembly is mounted on said hinge.

10 Again according to the invention, each first and second part may be divided into two separate sub-part, at said groove.

Again according to the invention, the convex vertical seat of each part of the hinge can have a cross section with a substantial elliptical shape, with the part with smaller diameter slightly flattened, the cross
15 section of the concave vertical seat of each part of the hinge can have a substantially elliptical shape and a sufficiently large opening for housing and inserting with just enough interference the portion of smaller diameter of the respective convex vertical seat, and for preventing the escape of the portion of larger diameter of the respective convex vertical seat.

20 Further, according to the invention, the cross section of the convex vertical seat of each part of the hinge can comprise two semicircles, with the respective centres of rotation shifted linearly one from the other by a predetermined distance, and wherein the two semicircles are joined together by two linear sections which form the flattened portion
25 of the elliptical shape of the convex part.

Preferably, according to the invention, one of the two centres of rotation, in particular the centre of rotation on the side of the part of the hinge towards the respective groove, may coincide with a centre of rotation of the hinge.

30 More specifically, according to this invention, the flattened part is substantially parallel to the longitudinal axis of the groove, in particular parallel to the direction of insertion of the panel in said groove.

More specifically, according to the invention, the cross section of the concave vertical seat of each part of the hinge may comprise two
35 circular arcs, each having the radius of the same length, with the respective centres of rotation shifted linearly one from the other by a predetermined distance, along an axis transversal to the longitudinal axis

of the groove, and wherein the two arcs are joined together by a third arc, the radius of which is smaller than the other radiuses.

Moreover, according to the invention, the first centre of rotation of the concave vertical seat, positioned towards the outer side of the
5 respective part of the hinge may coincide substantially with a centre of rotation of the hinge.

Again according to the invention, the hinge may comprise an eccentric bush or ring at said convex vertical seat designed to create a slight interference in the coupling between the convex vertical seat of a
10 part with the respective concave vertical seat of the other part in said neutral position, and designed to facilitate the sliding with reduced friction during the rotation of the respective convex seat in the respective concave seat.

The invention also relates to a wall comprising a plurality of wall
15 or door elements coupled by hinge as described above.

Preferably, said wall comprises offset wall or door elements with hinges without accessories and hinges with upper reverse rotation carriage assembly and lower self-adjustable pressure assembly.

Further, according to the invention, the wall comprises centred
20 wall elements or doors with hinges without accessories and upper reverse rotation carriage assembly and lower self-adjustable pressure assembly mounted on substantially cylindrical components lathed and placed in the centre of each element.

Again according to the invention, the wall sides on upper and/or
25 lower guides.

The present invention is now described, by way of example and without limiting the scope of the invention, with particular reference to its preferred embodiments illustrated in the accompanying drawings, in
which:

30 Figure 1 is a top view of a first part of the hinge according to this invention, the second part being substantially equal;

Figure 2 is a rear perspective view of the part of the hinge of Figure 1;

Figure 3 is a front perspective view of the part of the hinge of
35 Figure 1;

Figure 4 illustrates a perspective view, with some parts exploded, of the hinge according to this invention, comprising the part of the hinge of Figure 1;

5 Figure 5 illustrates in detail the two cavities of the two parts of the hinge of Figure 1 coupled to each other;

Figures 6 to 15 illustrate from above the various operating positions which can be adopted by the hinge of Figure 4;

10 Figure 16 illustrates an exploded view of the reverse rotation carriage assembly to be used in combination with the hinge according to this invention;

Figures 17a, 17b and 17c are, respectively, an assembled view in cross section and from above of the levelling discs or washers system for reducing the friction, to be used in combination with the carriage assembly of Figure 16;

15 Figure 18 illustrates an exploded perspective view of the reverse rotation carriage system of Figure 16 in combination with the hinge according to the invention and the discs system of Figures 17a to 17c;

20 Figure 19a illustrates an exploded perspective view of the reverse rotation carriage system of Figure 16 comprising an alternative system for coupling to the hinge according to this invention;

Figures 19b and 19c are side and front views of the carriage system of Figure 19a;

25 Figures 20a and 20b illustrate a front view and a view from above of the reverse rotation carriage assembly to be used in combination with the hinge according to this invention;

Figure 21 illustrates an exploded view of the carriage assembly of Figures 20a and 20b;

30 Figure 22 illustrates a view along cross section line XX-XX' of the carriage assembly of Figure 20a inserted in an upper guide when applied to a hinge according to the invention;

Figure 23 illustrates a perspective view of a hinge 100 according to the invention coupled with an adjustable and self-adjustable pressure assembly;

35 Figure 24 illustrates a cross section view along the line XXIV of the pressure assembly of Figure 23;

Figure 25 illustrates a perspective view of the pressure assembly of Figure 23 and 24;

5 Figure 26a illustrates a front view of an example of a glass panel foldable by packing with offset wall or door elements having hinges according to the invention on the two sides of the elements;

Figures 26b – 26e illustrate, respectively, a front view, a view from below, a view from above, a view along cross section line XXVI d-XXVI d', and a view along cross section line XXVI e-XXVI e' of the glass panel of Figure 26a;

10 Figure 26f is a detail XXVI f of Figure 26d;

Figures 27a – 27f illustrate perspective views of various operating positions of the glass panel of figure 26a;

15 Figure 28 illustrates a perspective view of a pressure assembly provided for a glass panel foldable by packing with panel elements or centred doors with the hinge according to this invention;

Figure 29a illustrates a front view of the pressure assembly of Figure 28;

Figure 29b illustrates a view of the pressure assembly of Figure 28 along cross section line XXIX b-XXIX b' of Figure 29a;

20 Figure 30 illustrates an exploded view of the pressure assembly of Figure 28;

Figure 31a illustrates an example of a glass panel foldable by packing with panel elements or centred doors with the hinge according to this invention;

25 Figure 31b illustrates a view along cross section line XXXI b-XXXI b' of the glass panel of Figure 31a;

Figures 32a – 32c illustrate various operating positions of the glass panel of Figure 31a;

30 Figures 33a and 33b illustrate, respectively, a perspective view and an exploded view of a part of the hinge according to a second embodiment of the invention coupled with a reverse rotation bearing assembly using a plate alternative to that of Figure 18;

35 Figures 34a and 34b illustrate, respectively, a perspective view and an exploded view of a part of the hinge according to a second embodiment of the invention comprising a pressure assembly alternative to that of Figure 23;

Figures 35a and 35b illustrate, respectively, a perspective view and an exploded view of a part of the hinge according to a second embodiment of the invention comprising a pressure assembly according to a further embodiment;

5 Figure 36 illustrates the detail XXXVI of the glass panel of Figure 26d to which is applied the pressure assembly of Figure 35a;

Figure 37 illustrates a view from above of two parts of the hinge according to a second embodiment of the invention which are complementary and coupled to each other;

10 Figure 38 illustrates a perspective view of a cover profile which may be coupled to the parts of the hinge of Figures 33 – 37;

Figure 39 illustrates a view from above of the detail of the two cavities of the two parts of the hinge of Figure 37 coupled to each other;

15 Figures 40a – 40d illustrate views from above of various steps of the rotational movement of the hinge of Figure 37 with respect to its two centres of rotation; and

Figures 41a – 41c illustrate views from above of various steps of the disengagement movement of the hinge of Figure 37 from the neutral position.

20 With the hinge according to the invention, it will be possible to obtain a glass panel (some embodiments of which will be described below, with reference to the accompanying drawings) which, when two or more panels are positioned longitudinal parallel and coplanar, they are normally coupled to each other by means of the hinges according to the invention.

25 Since the hinges according to the invention in the neutral position can uncouple from each other longitudinally generating a single release movement of each panel with respect to the previous one, the individual panels can be shifted axially along the direction of the guide and rotated with respect to it for being arranged individually to the left or right
30 or in any other non-predetermined position.

Moreover, the hinge according to the invention also allows, if the single panel is not to be uncoupled, use of the rotational function in a clockwise and/or anticlockwise direction, to obtain a book-like or bellows-like movement of the panels.

35 For this reason, the hinge according to the invention allows a linear book-like or bellows-like opening to the right or to the left, a linear book-like or bellows-like opening towards the inside or the outside, and a

single element opening with the possibility of performing a movement along sides oriented at an angle with respect to the main side according to a broken line.

5 Figures 1 – 15 show a first embodiment of a hinge 100 according to the invention, made preferably by extrusion of two parts 1 (see in particular Figure 1), with a substantially triangular shape, shaped to obtain the articulations and the connections necessary and substantially equal.

10 In other words, the hinge 100 according to the invention consists of two parts 1, which can be mutually coupled (as described in more detail below).

15 Each part 1 comprises, in the “vertex” portion of the triangular shape, a vertical seat or groove 2, to receive a panel made of glass or other material (not shown in these drawings) and a plane part 3, opposite said seat 2, which represents the base of the triangle.

20 On the two vertices of the plane part 3 are made a concave seat or concave vertical seat 4, the variable radiuses and centres of which are illustrated in more detail in Figure 5, and a convex seat or convex vertical seat 5, the variable radiuses of which are also shown in more detail in Figure 5.

25 It may be clearly seen that the concave seat 4 has larger dimensions than the convex seat 5, and, as will be described in more detail below, their shapes are complementary, so the corresponding convex seat 5 of one of the two parts 1 of the hinge 100 couples in the concave part 4 of the other part 1 of the same hinge 100 according to the invention.

30 Figure 5 shows how the cross section of the convex seat 5 has a substantial elliptical shape, with the part with the smaller diameter slightly flattened.

35 More specifically, according to the embodiment shown, the convex seat 5 may comprise two semicircles each having the radius R5 and R6 of the same length, for example approximately 8 mm, with the respective centres of rotation C5 and C6 shifted linearly one from the other by a predetermined distance, for example 1 mm, along an axis y' parallel to the longitudinal axis of the seat 2 e and wherein the two semicircles are joined together by two linear sections which form the substantially flattened portion of the elliptical shape of the convex seat 5.

When the hinge is in the neutral position (shown, for example, in Figures 6, 7 or 9) the flattened part may be substantially parallel to the longitudinal axis y of the seat 2, in particular parallel to the direction of insertion of the panel in said seat 2.

5 One C6 of the two centres of rotation C5, C6, in particular the centre of rotation C6 on the side of the part 1 of the hinge towards the respective groove 2, coincides with one of the centres of rotation O or O' of the hinge 100.

10 The cross section of the concave seat 4 of each part 1 of the hinge 100 may also have a substantially elliptical shape, in such a way as to house the respective convex seat 5.

15 More specifically, the concave seat 4 has a sufficiently large opening for the for the insertion with slight interference of the narrowest portion, in particular the one with the smallest diameter, of the convex seat 5, in particular at the smaller diameter of the ellipse of the convex seat 5, and to prevent the escape of the larger portion, in particular the one with the larger diameter, of the convex seat 5, in particular at the larger diameter of the ellipse of the convex seat 5. Preferably, the opening is approximately 16 mm.

20 Preferably, the cross section of the concave seat 4 may comprise two circular arcs, each having the radius R1 and R4 of the same length, for example approximately 8.5 mm, with the respective centres of rotation C1 and C4 shifted linearly one from the other by a predetermined distance, for example by 0.5 mm, along an axis z transversal to the
25 longitudinal axis y of the seat 2 and wherein the two arcs are joined together by a third arc, the centre of rotation C3 of which is shifted linearly, transversally to the distance between the centres C1 and C4, with respect to the centre of rotation C1 of the first arc by a predetermined distance, for example approximately 1 mm and the radius R3 of which is less than the
30 other radiuses, for example equal to 7.5 mm. [The third joining arc preferably represents approximately 1/10 of the cross section of the concave seat 4.

35 The first centre of rotation C1 of the concave vertical seat 4, positioned towards the outer side of the part 1 of the hinge 100 coincides substantially with one of the centres of rotation O or O' of the hinge 100.

 This particular geometry allows a fluid rotation between the two parts 1 of the hinge 100 with adequate operational clearance with respect

to the same centre of rotation O or O' and a blocking of the coupling during the rotation and the release in the neutral position, when the axis between the two centres of rotation C5 and C6 of the convex seat 4 is substantially parallel to the direction of insertion of the panel in the seat 2.

5 According to a second embodiment of the hinge 100 according to the invention, as shown in Figures 33 – 38, the particular geometry of the convex seat 5 is obtained by coupling to it an eccentric bush or ring 16 which has a geometry such as to have a slight interference in the reciprocal concave seat 4 of the complementary part 1 of the hinge 100,
10 when coupled in the neutral position (as shown for example in Figures 6, 7, 9) whilst it has a clearance during the rotation of the same two parts of the hinge 100.

 The result is the sliding with reduced friction during the rotation for the book-like/bellows-like opening, and a clip coupling in the neutral
15 position such as to maintain the coupling of the parts 1 of the hinge 100 in the absence of pushing upon release.

 More specifically, come as shown in Figure 39, the geometry of the second embodiment of the hinge 100 according to the invention varies slightly with respect to that of the first embodiment. In the embodiment
20 illustrated, the radiuses R5 and R6 of the two semicircles of the cross section of the convex seat 5 have a slightly different length, in particular, respectively, 7.3 mm and 8 mm. Preferably, the opening of the concave seat 4 is approximately 14.4 mm.

 In relation to the cross section of the concave seat 4, the
25 centres of rotation C1 and C4 of the two arcs are shifted linearly along the transversal axis z in such a way that they cross each other, so that the centre C4 coincides with the centre of rotation O or O' of the hinge 100. The third joining arc has a radius R3 of approximately 8 mm.

 Moreover, Figures 33 - 38 illustrate the second embodiment of
30 the hinge 100 which preferably comprises two parts 1 as substantially described above, which are in turn divided into two sub-parts 1a and 1b, each comprising a concave seat 4 and a convex seat 5 and divided at seat 2.

 The further division of the two parts 1 of the hinge 100 is useful
35 for optimising the production process, simplifying the extrusion of the profiles.

Moreover, the further division allows the hinge 100 to be used on panels with different thicknesses, without a dimensional limit, as it is possible to apply the sub-parts 1a and 1b at the opposite edges of the panel and then join them with suitable coupling elements.

5 Again, preferably, as may be seen in the second embodiment of the hinge 100 according to the invention illustrated in Figures 33 – 38, the seat 2 may have a groove 18, in particular at the bottom, which allows a possible snap assembly of suitable protrusions 69 of a cover profile 68 (as shown, for example, in Figure 37), preferably with a brush, suitable for
10 reducing the draughts coming from the operational space which is created between the panels and the upper and lower guides.

Figures 40a - 40d illustrate the rotational movement of the hinge 100 according to the second embodiment with respect to a first centre of rotation O or with respect to the second centre of rotation O'
15 allowing openings in both cases of up to 180° (Figures 40b and 40d).

Figures 41a – 41c illustrate the detachment movement between the two parts 1 of the hinge 100 of the second embodiment when in the neutral position (of Figure 41a) and a detachment force F is exerted parallel to the longitudinal axis y of the seat 2.

20 Preferably, the machining operations of the extruded part 1 are rationalised in such a way that the part is cut into equal pieces and subjected to other machining operations of milling, drilling, and galvanic protection treatments which can ensure the maximum smoothness between the various elements.

25 With reference in particular to Figure 2, it may be seen how the convex seat 5 and the compartments 7, 8 adjacent to the seat 5 and opposite each other in the vertical direction of the part 1, allow the maximum rotations allowing two surfaces 3 of two parts 1 to be moved from coincident (as shown in Figure 9) to parallel on the right and on the
30 left (as shown in Figure 15).

Two seats 9, 10 may be formed in the concave cavity 4 for housing springs 11 (shown in Figure 4), which are blocked by means of a pin 12 to be inserted in a hole 13, which intercepts the cavity 14 of the spring 11, having a diameter greater than the pin 12.

35 As mentioned, Figure 2 illustrates a part 1 of the hinge 100 (that is to say, a half of the 100), provided with all the mechanical machining

operations necessary for its operation when coupled with another equal part 1 to constitute the entire hinge 100.

The coupling between the two parts 1 is illustrated in Figure 4.

5 On the end edge of the convex seat 5 (see Figure 4) there is an addition of material 17, over the entire length, which is necessary, together with the geometry of the variable radiuses shown in Figure 5, for limiting the uncoupling freedoms of constraint of the hinge 100 in some conditions.

10 With reference to Figures 6 – 15 in particular, Figure 6 shows a plan view of the hinge 100 with the plane parts 3 coincident and coplanar; if it is assumed that the part 1 of the left hinge is stationary, applying a force F on the part 1 on the right tending to detach the two parts 1 (Figure 7), the force F overcomes the reaction of the springs 11 anchored which open the end arms towards the outside, bot at the top and at the bottom, thus detaching the two parts 1 (see figure 8). In this position, the springs
15 return to the rest condition with the end arms closing inwards.

The hinge 100 according to the invention comprises, in this embodiment, four springs 11, so that if the force F acts in a direction normal to the plane parts 3, their detachment is caused by the action of all four springs 11 but if the force F acts in a different manner (as shown in
20 Figure 9) there will be a rotational motion which will cause the detachment of two springs 11 distant from the axis of rotation O contained in the other two springs 11 (see also Figures 9 – 15).

Figure 9 does not show the springs 11 (which could also not be provided, since important, but not necessary) so as to better understand
25 what occurs during the rotations and in particular rotating about the axis of rotation O a part 1, and keeping still the other part 1 of the hinge 100. The convex seat 5 of the first part 1 comes out from the concave seat 4 of the second part 1, without any impediment, whilst the convex seat 5 of the first part 1 does not come out from the concave seat 4 of the second part 1
30 because the geometries studied do not allow it (see in particular Figures 11 and 12). In Figures 13 and 14 it may be noted how the hinge 100 according to the invention, allows, within the maximum permissible degrees of freedom, the rotation about the axis O or about the axis O' allowing in both cases openings up to 180°. Consequently, it is possible to
35 rotate two panels with each other (not shown in these drawings) so that continuous longitudinal faces can be parallel in both clockwise and anticlockwise rotation.

It is immediately evident how, with the hinge 100 according to the invention, it is possible to obtain a greater simplicity and flexibility, since when one orders a product of this type it is no longer necessary to decide which side the panels are to be accumulated, to the right or left, whether they must be opened individually or all together and establish the direction of opening, as all these possibilities are guaranteed by the solution according to the invention.

The hinge 100 according to the invention may be made of any material, such as, for example, plastic, steel, preferably stainless steel, or aluminium, but it is evident that it can be made with any suitable material, either known or not yet known.

In the installation, two upper and lower hinges 100 are installed on a panel (not illustrated). A reverse rotation carriage assembly 20 is installed on the upper hinge 100, as illustrated in Figures 16 – 19.

Said assembly 20, a variant of which is described below with reference to Figures 20 – 22, plays a decidedly important role, since, with very reduced dimensions, it allows the panels to be hung using the hinge 100, to carry out fluid rectilinear translational movements of the panels along the upper guides (not shown), being able to roll during the translation; rotational movements on variable angles if the guide are installed joined together with the formation of angles, such as, for example, in the case of closing of areas with two or more sides which are not rectilinear to each other; a rotation up to 360° of each single panel with respect to the vertical axis passing through the centres of the assembly 20 and of the pressure assembly (not shown in these drawings), and in any position along the upper guides.

In the system of offset wall or door elements of Figures 26 and 27, the hinge 100 is mounted at the top only on one side of each panel or door, in an alternating fashion from door to door, and interacts with the upper guide by means of a pin 22, by which is mounted the reverse rotation carriage assembly 20.

The upper hinge assembly 100 with reverse rotation carriage assembly comprises the passage of the pin 22 through the part 1, in particular inserted through the convex cavity 5. The pin 22 has two grooves 23 and 24, respectively upper 23 and lower 24. Before insertion in the convex cavity 5, the pin 22 passes through the shaped washer 25, or levelling disc 25, and in the variant illustrated in Figures 17a-17c,

perforated centrally. On the lower groove 24 of the pin 22 there is a safety or stop ring 26, in particular of the Seeger type, in such a way that the pin 22 cannot rise further than planned.

5 A tab 27 (which may also not be provided, since it is important but not necessary) on the shaped washer 25 inserts in the opening 28 of the convex cavity 5 for positioning the washer 25 correctly, also contributing towards an increase in the robustness of the system.

10 The pin 22 passes through the part 1, and comes out at the top inserting into a hole 48 of the plate 21, keeping it in position by means of a further safety or stop ring 26, in particular of the Seeger type, in the upper groove 23. A screw 29, which passes through the hole 30 made in the plate 21 and in the hole 49 made in the upper surface of the part 1 (shown, for example, in Figure 1), ensures the fixing and position of the plate 21 to the part 1 of the hinge 100.

15 Said plate 21 has a recessed surface 31 which receives, through a hole 32, a pin 33 of the carriage assembly 20, in such a way that the lower groove 34 made on its lower end can also receive a safety or stop ring 35, in particular of the Seeger type, thereby achieving the fixing of the reverse rotation carriage assembly 20 to the plate 21.

20 Figure 16 clearly shows the structure of the reverse rotation carriage assembly 20.

The pin 33 also comprises, as well as the lower groove 34, an upper groove 36, and can receive the axial bearing 37, which has for this purpose the central hole 38, and therefore the rotation bush 39, which also has for this purpose the central hole 40.

25 Said rotation bush 39 has, on its cylindrical part 41 a slight impression 42 designed to contain, with free coupling, the disc 44, by means of the shaped hole 45, made on said disc 44, pressure-fitted and free to rotate when in contact with the balls 43.

30 At the top is mounted a safety or stop ring 46, in particular of the Seeger type, inserted in the groove 36, which prevents the bearings 37 and 39 from escaping from the pin 22, if turned over and under the weight of the door.

35 It can be clearly seen in Figures 19a – 19c how, for the glass panels foldable by packing with centred panel elements or doors (shown, for example, in Figures 31 - 32), the reverse rotation carriage assembly 20 is mounted without the pin 33 because the same 22' is integral with a

support 70 with a cylindrical shape with an upper surface 71 on which is located a pin 22' with groove 23', which inserts in the assembly 20, using the hole 40.

Figures 20 – 22 illustrate an alternative to the assembly 20 of Figure 16, indicated as a reverse rotation carriage assembly with rollers 50 which allows an opening of the single element glass panel with the possibility of performing a movement along the sides oriented at an angle with respect to the main side according to a broken line.

The assembly 50 also allows, with a very reduced overall size, the panels (not shown in these drawings) to be hung and connected by means of components of various types, fluid rectilinear translational movements along the upper guides, being able to roll during the translation; rotational movements on variable angles if the guide are installed joined together with the formation of angles, such as, for example, in the case of closing of areas with two or more sides which are not rectilinear to each other; and rotation up to 360° of each single panel with respect to the vertical axis passing through the centres of the assembly 50 and of the pressure assembly (not shown in these drawings), and in any position along the upper guides.

Like for the assembly 20, the assembly 50 has a pin 51 provided with a lower groove 52 and an upper groove 53, and which can receive the rack 54, which has for this purpose the central hole 55, and, therefore, the rotation bush 56, which also has for this purpose a central hole 57.

Said rotation bush 56 has, on its cylindrical part 67 a slight impression 58 designed to contain, with free coupling, the disc 59, by means of the shaped hole 60 pressure-fitted and free to rotate when in contact with the rollers 61.

At the top is mounted a safety or stop ring 62, in particular of the Seeger type, inserted in the upper groove 53, which prevents the rack 54 from escaping from the pin 51, if turned over and under the weight of the door.

Figures 33a and 33b illustrate a plate with a pin with bush alternative to the pressure assembly 63 of Figure 23.

Figures 23 – 25 illustrate a self-adjustable pressure assembly indicated generically with reference numeral 63, on which is mounted the hinge 100 according to the invention.

Alternatively, Figures 34a and 34b illustrate a variant of the pressure assembly 63. The drawing shows a part 1 of the hinge 100 according to the invention, coupled to a pin assembly with rotatable bush 6 positioned below the hinge 100 to be coupled to the lower portion of the panels (as in the embodiment of Figures 26 - 27) in such a way that it is coaxial with the upper reverse rotation carriage system (for example as shown in Figures 18 and 33). Said assembly 6 comprises a coupling bush 15 which inserts in the central seat of the lower sliding guide of the glass panel, guaranteeing a more certain position of not escaping from the seat of the guide.

Figures 26 – 27 illustrate an embodiment of a glass panel 200, consisting of n offset panels 201, of the type with the hinge 100 laterally on each panel 201, which comprises the hinge 100 above and below according to the invention, with assembly 20 or assembly 50.

In this case, there are both hinges 100 without accessories and hinges 100 with upper reverse rotation carriage assembly and lower pressure assembly.

More specifically, Figures 27a – 27f illustrate the various possible positions which the glass panel 200 may adopt thanks to the hinge 100 according to the invention.

Figures 28 – 30 illustrate, on the other hand, a pressure assembly, indicated generically with reference numeral 64, specifically designed for glass panels with centred wall elements.

Figures 31 – 32 illustrate an embodiment of a glass panel 300, consisting of n panels 301, of the type with wall elements centred on upper guide 302, which comprises the hinge 100 above and below according to the invention, without assembly 20 or assembly 50 and without assembly 64.

In this case, there are hinges 100 without accessories and upper reverse rotation carriage assembly and lower pressure assembly mounted on substantially cylindrical components lathed and placed in the centre of each element.

More specifically, Figures 32a – 32c illustrate the various possible positions which the glass panel 300 may adopt thanks to the hinge 100 according to the invention.

The present invention is described by way of example only, without limiting the scope of application, according to its preferred

embodiments, but it shall be understood that the invention may be modified and/or adapted by an expert in the field without thereby departing from the scope of the inventive concept, as defined in the claims herein.

CLAIMS

1. A hinge (100), in particular for folding walls by packing comprising a plurality of panels, and sliding along guides, said hinge comprising a first part (1) and a second part (1), substantially equal to each other, and which can be mirror coupled, each one of said first and second parts (1) having a first base portion and a second portion opposite the first, on the second portion being provided a groove (2) for receiving an edge of one of said panels, on the base portion being provided a central substantially plane portion (3), and on the two sides respectively a concave vertical seat (4), and a convex vertical seat (5) having a shape permitting its coupling with the respective concave seat (4) of the other respective part of the hinge (100), said concave (4) and convex (5) seats having radiuses such to permit a mutual coupling with each other during movement of the two respective parts (1), and such as to permit disengagement of the two parts (1) at the predetermined neutral position (0°) and the blocking of the disengagement during the rotation movement of the two parts (1) which can rotate reciprocally from 0° (neutral position) up to 180° in a clockwise direction and from 0° to 180° in a counter-clockwise direction, said hinge (100) providing a seat for a pin which provides for the mounting of coupling accessories with said guides of said wall.

2. The hinge (100) according to the preceding claim, characterised in that each of said first and second parts (1) has a substantially three-dimensional triangular or trapezoidal shape, on the vertex of said substantially triangular shape or on the small base of said substantially trapezoidal shape being provided said groove (2), on the base of said substantially triangular shape or on the large base of said substantially trapezoidal shape being provided said central substantially plane portion (3), and at the two base vertices, respectively, said concave vertical seat (4) and said convex vertical seat (5).

3. The hinge (100) according to claim 1 or 2, characterised in that on said concave seats (4) are provided, above and/or below, seats for springs (11).

4. The hinge (100) according to any one of the preceding claims, characterised in that said hinge (100) is made of any material, preferably plastic, steel, preferably stainless steel, or aluminium.

5. The hinge (100) according to any one of the preceding claims, characterised in that it receives a pin (22) by which a reverse rotation carriage assembly (20; 50) is mounted.

5 6. The hinge (100) according to any one of claims 1 to 4, characterised in that it receives a pin through which an adjustable and self-adjustable pressure assembly (63) is mounted.

7. The hinge (100) according to any one of the preceding claims, characterised in that each first and second part (1) is divided into two separate sub-parts (1a, 1b), at said groove (2).

10 8. The hinge (100) according to any one of the preceding claims, characterised in that the convex vertical seat (5) of each part (1) of the hinge (100) has a cross section with a substantial elliptical shape, with the part with smaller diameter slightly flattened, in that the cross section of the concave vertical seat (4) of each part (1) of the hinge (100) has a
15 substantially elliptical shape and a sufficiently large opening for housing and inserting with just enough interference the portion of smaller diameter of the respective convex vertical seat (5), and for preventing the escape of the portion of larger diameter of the respective convex vertical seat (5).

9. The hinge (100) according to the preceding claim,
20 characterised in that the cross section of the convex vertical seat (5) of each part (1) of the hinge (100) comprises two semicircles, with the respective centres of rotation (C5, C6) shifted linearly one from the other by a predetermined distance, and wherein the two semicircles are joined together by two linear sections which form the flattened portion of the
25 elliptical shape of the convex part (5).

10. The hinge (100) according to the preceding claim, characterised in that one (C6) of the two centres of rotation (C5, C6), in particular the centre of rotation (C6) on the side of the part (1) of the hinge towards the respective groove (2), coincides with a centre of rotation (O;
30 O') of the hinge (100).

11. The hinge (100) according to any one of claims 8 to 10, characterised in that the flattened part is substantially parallel to the longitudinal axis (y) of said groove (2), in particular parallel to the direction of insertion of the panel in said groove (2).

35 12. The hinge (100) according to any one of claims 8 to 11, characterised in that the cross section of the concave vertical seat (4) of each part (1) of the hinge (100) comprises two circular arcs, each having

the radius (R1, R4) of the same length, with the respective centres of rotation (C1, C4) shifted linearly one from the other by a predetermined distance, along an axis (z) transversal to the longitudinal axis (y) of the groove (2), and wherein the two arcs are joined together by a third arc, the
5 radius (R3) of which is smaller than the other radiuses (R1, R4).

13. The hinge (100) according to the preceding claim, characterised in that the first centre of rotation (C1) of the concave vertical seat (4), positioned towards the outer side of the respective part (1) of the hinge (100) coincides substantially with a centre of rotation (O; O') of the
10 hinge (100).

14. The hinge (100) according to any one of the preceding claims, characterised in that it comprises an eccentric bush or ring (16) at said convex vertical seat (5) designed to create a slight interference in the coupling between the convex vertical seat (5) of a part (1) with the
15 respective concave vertical seat (4) of the other part (1) in said neutral position, and designed to facilitate the sliding with reduced friction during the rotation of the respective convex seat (5) in the respective concave seat (4).

15. A wall (200; 300) comprising a plurality of wall or door elements (201; 301) coupled by hinge (100) according to any one of the preceding claims.
20

16. The wall (200) according to the preceding claim, characterised in that it comprises offset wall or door elements (201) with hinges (100) without accessories and hinges (100) with upper reverse rotation carriage assembly (20; 50) and lower pressure assembly (63).
25

17. The wall (300) according to claim 15, characterised in that it comprises centred wall elements or doors (301) with hinges (100) without accessories and upper reverse rotation carriage assembly (20; 50) and lower pressure assembly (63) mounted on substantially cylindrical components lathed and placed in the centre of each element (301).
30

18. The wall (200; 300) according to any one of claims 15 to 16, characterised by sliding on upper and/or lower guide rails.

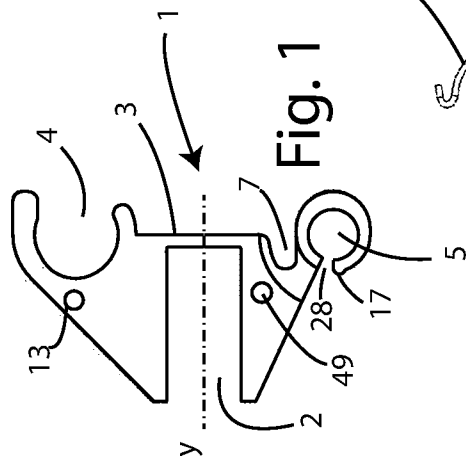


Fig. 1

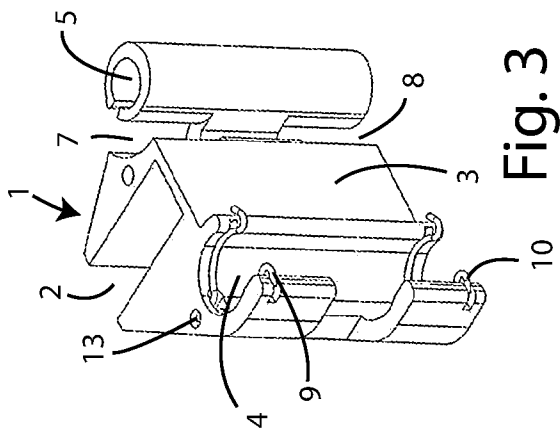


Fig. 3

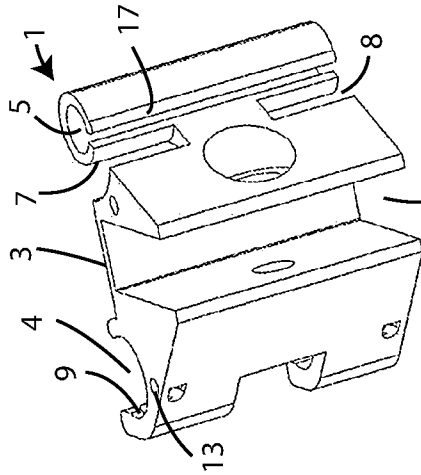


Fig. 2

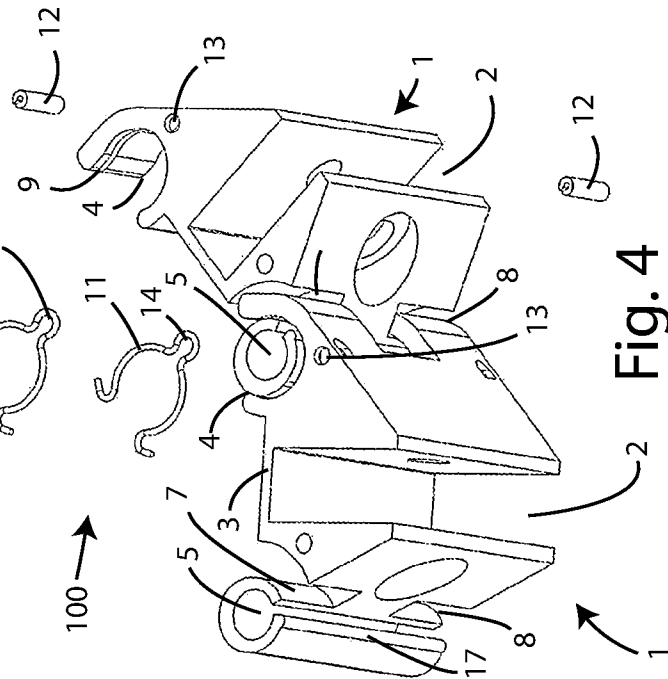


Fig. 4

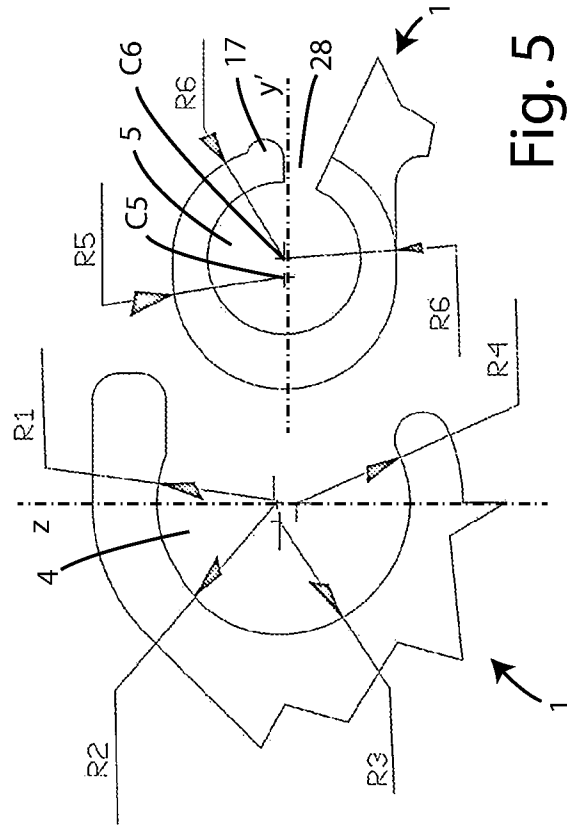
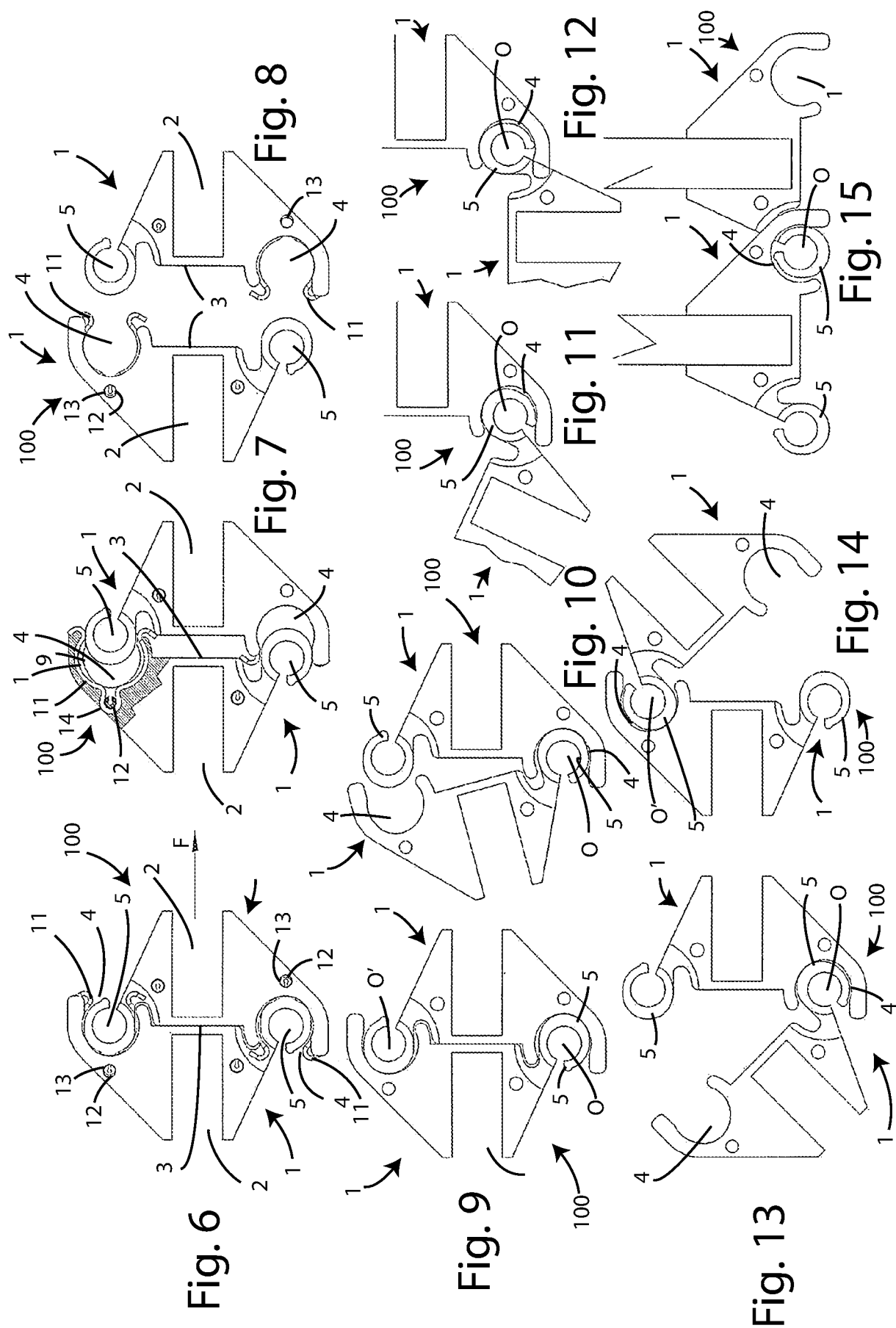
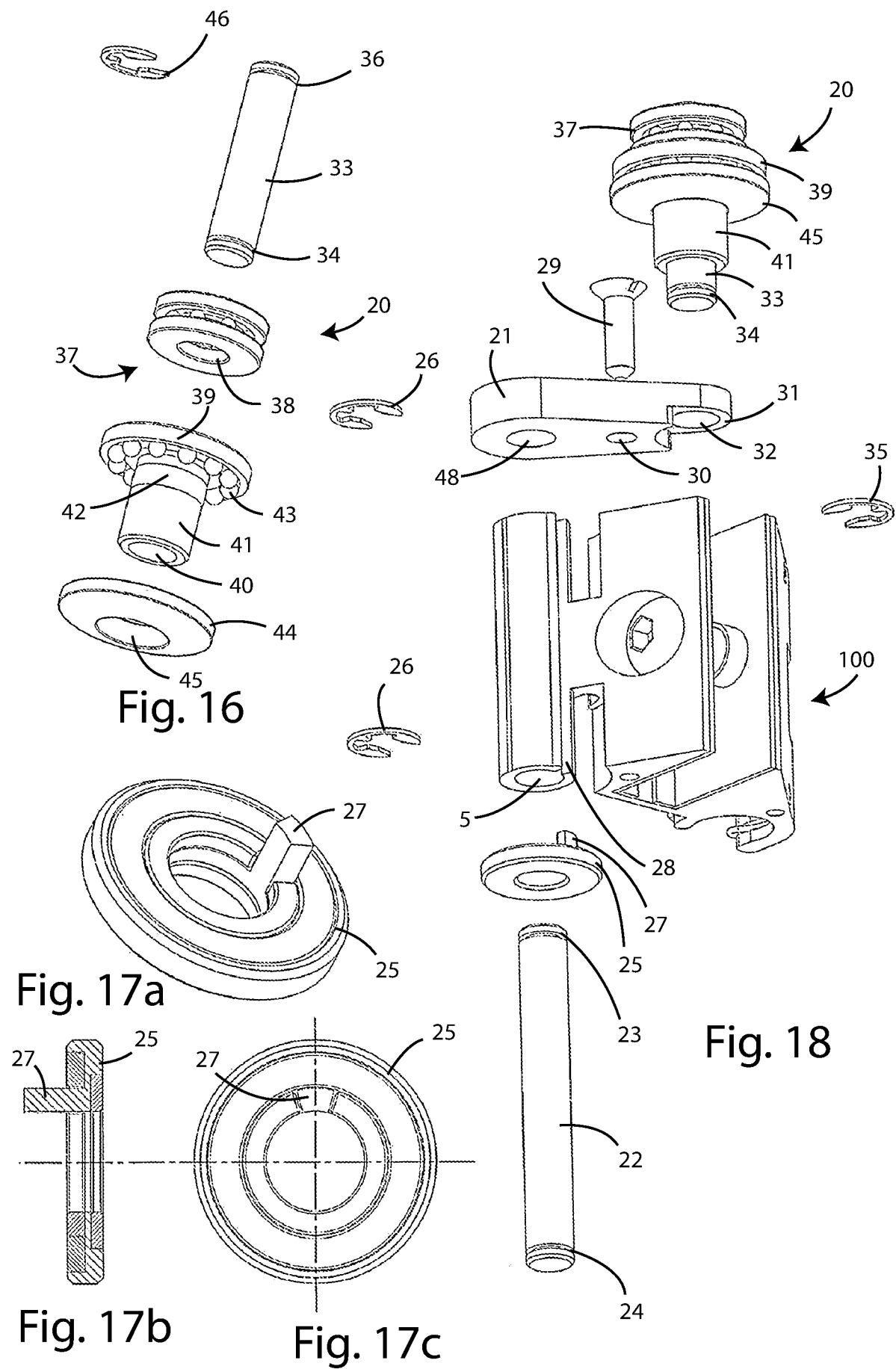


Fig. 5





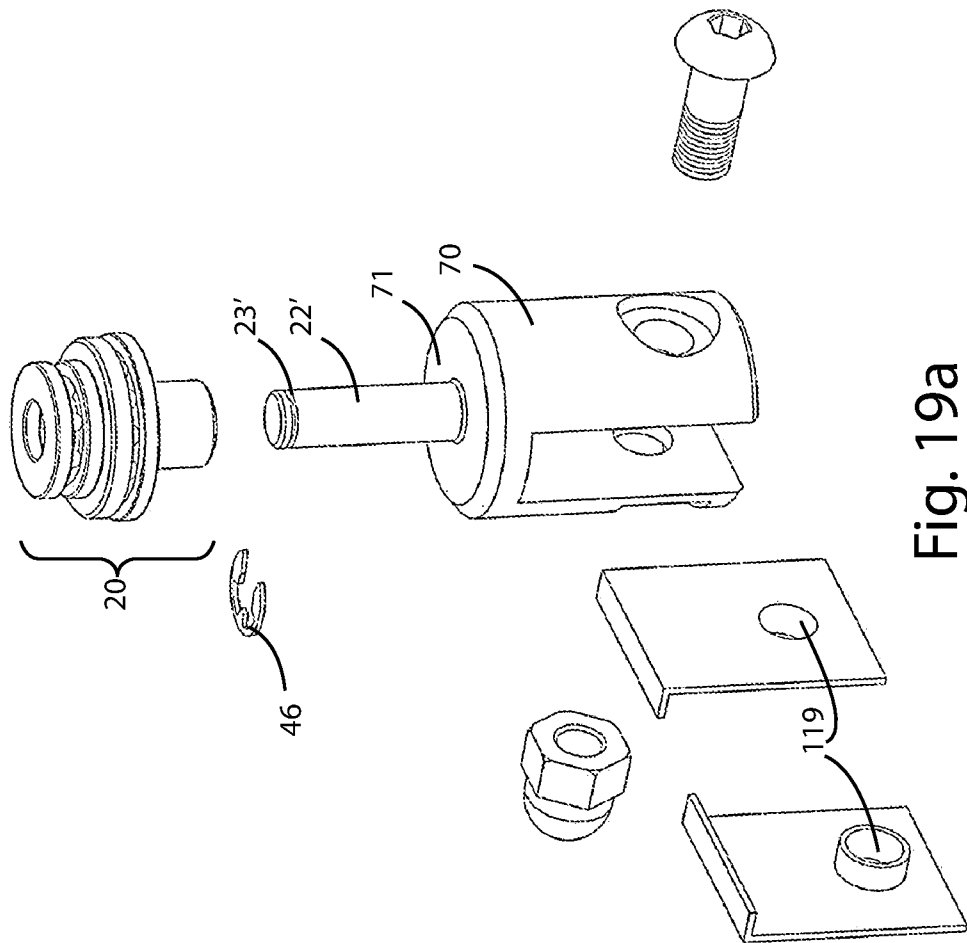


Fig. 19a

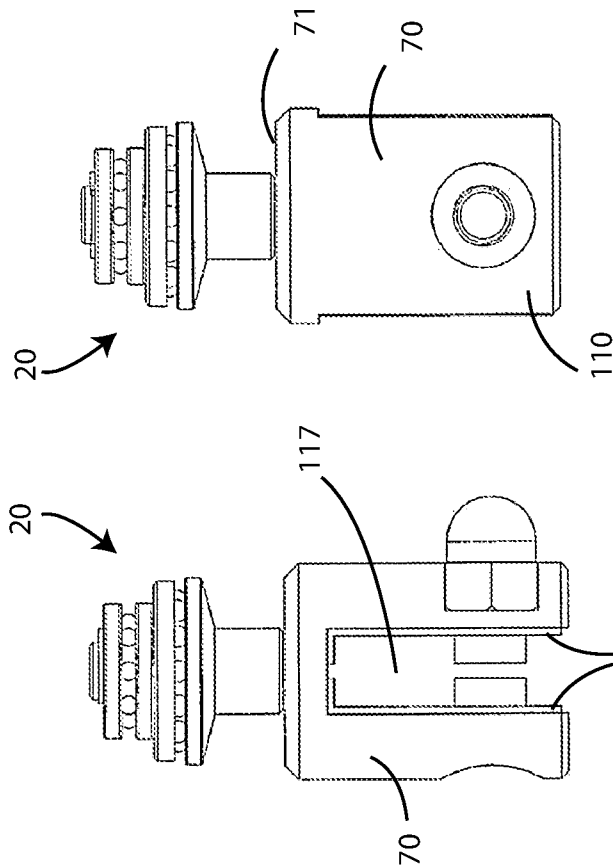


Fig. 19c

Fig. 19b

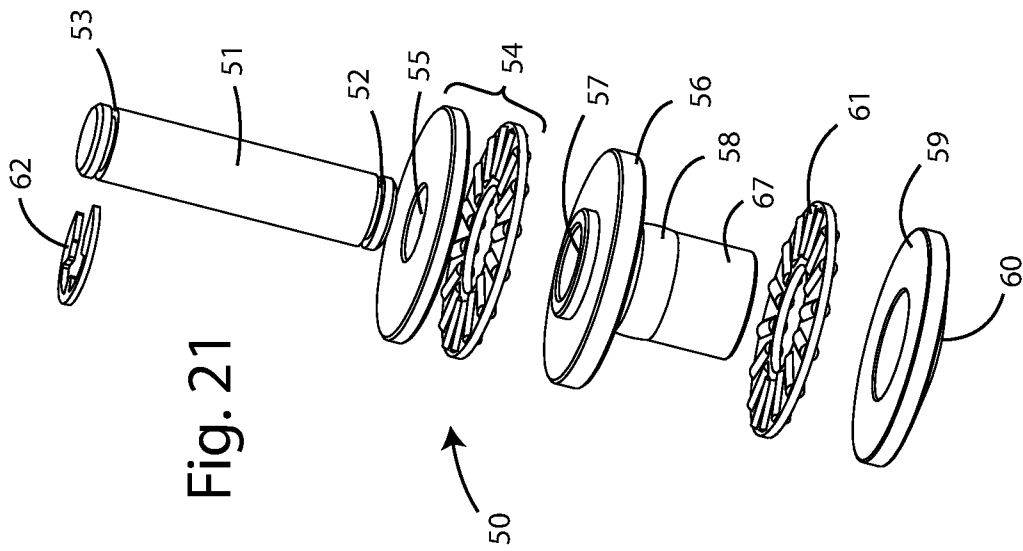


Fig. 21

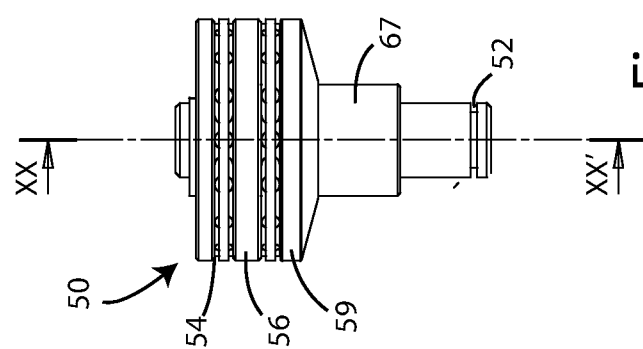


Fig. 20a

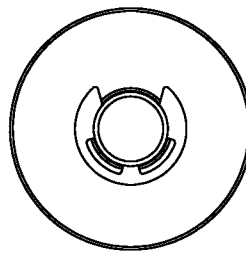


Fig. 20b

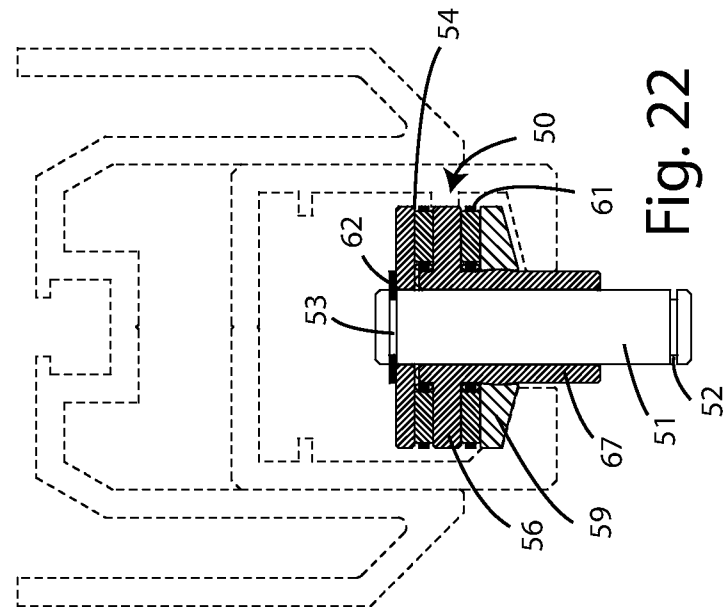


Fig. 22

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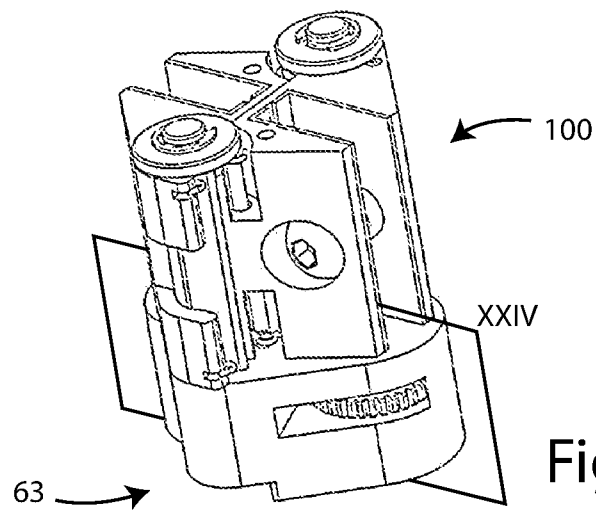


Fig. 23

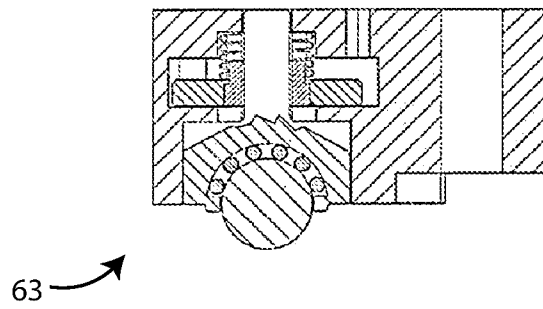


Fig. 24

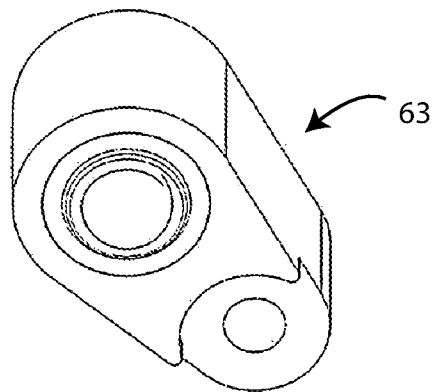
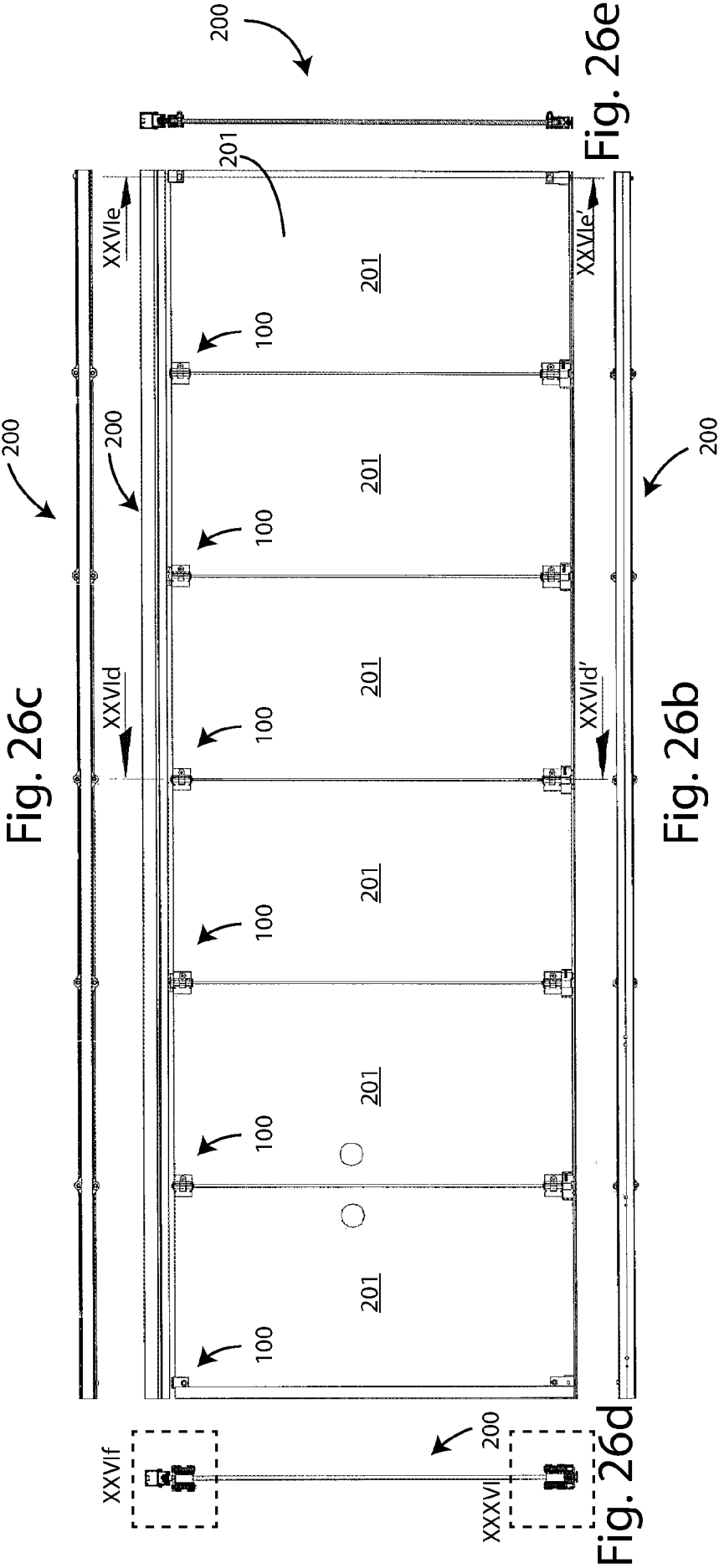


Fig. 25



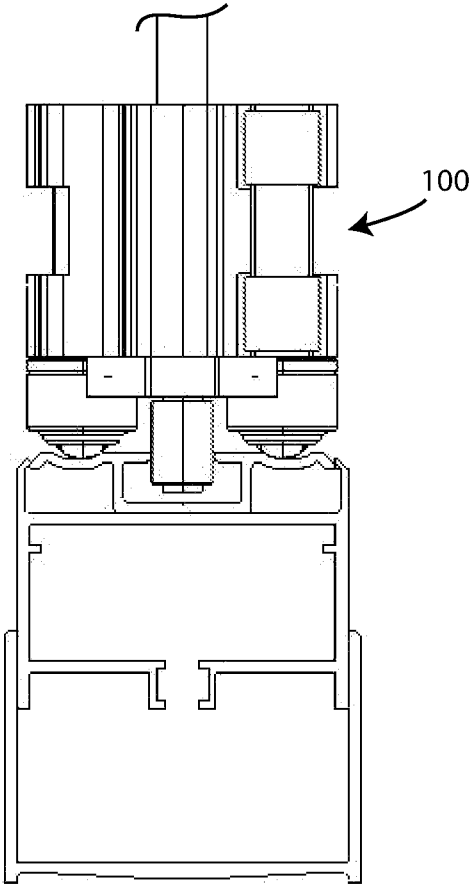


Fig. 36

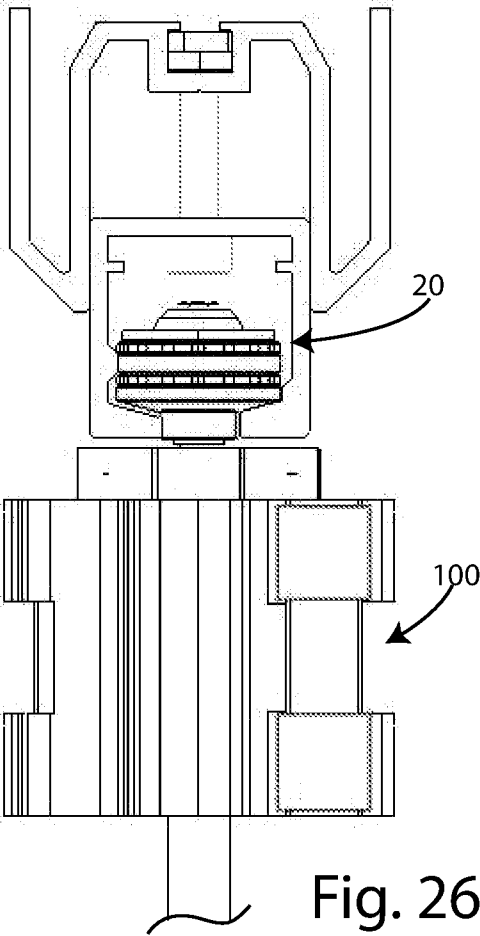


Fig. 26F

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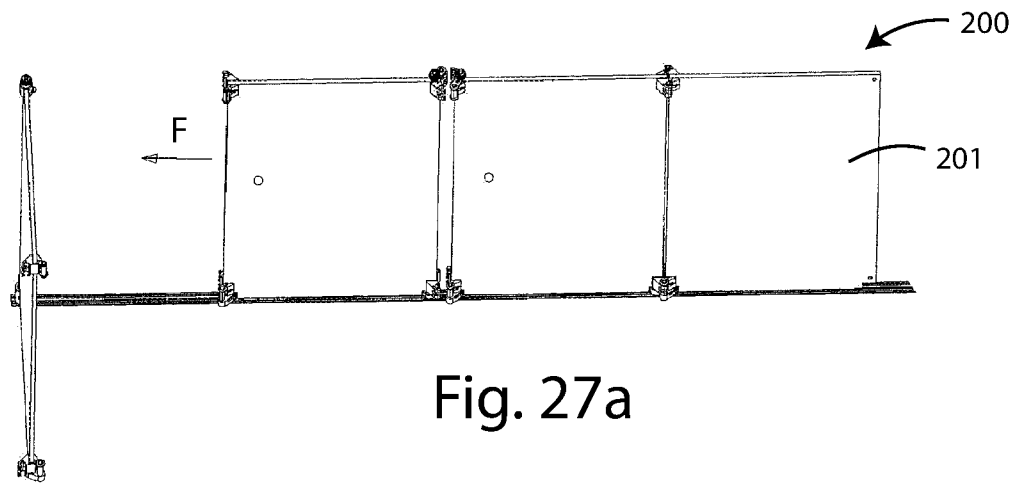


Fig. 27a

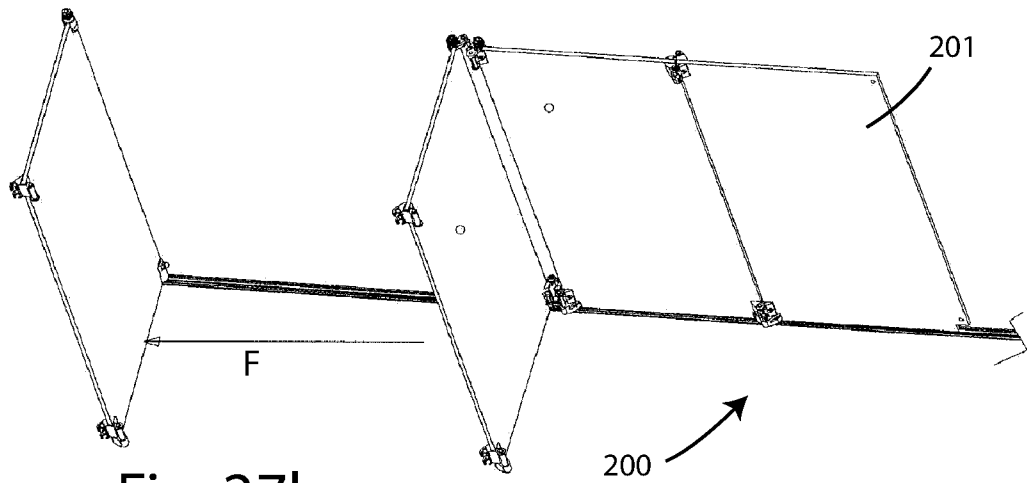


Fig. 27b

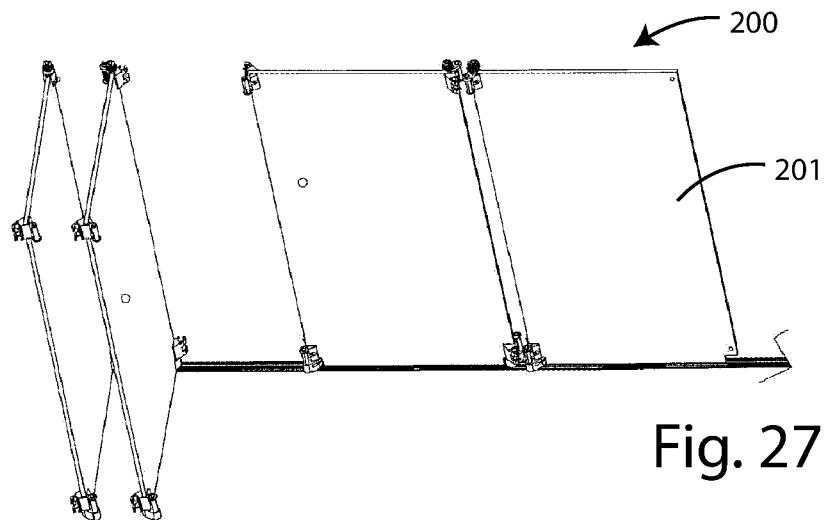


Fig. 27c

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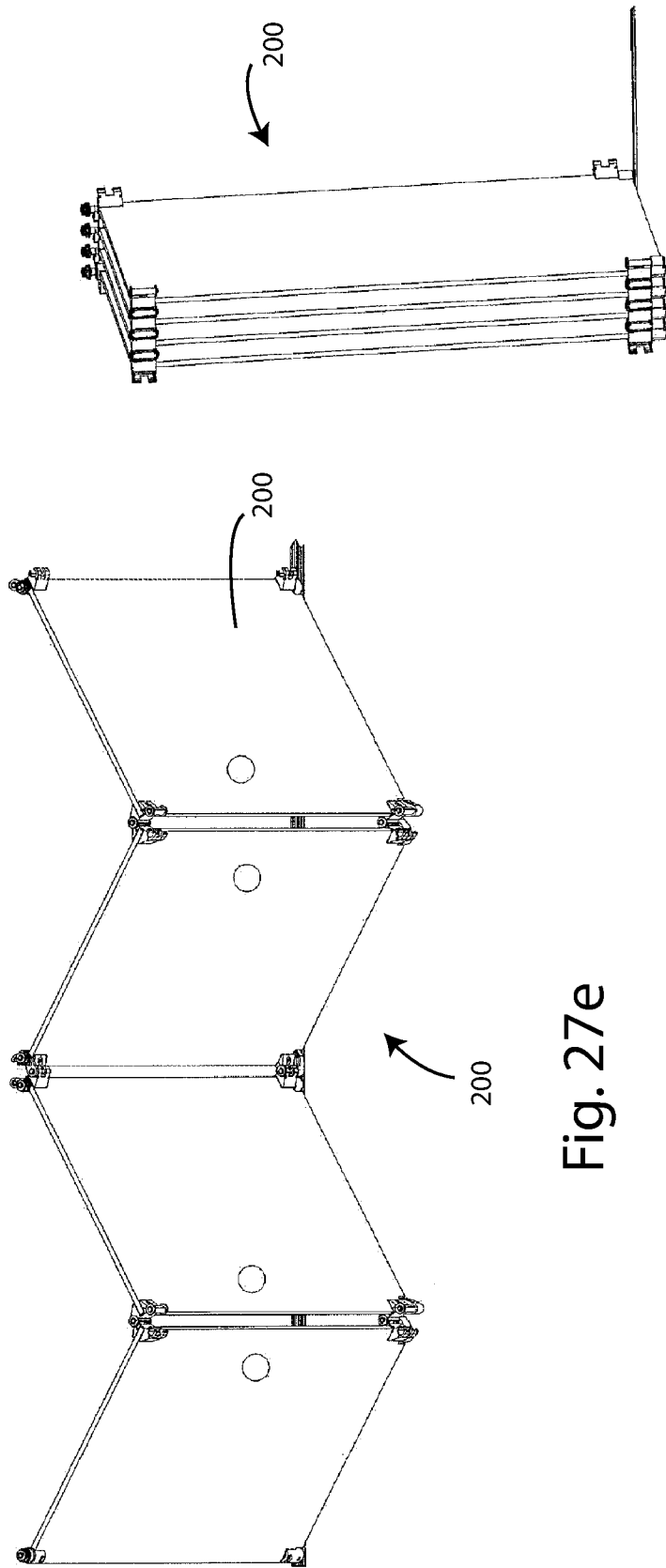


Fig. 27e

Fig. 27f

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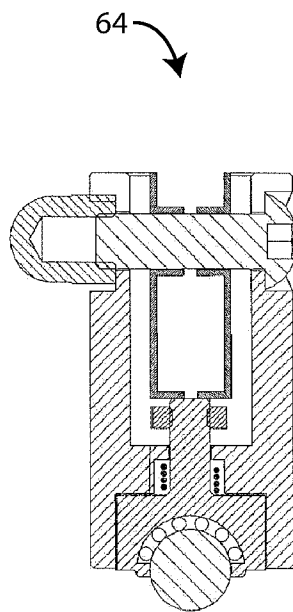


Fig. 29b

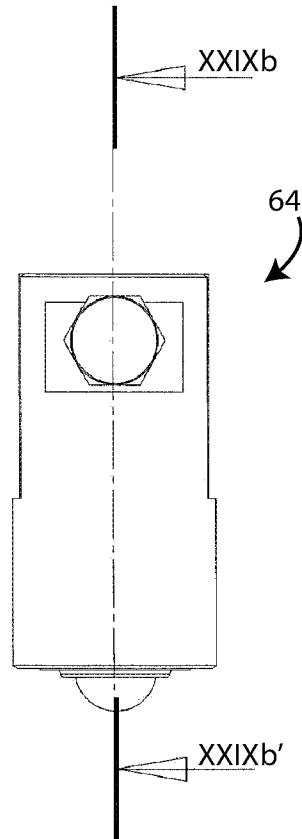


Fig. 29a

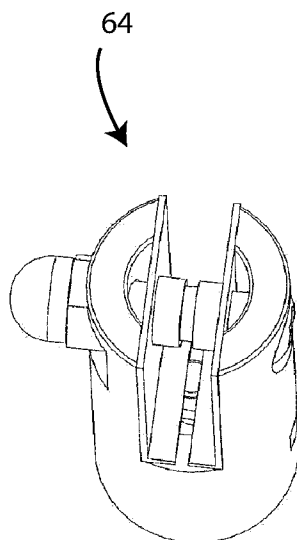


Fig. 28

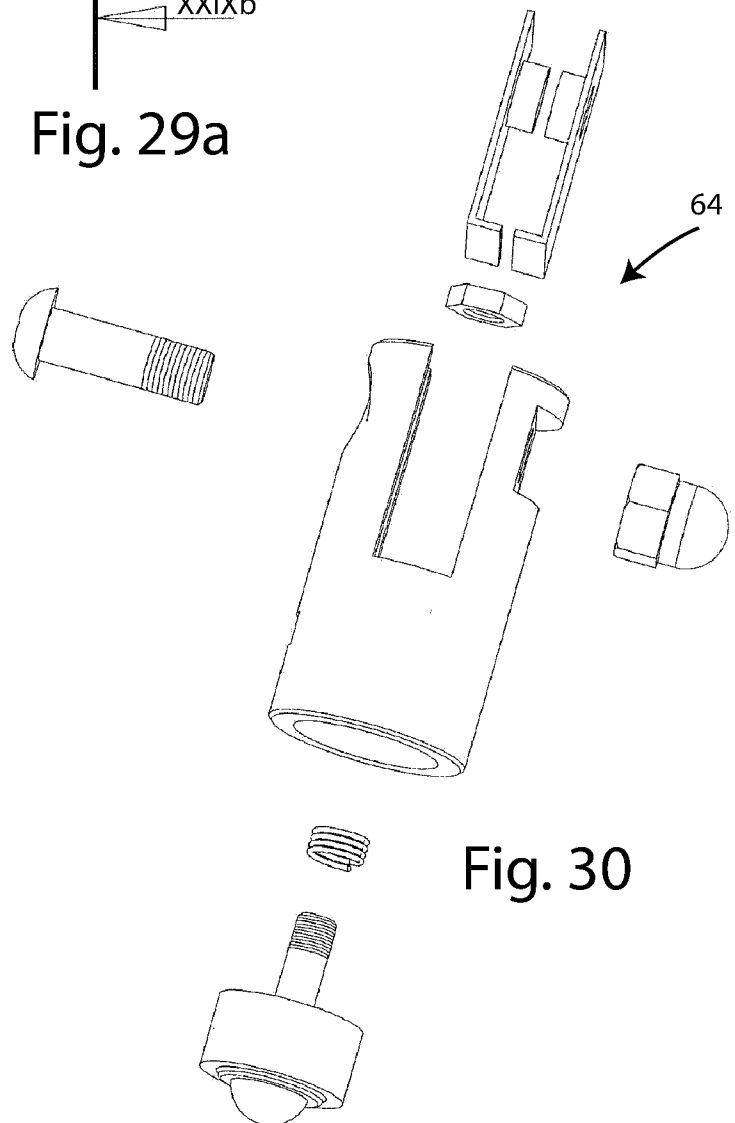
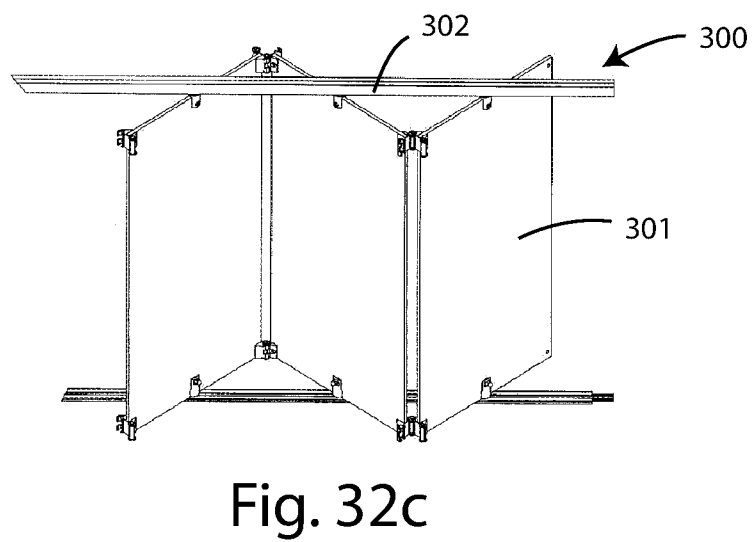
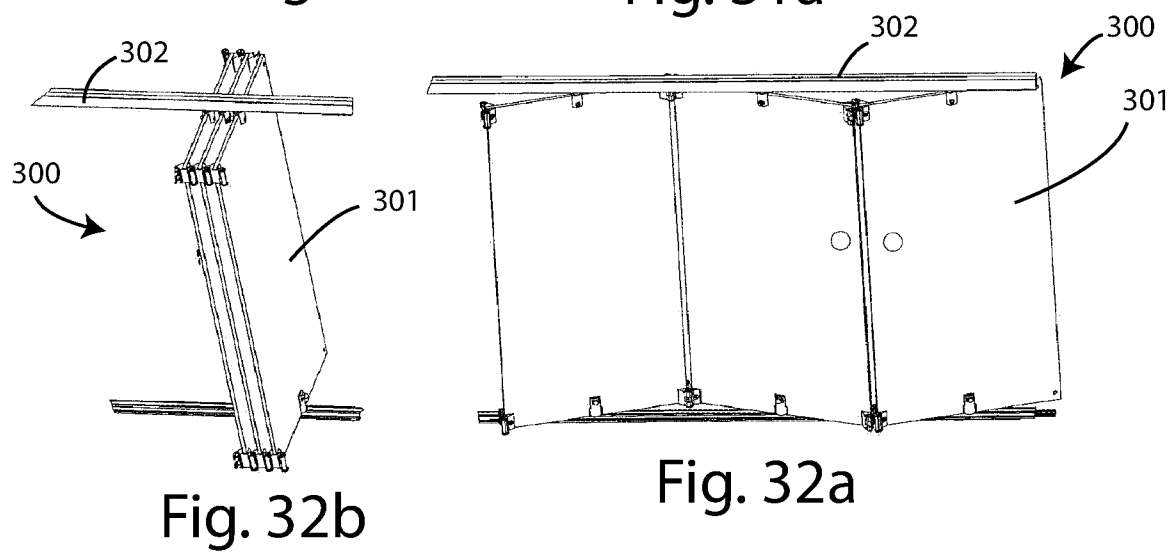
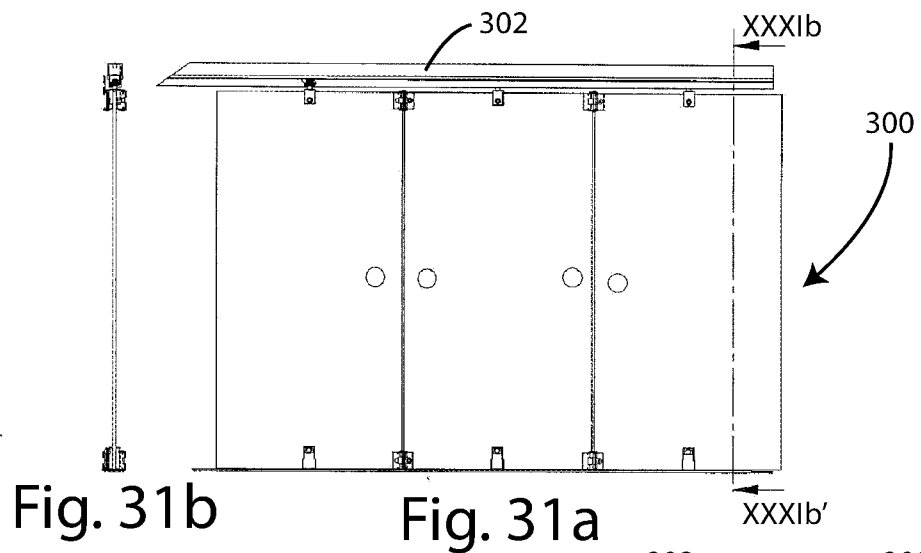
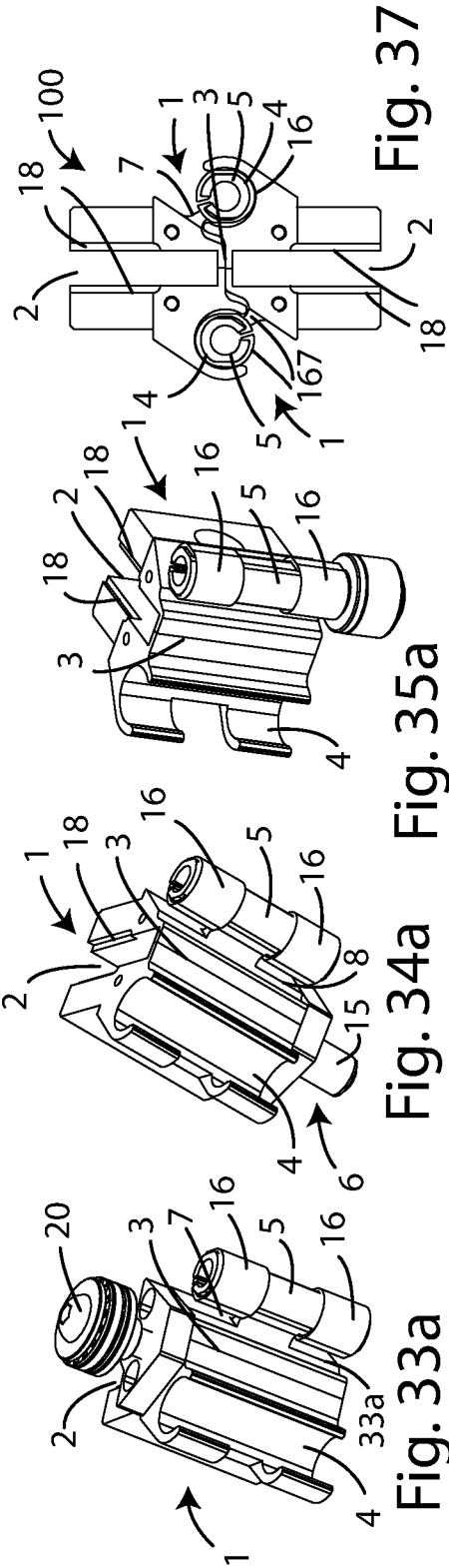
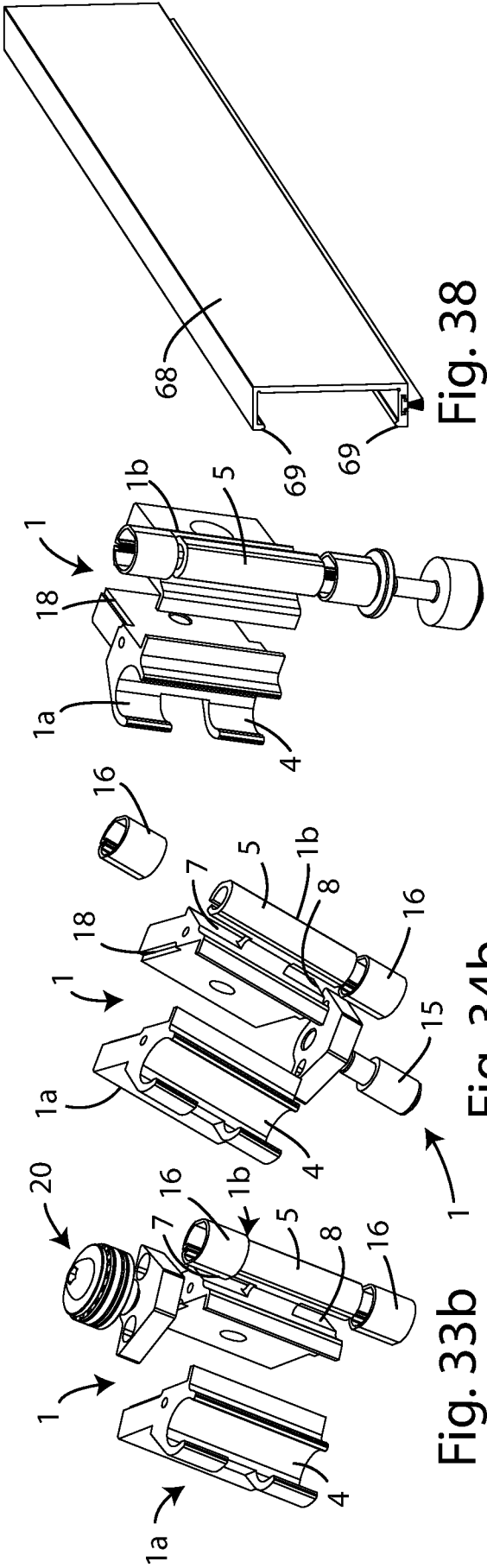


Fig. 30

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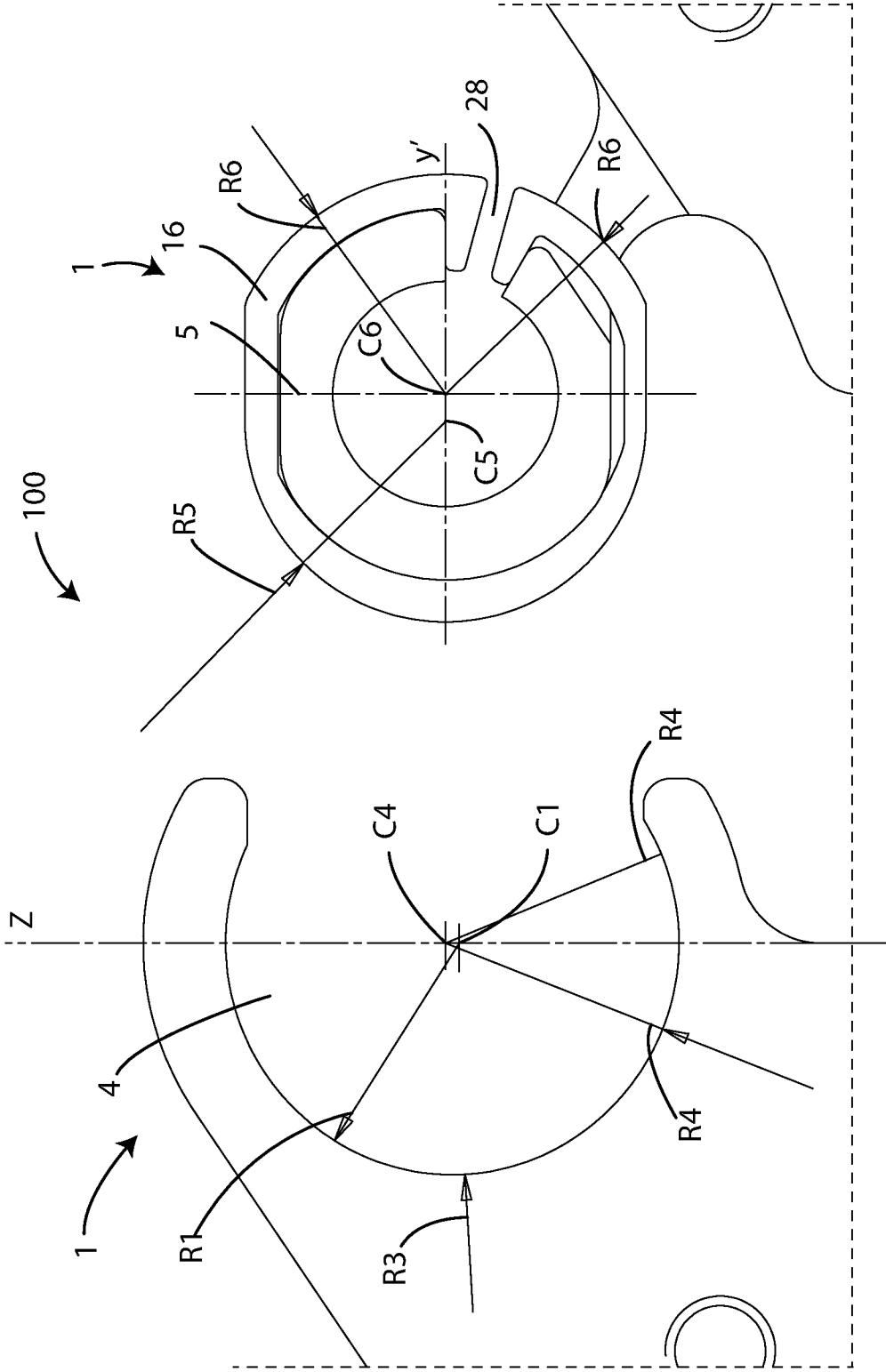
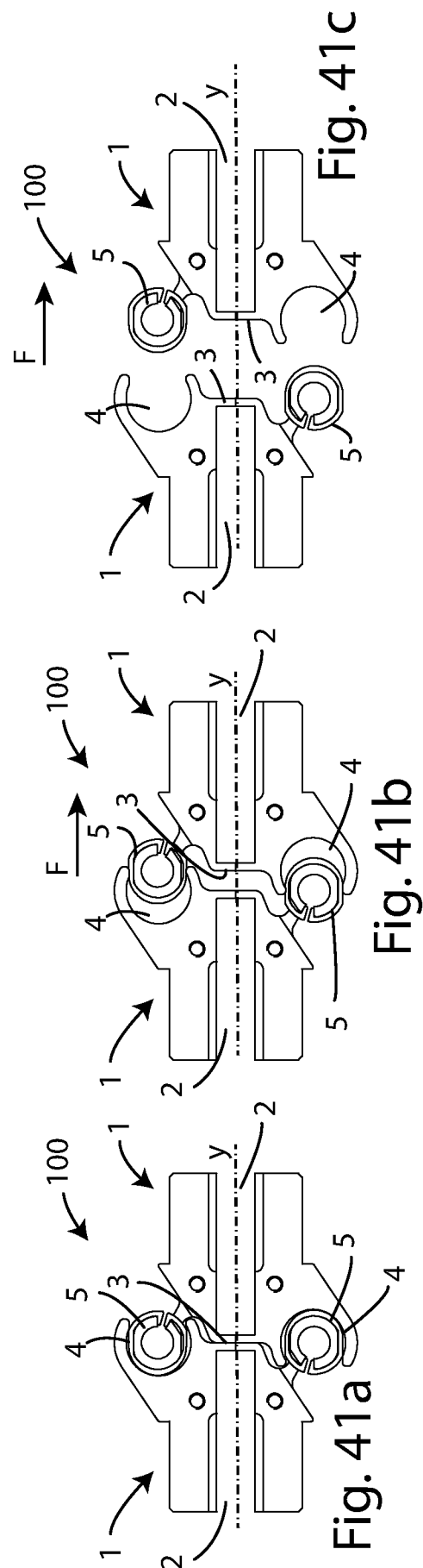
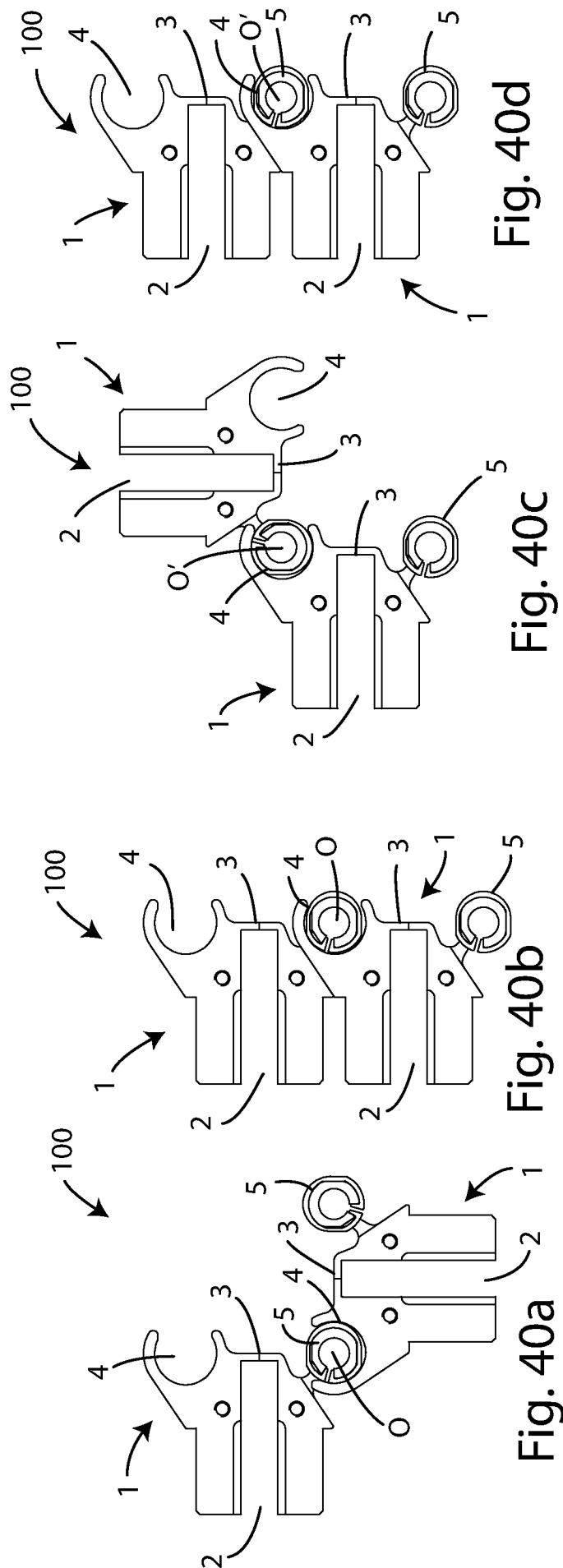


Fig. 39



INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2018/050115

A. CLASSIFICATION OF SUBJECT MATTER

INV. E05D1/04 E05D3/08 E05D15/26 E05D7/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2006/134242 A2 (AIRBUS FRANCE [FR]; GUERING BERNARD [FR]; GROH BERNARD [FR]; BERGERET) 21 December 2006 (2006-12-21) cited in the application page 7, line 4 - page 9, line 9; figure 4 -----	1,2,15
A	US 4 610 289 A (SUGIHARA TOSHIHIKO [JP]) 9 September 1986 (1986-09-09) cited in the application column 2, line 42 - column 3, line 16; figures 6,10 -----	1,2,15



Further documents are listed in the continuation of Box C.



See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search

24 September 2018

Date of mailing of the international search report

04/10/2018

Name and mailing address of the ISA/

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Authorized officer

Guillaume, Geert

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IT2018/050115

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