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(54) **Structural beam system**

(57) The invention relates to a load-bearing structure for a building comprising a first set (1-1) of beams arranged substantially horizontally and a second set (1-2) of beams arranged at right angles in relation to the first set (1-1) of beams, said first (1-1) and second (1-2) sets of beams forming a frame, which confines a number of rectangular sections. Each frame section can be occupied by a panel, such as an infill, a window (I,II,III,IV,V,VI), a door or a solar energy collector. The beams of at least one set is provided with one or more feathers (3-1),(3-3), which in the mounted state, projects at substantially right angles to the frame plane, runs along substantially the entire length of the beam in parallel with the length axis thereof along the side of the beam so that no part of the feather projects above the upper level of the frame, and defines a groove (3-2),(3-4) running in parallel with the length axis of beam, the groove (3-2),(3-4) being located between the main portion of the beam and the feather (3-1),(3-3). Feathers (3-1),(3-3) and grooves (3-2),(3-4) may be provided on both sides of the beams. Windows (I,II,III,IV,V,VI) or other types of panels are mounted on the load-bearing structure by fitting grooves in the window frame or mounting brackets (3-6) secure thereto over the beam feathers (3-1),(3-3).

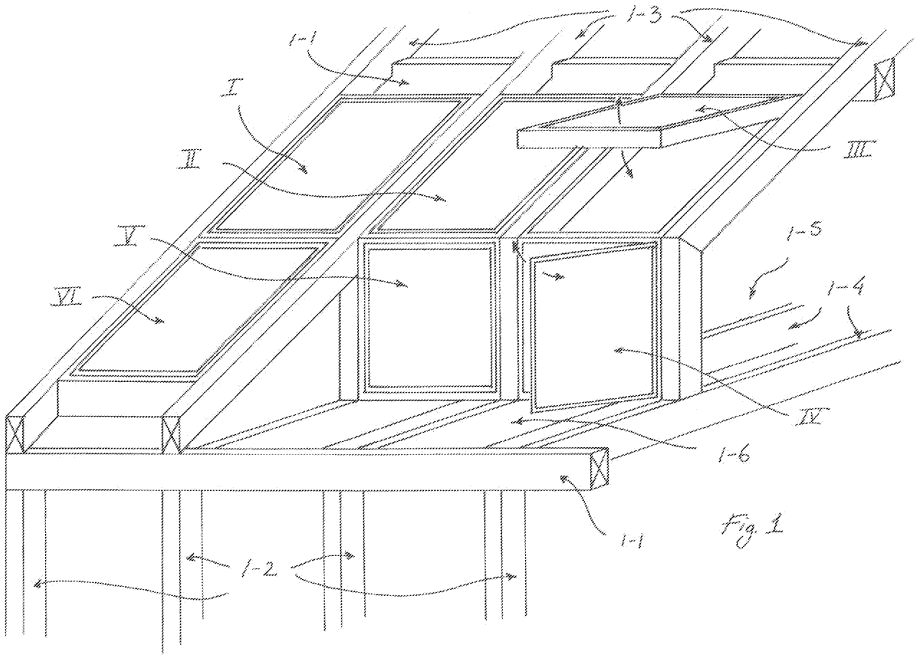

Fig. 1

EP 1 978 176 A2

Description

[0001] The present invention relates to a load-bearing structure for a building comprising a first set of beams arranged substantially horizontally and a second set of beams arranged at right angles in relation to the first set of beams, said first and second sets of beams forming a frame, which confines a number of rectangular sections that may each be occupied by a panel, such as an infill, a window, a door or a solar energy collector. Furthermore the invention relates to a building envelope component and to a method of mounting a panel.

[0002] Systems of this kind are known from half-timbered houses, where the supporting walls are made from a number of vertical posts, horizontal beams and inclined braces forming a load bearing lattice. The spaces between these load bearing timber elements are occupied by infill panels, normally made from brickwork, or by windows, doors and the like. In this manner the half-timbering may be seen as a grid, which is fitted with suitable panels depending on the intended use of a particular section. The method thus provides a very flexible system, where windows, doors and like panels can be placed very freely and where it is relatively easy to rearranged the design later on, which is e.g. not possible when using concrete elements.

[0003] Building houses using half-timbering, however, tends to be quit costly. This is due the fact that the infill panels are constructed in-situ and that windows and doors are positioned by means of wedges and then fastened using nails or screws. This process is cumbersome and labour-intensive and must normally be performed by skilled craftsmen.

[0004] It is therefore the object of the invention to provide a load-bearing structure, where the completion of the sections confined by the beam frames can be done in a more cost-effective manner.

[0005] According to the invention this problem is solved by the beams of at least one set being provided with one or more feathers, which in the mounted state, projects at substantially right angles to the frame plane, which runs along substantially the entire length of the beam in parallel with the length axis thereof along the side of the beam so that no part of the feather projects above the upper level of the frame, and which defines a groove running in parallel with the length axis of beam, the groove being located between the main portion of the beam and the feather.

[0006] This configuration allows windows and other panels to be arranged in relation to the frame by positioning them in relation to the feather. Preferably the panels are provided with grooves, which may be fitted over the feathers using a "groove and tongue"-technique, but the feathers may also serve as guides for mounting brackets of various kinds. As for windows they may be constructed with a groove in their stationary frame, whereas infill panels may be constructed as prefabricated panels containing insulation, weather screen etc. and having a groove and/or a number of mounting bracket fitting over the beam feathers.

[0007] All beams may be provided with feathers and grooves leading to a particularly precise positioning of the panels but it may also be advantageous that only the second set of beams is provided with feathers and grooves, since the panels may then be slit into place guided by the feathers.

[0008] The beams defining the outer boundaries of the frame usually need only have a feather on the side facing the confined sections, whereas the remaining beams, facing panel sections on both sides, are advantageously provided with feathers and grooves on both sides. If using two different kinds of panels in two neighbouring sections it may be advantageous that the feathers and/or the grooves on the two sides are located at different levels in relation to the frame plane as it is then possible to compensate for differences in e.g. installation depths. It is thus to be understood that beams belonging to the same set of beams may have different configurations, including a different number of feathers.

[0009] The dimensions of the feathers and grooves depend on a number of factors such as the necessary strength and rigidity. For softwood beams of the type usual used for the construction of residential buildings the feathers will usually have a width in the plane of the frame of approximately 5-30 mm, preferably approximately 5-15 mm, more preferred approximately 10 mm, whereas the grooves will have a width in the plane of the frame of approximately 5-30 mm, preferably approximately 10-20 mm, more preferred approximately 15 mm.

[0010] If using the load-bearing structure in facade, where the beams are exposed to the weather they may advantageously be provided with a drainage groove in the top side seen in relation the frame plane. Depending on the material used for the beams, the drainage groove may in itself serve as a gutter or a trough shaped covering may be employed.

[0011] The load-bearing structure according to the invention may be used for the construction of partitions such as walls, roofs or floors. It may therefore comprise further sets of beams arranged at right angles in relation to the first set of beams and inclined in relation to the second set of beams, said beams forming two or more non-parallel frame portions. Typically a building may comprise two oblique frame portions serving as the two faces of a pitched roof and two or more vertical frame portions serving as exterior walls.

[0012] The object of the invention is further met by a building envelope component such as a wall or roof element comprising a load-bearing structure according to any of the preceding claims and a window occupying a section of the frame, said window comprising a stationary frame with grooves running along the length axis of the at least two parallel frame members, and where the window is mounted on the load-bearing structure by the grooves of the window frame fitting over the feathers of the beams of the load-bearing structure. Common type

roof windows are usually provided with a groove for the introduction of side liners and these grooves may thus in stead be used as mounting grooves fitting over the feathers as will be explained later.

[0013] The terms "component" and "element" are to be understood as sections of a building constructed by traditional methods on site as well as prefabricated elements.

[0014] The invention will now be described in detail with reference to the accompanying drawing, in which

Fig. 1 is a principle sketch in perspective view of a building constructed with a load-bearing structure according to the invention,
Fig. 2 is a cross-sectional view in a roof construction,
Fig. 3a-d cross sectional views of the different kinds beams used in the construction shown in Fig. 2, the location of each beam being marked with circles in Fig. 2,
Fig. 4 a perspective view of a common type roof window, which may be used as a panel according to the invention,
Fig. 5 is a perspective view of the first hinge part according to the alternative description regarding panel I,
Fig. 6 is a perspective view, from another angle, of the first hinge part shown in Fig. 5,
Fig. 7 is an exploded perspective view of the first hinge part shown in Fig. 5, and
Fig. 8 is a perspective view of the second hinge part.
Fig. 9 is a sectional view of the upper part of an upper roof window, where a locking assembly according to the description is in its closed position,
Fig. 10 is a sectional view corresponding to the one in Fig. 9, but where the locking assembly is in its open position,
Fig. 11 is a plane view of the strike plate seen from below.
Fig. 12 is a plane view of a part of the locking assembly seen from below.
Fig. 13 is a plane view of a part of the locking assembly seen from above,
Fig. 14 is a perspective view of an encased operator hinge.
Fig. 15 is a perspective view of a hinge for connecting the operator member to the sash.
Fig. 16 is a plane view seen from the side of the hinge shown in Fig. 15.
Fig. 17 is a perspective view of a liner for the actuator slide.
Fig. 18 is a perspective view of a pawl liner.
Fig. 19 is a schematic side elevation, partially in section, of one of the top corners of a top-hung window according to the description.
Fig. 20 indicates the arrangement of the intermediate sash according to the description regarding panel II.
Fig. 21 is a side elevation of a hinge fitting according to the description regarding panel I.
Fig. 22 a perspective view of a part of a window frame element,
Fig. 23 a perspective view of a hinge for a side-hung window,
Fig. 24 a detailed perspective view of the joint between two frame elements of panels III and IV prior to assembly,
Fig. 25a-e further perspective views of the joint in Fig. 24 at different stages of assembly,
Fig. 26 a cross sectional view of the joint between two roof windows mounted one above the other in a pitched roof,
Fig. 27 a cross sectional view of the joint between two windows mounted one above the other, the uppermost in a pitched roof and the lowermost in a vertical facade,
Fig. 28 a cross sectional view of the lowermost part of a vertically mounted window with coupled sash and frame,
Fig. 29a-b a cross sectional view of two roof windows mounted one above the other in a pitched roof and of a detail of the joint between the two,
Fig. 30a-b a perspective view of a vertical window with an intermediate element for providing a joint with an inclined window mounted above it and of the intermediate element in detail.

[0015] Fig. 1 shows a building constructed by means of the load-bearing structure according to the invention. In this case the structure is composed of four sets of beams, where the first set 1-1 is horizontal defining the shape of the building in the longitudinal direction, the second set 1-2 is vertical forming the exterior walls, the third set 1-3 is inclined at an angle of approximately 45 degrees forming the roof and the fourth 1-4 is also horizontal forming a horizontal division 1-5 and a balcony 1-6. Of cause, the structure shown in Fig. 1 is only a sketch meant to illustrate the principle of the system. It is, thus, to be understood that more beams are needed for the construction of an entire building and that the mutual angles and positions of these may vary greatly depending on the architecture. Roofing, walling, flooring, gutters etc. have been left out for the sake of clarity and to allow the beams to be seen. For the same reasons, the beams are depicted as having a rectangular cross-section but it is to be understood that they are provided with feathers according to the invention, which is illustrated in detail in Figs. 2 and 3a-d.

[0016] The spaces between the beams forms sections that are filled by different kinds of panels; in the present case illustrated by windows of different kinds I, II, III, IV, V, VI. It is, however, to be understood that other kinds of panels such as solar energy collectors, showcases, advertisement panel and the like may also be employed and that the sections shown unfilled in Fig. 1 are to be provided with roofing, walling and flooring, preferably in the form of prefabricated cassettes.

[0017] As shown in Figs. 3a-d the beams are provide

with a feather 3-1, which defines a longitudinal groove 3-2. When mounting the panels, these feathers and grooves are used for positioning them, either by fitting with a corresponding set of feather 3-3 and groove 3-4 in the panel sash 3-5 as shown in Fig. 3b or by receiving mounting brackets 3-6 attached to the panel sash as shown in Fig. 3c. Depending on the intended method of mounting the panels may be designed for mounting on feathers along either two or all four of their sides.

[0018] In Fig. 3d the feathers 3-1 and grooves 3-2 on the two sides of a beam are shown as located in different levels in relation to the frame plane as indicated by the broken line. This may is particularly advantageous when the two sections adjacent to the beam is to be filled with different types of panels where the feathers and grooves or mounting brackets of the panels are positioned at different levels in relation to a panel frame. An example is the case, where the section on one side of the beam is to be filled by a roofing panel, while the section on the other side is to hold a window.

[0019] In addition, the beam may, as also shown in Fig. 3d, be provided with a drainage groove 3-7 for draining off rainwater and the like. If using beams of extruded aluminium profiles, as is often the case in the construction of greenhouses and the like, the groove may in itself serve as a gutter. If, however, wooden beams are used, as is often the case in residential or office buildings, the groove should be provided with a covering, which may consist of a plastic material, sheet metal or the like.

[0020] Other types of beams made for instance from steel, concrete or composites of wood and plastic and possibly comprising reinforcing steel profiles may also be employed. In such cases the design of the feathers and grooves may diverge from that shown in the drawing, particularly regarding the relative dimensions thereof, and the need for covering of the drainage groove and possibly other parts of the beams may vary.

[0021] In particular when using panels mounted by means of mounting brackets it may be advantageous that the beams are made from a composite material consisting of a plastic intermixed with wood fibres. Such materials combine many of the advantages of the two materials, thus allowing mounting screws to be driven directly into the beams in the same way as if using all wooden beams and having an increased resistance to moisture.

[0022] Common type roof windows usually comprise a groove 3-4 in the longitudinal direction of each frame member on the side that faces the interior of the building in which the window is installed. In a traditional mounting of the roof window this groove is intended to receive a lining, but it is equally well suited for mounting on a beam feather as explained above.

[0023] A window of this type, which may be used as a panel according to the invention, is shown in Fig. 4. It comprises a stationary frame 4-1, 4-2, 4-3, 4-4 and a sash 4-5, 4-6, 4-7, 4-8, the latter supporting a pane of glass 4-16. The frame and the sash each comprises a horizontal bottom member 4-2, 4-6, a pair of parallel side members 4-3, 4-7; 4-4, 4-8 and a horizontal top member 4-1, 4-5.

[0024] The frame and sash members are usually made from painted pinewood profiles or from plywood coated with polyurethane, but other embodiments such as all-plastic or aluminium profiles also occur.

[0025] In most cases the window is openable. The sash is then connected with the frame by means of a set of hinge fittings 4-9 defining a hinge axis 4-10, which may be parallel to either the top and bottom members or to the side members. The hinge axis may be located closely to the frame and sash either at the top, the bottom or one of the sides, but in common type roof windows it is usually located substantially halfway between the top and bottom members as shown in Fig. 4. The hinge axis may also be displaceable during opening e.g. by providing the window with a pair of sash arms, which, as will explained later, displaces the centre of rotation e.g. from the top of the window to the centre during opening.

[0026] Hinges normally comprise a first hinge part for fastening to the frame, and a second hinge part for fastening to the sash. Each hinge part may be provided with fastening means such as spigots intended to be inserted into corresponding bores in the frame and sash side member, respectively. In addition each hinge part often comprises a base plate having a number of apertures intended to receive screws or like fastening means to be secured to the frame or sash member.

[0027] For opening and closing the window, vertical facade windows and top-hung roof windows comprise a handle positioned at a side sash member or at the bottom sash member depending on the location of the hinge axis. Said handle provides a locking action of the sash relative to the frame by way of a connected pawl engaging corresponding grooves in a keeper mounted on an adjacent frame member. Locking mechanisms of this type are commonly known as cremone bolts. Securing of the sash in relation to the frame is often possible in two distinct positions, namely, a closed position and a ventilation position.

[0028] Centre-hung roof windows are opened and closed by means of an operator member, which is accessible from the inside of the window and usually arranged at the top sash member. The operator member is connected to a locking control mechanism as will be explained later.

[0029] On the exterior each of the frame and sash members are shielded from the weather by means of a series of covering members usually made from thin metal sheeting. The covering usually comprises a hood-like upper covering cap 4-32 for covering the frame top member 4-1, a glazing profile 4-15 for covering the joint between the window pane 4-16 and the sash members 4-5, 4-6, 4-7, 4-8, side covering members 4-11 for covering the side of each frame side member 4-3, 4-4 facing away from the window pane and protruding from the roofing (not shown), side cap members 4-20, 4-21 overlapping the glazing profile and side covering member and a pair

of lower covering members 4-12, 4-17 covering the bottom members of the sash and the frame.

[0030] If the window is centre-hung, as is the case with most roof windows, two side cap members are arranged at each side, one 4-20 above the other 4-21 to thereby allow opening of the window.

[0031] To weatherproof the point where the window and the surrounding structure, e.g. roofing or walling, meet a set of flashing members are attached to the exterior side of sash. Such a set normally comprises a top member, a bottom member and two side members each corresponding to one of the sash members, but additional flashing members may be necessary depending on the site of installation. Likewise additional or alternatively shaped flashing members may be employed when installing the window in close connection with another window as will be explained later.

[0032] The covering and flashing members may be connected to the frame and sash members by means of screws, by integral engagement means for snapping engagement with an engagement means secured to the sash or frame or by fittings in fixed connection with the frame or sash. If using screws or the like the frame may, depending on the materials used, comprise pre-bored grooves in which bearing bushings made of a plastic material are arranged for receiving the screws.

[0033] Sealing elements are provided at the points where the cap members meet, at the lower ends of the lower cap members, where the glazing profile meet the pane and between the sash and the frame.

[0034] The windows may be fixed to the supporting beam structure by means of mounting brackets. These brackets usually consist of angular sheet metal provided with holes for receiving screws or similar fastening means. Examples of mounting brackets 22-2 may be seen in Fig. 22 and 30.

[0035] In the following the windows I-VI illustrated as examples of panels in Fig. 1 will be described in closer detail.

[0036] Panel I is a roof window in accordance with the standard description above. Characteristic of this window is that it is a centre-hung, horizontally pivoting upper roof window. This window is in addition to that prepared for electric operation. Panel I is made from a wood-base core, such as plywood, coated with a plastic material, such as polyurethane, and is applicable for roof pitches of 15 to 90 degrees.

[0037] Panel I comprises covering members or cap members as described in the standard description and as depicted in Fig. 4; however, the upper cap members 4-20 (above the pivot axis 4-10) are secured to the upper part of the frame side members to make opening of the window possible.

[0038] As mentioned in the standard description above, the window comprises a set of hinge fittings for mounting the moveable sash in the stationary frame. Said hinge fittings will be described in further detail below with reference to Figs. 21 and 5 to 8.

[0039] In Fig. 21, a hinge fitting for a pivotal window is shown, comprising a first hinge part 21-1 which with a base plate 21-2 is adapted to be fastened on a not shown side element of the window frame, and a second hinge part 21-3 which also with a base plate is adapted to be fastened on a corresponding sash side element, neither shown. A corresponding, but mirror-inverted hinge fitting is mounted on the opposite pair of frame and sash side elements to determine the pivot axis.

[0040] On the base plate 21-2 of the first hinge part 21-1 by means of rivets or screws 21-5 and in a distance from the base plate 21-2, there is fastened a plate member 21-6 with a circular arc-shaped aperture which forms a guide means or a guidance 21-7 for a slide rail 21-8 essentially uniform herewith on the second hinge part 21-3 during a part of the opening and closing movement of the window. The slide rail 21-8 is by means of a hinge pin 21-9 pivotally connected to the base plate 21-4 of the second hinge part 21-3, which in addition has a guide pin 21-10, the function of which will be explained in the following.

[0041] The convex side or wall 21-11 of the guidance 21-7 comprises in addition to the plate member 21-6 one or more discs provided between the plate member 21-6 and the base plate 21-2, and which with the plate member forms an abutting surface for the guide pin 21-8 and the guide pin 21-10, whereas in the concave side between the plate member 21-6 and the base plate 21-2, there is inserted a spring device comprising a leaf spring 21-12 which with its folded ends is clasped on the exterior rivets 21-5 in this side and which is less curved than the guidance 21-7 such that its middle portion projects into the guidance.

[0042] In the position shown in Fig. 21, the window sash and thus the second hinge part 21-3 are turned out to an opening angle of about 135° from the closing position. e.g. with a view to cleaning the outside of window.

[0043] The principle of operation of the hinge shown in Fig. 21 corresponds to that for the pivot hinge described in the following with reference to Figs. 5-7.

[0044] An alternative embodiment of the hinges is described in Figs 5-7, in which said first hinge part 5-100, which is connected to the frame, comprises three main components, namely a base member, a top member and an intermediate member 7-130.

[0045] Said base member comprises a base plate 7-101 having a number of fastening means in the form of apertures 5-102 and spigots 7-103 as explained above. Furthermore, the base plate is provided with a track 7-104 having substantially the same shape as a guidance of the intermediate member (which will be described in further detail later). Said track is surrounded by a depressed portion 7-105 and an inclined portion 7-106.

[0046] Said top member comprises a plate part 7-110 and a disc part 7-120, the latter of which is inserted between the plate part and the intermediate member. The plate part comprises an arc-shaped track 7-111 having

a concave side 7-112 and a convex side 7-113 and extends between an inlet end 7-114 and a bottom end 7-115. In addition, the track defines an open section 7-116, which is open in the concave side of the track. Between the inlet and the open section, the plate part has a bridge section 7-117 spanning the gap between the concave side and the convex side.

[0047] In the following section, some elements will be described with reference to the position they have in Fig. 7, e.g. upper, lower, left-hand and right-hand. These references are made with a view to a proper description only, as the hinge fitting may assume other orientations in its mounted position.

[0048] Said intermediate member 7-130 comprises a bottom plate portion 7-131 having an extension corresponding to a substantial part of the base plate forming the base member. A convex guidance portion 7-132 is formed at the upper side of the bottom plate portion 7-131. The right-hand end of the convex guidance portion is joined to an upstanding wall portion 7-135. The height of the upstanding wall portion corresponds to the distance between the base member and the top member. Adjacent to the upstanding wall portion, a cladding-supporting portion 7-134 is formed intended for accommodating fastening means, e.g. a screw, for supporting the cladding, which, as explained above, protects the frame against the weather. In the left hand side of the bottom plate portion, a guide block portion 7-133 is formed, which forms part of the concave side of the guidance. Furthermore, the intermediate member has another upstanding wall portion 7-137, among other things serving as protection of the guidance against the intrusion of e.g. fingers and/or dirt.

[0049] The intermediate member is provided with a plurality of through-going holes 7-136, and the intermediate member is connected with the base member and the top member by means of a plurality of rivets 7-140 extending through said through-going holes.

[0050] The base member and the top member are made of a metal alloy, while the intermediate member is made as an integral piece of a plastic material.

[0051] In order to provide a braking action during movement of the sash with respect to the frame, a leaf spring 7-125 is positioned with folded ends clasped on the outer-most of said rivets. The leaf spring is made from spring steel, which has been subjected to surface treatment. The spring may have other forms depending on the braking action desired.

[0052] Referring now to Fig. 8, said second hinge part 8-200 comprises a base plate 8-201 having a number of apertures 8-202, and on its backside a number of spigots. The apertures are intended for receiving fastening means, such as screws, and the spigots are intended to be inserted into corresponding bores in the sash side member. In addition, the second hinge part has means 8-204 for supporting the cladding protecting the sash.

[0053] The second hinge part furthermore comprises a drive pin 8-209, a guide pin 8-210, and a slide rail 8-220. A separate bushing 8-210b has been placed on the guide pin as a wear layer. The slide rail has a first section 8-220a starting at a hinge pin 8-221 connected with the base plate. The slide rail also has a second section 8-220b, which is substantially arc-shaped. Near the free end of the slide rail, a blocking element in the form of a stop pin 8-230 is provided. The stop pin is moveable between two end positions in the transverse direction of the slide rail.

[0054] When closing the window from a widely open position, the sash pivots about the hinge pin 8-221 during the initial part of the closing movement, and during the subsequent part of the closing movement, the guide pin 8-210 is displaced in the guidance followed by the slide rail. The guide pin 8-210 and/or the slide rail 8-220 enter into frictional engagement with the leaf spring 7-125, thus providing a braking effect on the closing movement of the sash with respect to the frame. Said braking effect entails, that the sash may be parked in a desired opening angle with respect to the frame to provide ventilation within a certain interval of the opening angle.

[0055] It is possible to turn the sash almost 180° e.g. in order to allow cleaning the outside of the window. Hereby the slide rail 8-220 and the guide pin 8-210 are displaced in the guidance until the stop pin 8-230 is brought to abutment with the bridge section 7-117. The sash is then pivoted further, whereby the guide pin 8-210 moves out of the guidance at the open section 7-116 until the desired opening angle is obtained.

[0056] This type of upper roof window further comprises one barrel bolt in a sash member and one corresponding barrel bushing in a frame member (in comparison, panel II and III each comprises two barrel bolts and bushings) in order to secure the sash in the above described almost inverted position for easy cleaning the outside of the window.

[0057] In the following sections references will be made to Figs 9 to 18.

[0058] Between the frame top member 9-8 and the sash top member 9-2 a clearance is provided in order to allow space for a locking assembly and for ventilation. Said locking assembly comprises a strike plate 11-7 with stationary locking members 11-71 secured to the frame member 9-8 and a casing 9-4 secured to the sash member 9-2 opposite the strike plate 11-7.

[0059] Said strike plate 11-7 is made entirely of a plastic material. The inner side of the stationary locking members 11-71 of said strike plate describes a smooth, continuously advancing curve for the sake of the movement of pawl members 12-6, which will be described in further detail below.

[0060] Said casing 9-4 encases two pawl members 12-6, each being attached to the casing via a fastening pin 12-64. A part 13-6' of each pawl member projects through a slot 13-41 in the casing 9-4, and each pawl member 12-6 is arranged such that the protruding part 13-6' thereof is movable in said slot 13-41 between a locked position, in which it is adapted to be in locking engagement with said separate stationary locking mem-

ber 11-71, and an unlocked position, in which it is adapted to be released from said locking engagement to allow opening of the window.

[0061] Said slot 13-41 has the shape of a circular section with the same radius of curvature and the same length as the path of the pawl member 13-6', the movement of said pawl member 13-6' in said slot 13-41 being a rotation about the fastening pin 12-64.

[0062] An operator member 9-1 is located on the inside of the window in connection with the sash top member 9-2. When pulling on the operator member 9-1 to open the window, an actuator slide 10-3 that protrudes through a slot 13-42 in the casing 9-4 is moved towards the inside of the window, the operator member 9-1 and actuator slide 10-3 being connected via an operator arm 13-5 by means of an operator hinge 14-1a. Said operator hinge 14-1a is made of metal and is in the case of panel I - not the other panels - encased with a layer of lining material 14-1b.

[0063] Simultaneously, the pawl members 13-6' are being shifted to the unlocked position from the locked position at the other ends of the slots 13-41 in the casing 9-4, the pawl members 12-6 being connected to the actuator slide 10-3 via a locking control mechanism 12-43, 12-44, 12-45 consisting of a system of link joint arms inside the casing, as will be explained later. The pawl members 13-6' are thereby brought out of engagement with the stationary locking members 11-71 projecting from the strike plate 11-7. The slots 13-41, 13-42 in the casing 9-4 through which the pawl members 13-6' and actuator slide 10-3 protrude serve as guide means.

[0064] When closing the window, the pawl members 13-6' come into engagement with the stationary locking members 11-71 of the strike plate 11-7 and are thereby forced to the sides, moving along the slots 13-41 to the locking position. The movement of the pawl members 12-6 are transmitted to the actuator slide 10-3 via the locking control mechanism 12-43, 12-44, 12-45, and the actuator slide 10-3 is pulled in a direction away from the inside of the window to a position further away from the inside of the window. The pawl members 13-6' are now located behind the stationary locking members 11-71 of the strike plate 11-7 thereby locking the window.

[0065] The actuator slide 10-3 and pawl members 12-6 are interconnected via said locking control mechanism 12-43, 12-44, 12-45, which consists of said system of link joined arms 12-43, which are spring loaded 12-44, 12-45, and which force the actuator slide 10-3 to move stepwise between three predetermined positions, namely a locking position, an unlocking position and an intermediate ventilation position, while the pawl members move between only two positions.

[0066] To achieve ventilation with only a limited loss of heat, a window with a locking assembly as the one being described may be opened slightly by placing the actuator slide in said intermediate position. The pawl members are not affected by the moving of the actuator slide between its locked position and its ventilating position due to the locking control mechanism.

[0067] The airflow passage between the frame 9-8 and sash members 9-2 on which the strike plate and casing, respectively, are mounted, can in the locked position of the window thus be opened and closed by the pivotal cover member formed by said operator member 9-1.

[0068] The operator member 9-1 is connected to the sash member 9-2 by means of a hinge 15-9. The hinge consists of two hinge parts 15-91, 15-92, which are connected to the operator member 9-1 and the top sash member 9-2, respectively, and which are interconnected by means of a pivot 15-93 projecting through bend back edges 15-94, 15-95 of the two hinge parts. The pivot 15-93 is provided with a plastic coating 16-96 preventing direct contact between the pivot 15-93 and the hinge parts 15-91, 15-92.

[0069] The locking assembly further comprises noise-reducing liners. The noise-reducing liners include a slide liner 17-31 and a pair of pawl liners 18-61.

[0070] Each pawl liner 18-61 is positioned to prevent direct contact between the fastening pin 12-64 and the casing 9-4 and between the pawl member 12-6 and the casing 9-4, respectively. It has the overall shape of an isosceles triangle, where the apex 18-62 envelopes the fastening pin 12-64, the angle between the two legs projecting from the apex 18-62 corresponding to the angle of the circular section covered by the slot 13-41 in the casing, where these two legs extend beyond the third side 18-63 of the triangle, the two extensions 18-65 lining the end sides of the slot, and where the third side 18-63 of the triangle is curved with the same radius of curvature as the slot 13-41, lining the side surface of the slot facing the apex 18-62. To keep the liner secured in relation to the fastening pin 12-64, the liner may have one or more retaining or connecting members.

[0071] The slide liner 17-31 prevents the actuator slide 10-3 from coming into direct contact with the casing, the spring-loaded arms 12-43 and the operator arm 13-5. The slide liner has a base 17-311, which abuts against the spring-loaded arms 12-43, a projecting edge 17-312, which serves as a contact surface with the casing, a pair of projections 17-313 protruding through the slot 13-42 in the casing, and a connecting piece 17-314 projecting into the actuator slide and preventing contact with the operator arm. To make room for the slide liner, the slot 13-42 may be made slightly wider than in the traditional locking assembly so that the effective width of the slot is approximately the same.

[0072] The liners are made from a plastic material having a sufficient strength and resistance to wear.

[0073] As can be seen from Fig. 9, a filter is, by means of a filter rail and filter clips, retained in the hood-like upper cap described above for filtering the air flowing through said airflow passage between the top frame and top sash members.

[0074] This type of window is solely operated by said operator member and does not comprise a cremone-type of handle, unlike panel II and III, which will be described

below.

[0075] Panel II is an upper roof window in accordance with the standard description of a roof window and the description of panel I above. However, panel II differs from panel I in a number of ways, which will be described in the following.

[0076] Characteristic for panel II is, inter alia, that it is a top-hung, horizontally pivoting upper roof window. In the embodiment shown, the window is made from plywood coated with polyurethane and is applicable for roof pitches of 20 to 55 degrees; however, with special springs (said springs will be described later on) it is applicable for roof pitches up to 65 degrees.

[0077] Another difference includes the upper cap member 4-20, which, in order for the window to be openable about its axis defined by its top hinges, is secured to an intermediate sash arm, which will be described in further detail later on.

[0078] In the following sections references will be made to Fig. 19.

[0079] For this type of window, the first hinge part 5-100 of the hinge fitting as described above is not fastened to a frame member but to a member of said intermediate sash.

[0080] Said intermediate sash constitutes a support to said glass-carrying pivotal sash. The pivotal sash is normally connected with the intermediate sash by means of upper closing means, the hinges thus being in use at normal operation of the frame during opening and closing, while the pivoting function is mainly used for cleaning the outside of the glass. The hinge connection between the intermediate sash and the glass-carrying sash employed in this embodiment differs from the hinge connection described above, in that the first hinge part has no actual base member. Instead, the intermediate member is secured directly to the intermediate sash, thus forming one integrated member fulfilling the functions of the above described intermediate member as well as base member. Said integrated member is made entirely out of a plastic material.

[0081] The intermediate sash is supported on each side by lifting arms 19-5 pivotally connected with the sash at one end, and at their other end pivotally connected with slide shoes 19-6, which are displaceable in a longitudinal direction in guide rails 19-7 on the upwards facing sides of the frame. In its side facing the lifting arm 19-5, the slide shoe 19-6 has a hook-shaped recess 19-8 for engagement with a coupling member 19-9. The coupling member is U-shaped and is, in its mounted position, placed in such a way, that the U-branches are positioned on either side of the slide shoe 19-6 and a transverse pin 19-9a between the U-branches can engage with the recess. The upper end of a tie rod 19-10 extends through a hole in the bottom of the coupling member and has a head 19-10a abutting thereon. In its lower end facing away from the hinges 19-2, the guide rail has an end bottom 19-7a firmly connected with a top end of a spring box 19-11 having a U-shaped cross section and guiding an auxiliary spring 19-12. A bottom end of the spring box constitutes an abutment for the top end of a lifting spring 19-13, which at its bottom end has a bush 19-15 with a nut 19-16. The lifting spring can be pre-stressed to a desired value by screwing the nut 19-16 upwards toward the upper end of the tie rod.

[0082] In its wall near the top end 19-11a, the spring box 19-11 has a recess 19-17a for receiving a moveable abutment 19-18. Below the recess 19-17a, in the wall of the spring box 19-11, there is a plurality of successive recesses 19-17b, which are also adapted for receiving the moveable abutment 19-18. The bottom end of the auxiliary spring 19-12 bears against another abutment 19-19 which is stationary with respect to the tie rod 19-10, and can be pre-stressed to a desired value by moving the moveable abutment 19-18 from one recess 19-17a to another recess 19-17b, so that the spring 19-12 will be compressed between the abutments 19-18, 19-19.

[0083] A window of this type comprises a cremone-type handle as described above. The handle is located at the bottom sash member. This is used for normal operation of the window, i.e. opening and closing the window about the axis of rotation formed by its top hinges. However, the cremone-type handle must be in a non-engaging position in order to be able to operate the window by means of the operator member.

[0084] Panel III is an upper roof window in accordance with the standard description of a roof window and the description of panel II above, however, panel III differs from panel II in a number of ways, which will be described in the following.

[0085] Characteristic for this window is, inter alia, that it forms the upper part of a roof balcony. Thus, the frame of panel III differs from the standard frame in that, due to the window's ability to function as an element forming the upper part of said roof balcony, it has no frame bottom member, as this would block the necessary free passage from the interior of the building to the roof terrace.

[0086] This window type is made from surface coated pinewood profiles and is applicable for roof pitches of 35 to 53 degrees.

[0087] The lower roof windows, corresponding to panels IV, V and VI of Fig. 1, are regarding the general frame/sash structure identical with the aforementioned upper roof windows, corresponding to panels III, II and I of Fig. 1 respectively.

[0088] Hence, also the sash of the lower panels may be either movable or stationary with respect to said frame.

[0089] As an example of an element of the type referred to as panel IV, a lower roof window with a movable sash, i.e. a lower roof window that may be opened, shall be considered. The frame and sash structures of such a roof window are separate and said frame does not comprise a top member. In the case serving as example herein the frame and sash are both made of pinewood.

[0090] The parallel, vertical elements of the frame, cf. Fig. 22, comprise a longitudinal groove 22-1 adapted for receiving mounting brackets 22-2 and two bushings each

provided with a threaded inset 22-3. The insets 22-3 are adapted to receive adjustment screws 22-4 for purposes of exact placement of the roof window.

[0091] The horizontal bottom member is preferably made of a more durable material, e.g. hard wood, than the rest of the frame as this element serves as a doorstep for access to e.g. a balcony. The horizontal bottom member furthermore comprises two bushings each provided with a threaded inset 22-3. The insets 22-3 are adapted to receive adjustment screws 22-4 for purposes of exact placement of the roof win-dow.

[0092] The coupling of the parallel, vertical frame to the corresponding part of the upper roof window, and the to this end necessary elements will be described in the following.

[0093] Said moveable sash is side-hung. With reference to Fig. 23 one of the parallel side elements of said sash 23-1 is provided with a set of hinges of which only one 23-2 is shown. Each hinge comprises two hinge parts of which one 23-3 is attached to the sash and the other 23-4 on the adjacent frame element (not shown). The hinge part 23-3 attached to the sash is one-pieced and shaped as an angle iron with one half 23-5 adapted for attachment with the outwards facing part of said side element, and the other half 23-6 being provided with a substantially cylindrical bushing 23-7 with the opening facing downwards when oriented as shown in Fig. 23. The corresponding hinge part 23-4 is identical therewith, except instead of said bushing 23-7 it comprises a substantially cylindrical pin 23-8, which extends in parallel with the length axis of the frame and sash side elements connected by the hinge 23-2. Said pin 23-8 is inserted in the bushing 23-7 in such a way that the two hinge parts 23-3, 23-4 may pivot in relation to each other.

[0094] The opposite parallel side elements of the sash and frame respectively are provided with a handle and a corresponding locking mechanism of the cremone type respectively as described above to operate the opening and closing of the sash.

[0095] With regard to the frame, the now open upwardly facing ends 24-1 of the two parallel side members are bevelled to comprise a pointed end 24-2, which pointed end is displaced slightly towards the outer side 24-3 of the frame. The bevelling 24-4 towards the outer side 24-3 of the frame comprises a larger slope than the bevelling 24-5 towards the inner side 24-6.

[0096] Similarly for the corresponding upper panel, the frame and sash structures are separate and the frame does not comprise a bottom member. Similarly, the now open downwardly facing ends 24-7 are bevelled identically with their counterparts 24-1 on the lower panel. Said bevellings of said frame elements are provided to enable mounting of said panels in an angle with respect to each other.

[0097] Furthermore said open upwardly facing ends 24-1 of said frame comprise fittings 24-8 secured on the surface facing away form the sash (cf. Fig. 24). Said fittings 24-8 are intended to be coupled to corresponding fittings 24-9 on the corresponding surface of the open downwardly facing ends 24-7 of the corresponding two parallel side members of the upper panel.

[0098] The fittings 24-8 provided on said open upwardly facing ends 24-1 of said frame may for example be U-shaped with the bottom part 24-10 of the U intended to be coupled to said corresponding fitting by the use of screws or the like. To this end the U-shaped fitting/mounting is provided with a set of threaded holes 24-11. Furthermore said fitting/mounting is provided with an indentation 24-12 so formed that its protrusion on the inside of said fitting 24-8 will engage with a corresponding indentation 24-13 in said corresponding fitting 24-9. Furthermore the open ends 24-1, 24-7 in connection with bevellings 24-5 and 24-14 respectively comprise indentations 24-15 and 24-16 respectively shaped substantially as a keyhole halved along its longitudinal axis.

[0099] With reference now to Figs. 25a - 25e, the indentations 24-15 and 24-16 are placed with the top, 25-1 and 25-2 respectively, of the keyhole nearest the point 25-3 of the respective open ends 24-1 and 24-7 respectively, and lying along the least sloping of the said bevellings 24-5 and 24-14 respectively. The indentations are so placed as to bear against each other to form the shape of an entire keyhole, when the upper and lower panels are placed angled with respect to each other in their intended mounting position, cf. Figs. 25a and 25b. When placed in said position, the now keyhole shaped indentation is intended to receive a correspondingly shaped mounting 25-4 shown in Fig. 25b, which is secured thereto with screws or the like. Finally a set of covering members, cf. Figs. 25c, d and e, is placed to cover the so joined connection between lower and upper panel. Said set of covering members comprise a member 25-5 to cover said keyhole shaped mounting 25-4, two members 25-6 and 25-7 to cover the upper and lower part of said connection respectively and a supporting member 25-8 to be placed underneath the members 25-6 and 25-7.

[0100] As an example of an element of the type referred to as panel V and VI respectively a lower roof window with a stationary sash, i.e. a lower roof window that cannot be opened, shall be considered. The sash and the frame are in such roof windows provided in one integral piece. In the case serving as example herein the integral sash/frame structure of both roof windows are made of plywood coated with polyurethane.

[0101] Apart from said sash and frame being integral the lower roof windows exemplifying panels V and VI are identical with their counterparts of the corresponding upper roof windows exemplifying panels II and I respectively with the exception of upper horizontal part 27-1 and 26-1 respectively of the frame facing the upper panel. With reference to Figs. 27 and 26 respectively, this surface comprises a cut out 27-2 and 26-2 running along the entire length of the surface. The cut out 27-2 and 26-2 is provided with the shape of a lying U with the upper leg missing. In this cut out is provided indentations and bored holes in-tended for receiving and fastening a gutter-like

flashing member, which will be described later.

[0102] A lower panel adapted to be stationary may generally as shown in Fig. 1 be mounted together with an upper panel such that said panels are either lying in extension of each other in the plane of the roof, which is the case for lower panel VI, or angled with respect to each other such that the lower panel is mounted vertical in a wall and the upper panel is mounted in a roof construction, which is the case for lower panel V.

[0103] Returning to the exemplary roof windows, in the case that the lower and upper roof windows are intended to be mounted lying in extension of each other (panel VI of Fig. 1) in the plane of the roof, said outer surface as shown in fig. 26 further comprises a number of bushings 26-3 adapted to receive screws 26-4 or the like intended to hold together the upper and lower roof windows by protruding through the surface 26-5 at which said panels bear against each other.

[0104] In the case that the lower and upper roof windows are intended to be mounted angled with respect to each other (panel V of Fig. 1) said integral sash/frame structure of said lower roof window as shown in Fig. 28 further bears captive flashings 28-1, 28-2, 28-3 on the out-wards facing side of the bottom element of the frame 28-5, as well as a captive wooden element 28-6 on the underside of said bottom element 28-5 to facilitate the installation process.

[0105] When arranging panels of the kinds described above closely one above another special flashing and possibly also cover members are necessary for weather proofing of the joint. An example of this is shown in Fig. 29a, which is a cross sectional view showing panel I mounted closely above panel VI as illustrated in Fig. 1. Had the panels I and VI been mounted at a distance from each other, panel I would have been provided with a bottom flashing corresponding to the one 29-1 used on panel VI and panel VI would have been provided with a top flashing corresponding to the one 29-2 used on panel I. In the present installation these two flashings members have, however, been replaced by a gutter-like flashing 29-3 which leads rain water and the like of onto side flashing members (not shown) provided along the side sash members of the panel IV. Additionally an extra covering member 29-4 have provided for covering the gutter-like flashing member 29-3 thereby preventing it from being filled with snow, leaves and the like and giving the window assembly an aesthetically more pleasing appearance. Such a gutter-like flashing element is known from e.g. WO2004/055291.

[0106] Fig. 27 shows a detail of the joint between the panels II and V when mounted closely above one another as shown in Fig. 1. Here too an extra covering member 27-3 has been provided for covering the joint, but additional flashing members are not necessary.

[0107] Such a covering member 30-1 is shown in Fig. 30a and in detail in 30b. It comprises a front piece 30-2 adapted to cover the connection between the lower and upper panels seen from the inside. Said piece 30-2 is formed substantially perpendicular to an intermediate element 30-3 adapted to fit in between the respective frame elements of said upper and lower panels in the full length of said frame elements. Said intermediate element 30-3 is on the upwardly facing surface provided with a sealing strip 30-4. Said intermediate element is also provided with indentations (not shown) on the upwardly facing surface and on the surface opposite said piece 30-2, which indentations are adapted to receive flashing elements. Further indentations (likewise not shown) adapted to engage with corresponding indentations on the adjacent surface of the upper horizontal frame element of the lower panel are provided on the downwardly facing surface of said intermediate element. Furthermore said intermediate element is provided with bushings intended to receive screws 30-5 or the like for fastening the covering member to the upper frame element 30-6 of the lower panel. In this case said covering member 30-1 is adapted to function for roof inclinations in an interval ranging form 15° to 55°.

[0108] When mounting windows closely side by side as illustrated in Fig. 1 the side flashing members supplied for each window may be arranged in an overlapping manner, but it is preferred to use a common side flashing with a U-shaped cross section (not shown), where each vertical leg of the U abuts on the side sash member of each window.

[0109] The considerations regarding the covering and flashing of windows given above also applies to other kinds of panels, which do not form part of a weather screen as such, e.g. a solar energy collectors.

Claims

1. A load-bearing structure for a building comprising a first set of beams arranged substantially horizontally and a second set of beams arranged at right angles in relation to the first set of beams, said first and second sets of beams forming a frame, which confines a number of rectangular sections that may each be occupied by a panel, such as an infill, a window, a door or a solar energy collector, **characterized in that** the beams of at least one set is provided with one or more feathers, which:

   in the mounted state, projects at substantially right angles to the frame plane,
   runs along substantially the entire length of the beam in parallel with the length axis thereof along the side of the beam so that no part of the feather projects above the upper level of the frame, and
   defines a groove running in parallel with the length axis of beam, the groove being located between the main portion of the beam and the feather.

2. A load-bearing structure according to claim 1, **characterized in that** all beams are provided with feathers and grooves.

3. A load-bearing structure according to claim 1 or 2, **characterized in that** only the second set of beams is provided with feathers and grooves.

4. A load-bearing structure according to any of the preceding claims, **characterized in that** one or more beams are provided with feathers and grooves on both sides.

5. A load-bearing structure according to claim 4, **characterized in that** the feathers and/or the grooves on the two sides are located at different levels in relation to the frame plane.

6. A load-bearing structure according to any of the preceding claims, **characterized in that** the feathers have a width in the plane of the frame of approximately 5-30 mm, preferably approximately 5-15 mm, more preferred approximately 10 mm.

7. A load-bearing structure according to any of the preceding claims, **characterized in that** the grooves have a width in the plane of the frame of approximately 5-30 mm, preferably approximately 10-20 mm, more preferred approximately 15 mm.

8. A load-bearing structure according to any of the preceding claims, **characterized in that** one or more beams are provided with a drainage groove in the top side seen in relation the frame plane.

9. A load-bearing structure according to any of the preceding claims, **characterized in** a third set of beams arranged at right angles in relation to the first set of beams and inclined in relation to the second set of beams, said beams forming two non-parallel frame portions.

10. A building envelope component such as a wall or roof element comprising
a load-bearing structure according to any of the preceding claims and
a window occupying a section of the frame, said window comprising a stationary frame with grooves running along the length axis of the at least two parallel frame members, and
where the window is mounted on the load-bearing structure by the grooves of the window frame fitting over the feathers of the beams of the load-bearing structure.

11. A method of mounting a panel such as a window on a load-bearing structure
where the load-bearing structure comprises a first set of beams arranged substantially horizontally and a second set of beams arranged at right angles in relation to the first set of beams, said first and second sets of beams forming a frame, which confines a number of rectangular sections, the beams of at least one set being provided with one or more feathers, which in the mounted state, projects at substantially right angles to the frame plane, which runs along substantially the entire length of the beam in parallel with the length axis thereof along the side of the beam so that no part of the feather projects above the upper level of the frame, and which defines a groove running in parallel with the length axis of beam, the groove being located between the main portion of the beam and the feather,
where the panel is arranged in a section of the frame, said panel comprising a stationary frame with grooves running along the length axis of the at least two parallel frame members, and
where the panel is mounted on the load-bearing structure by fitting the grooves of the panel frame over the feathers of the beams of the load-bearing structure.

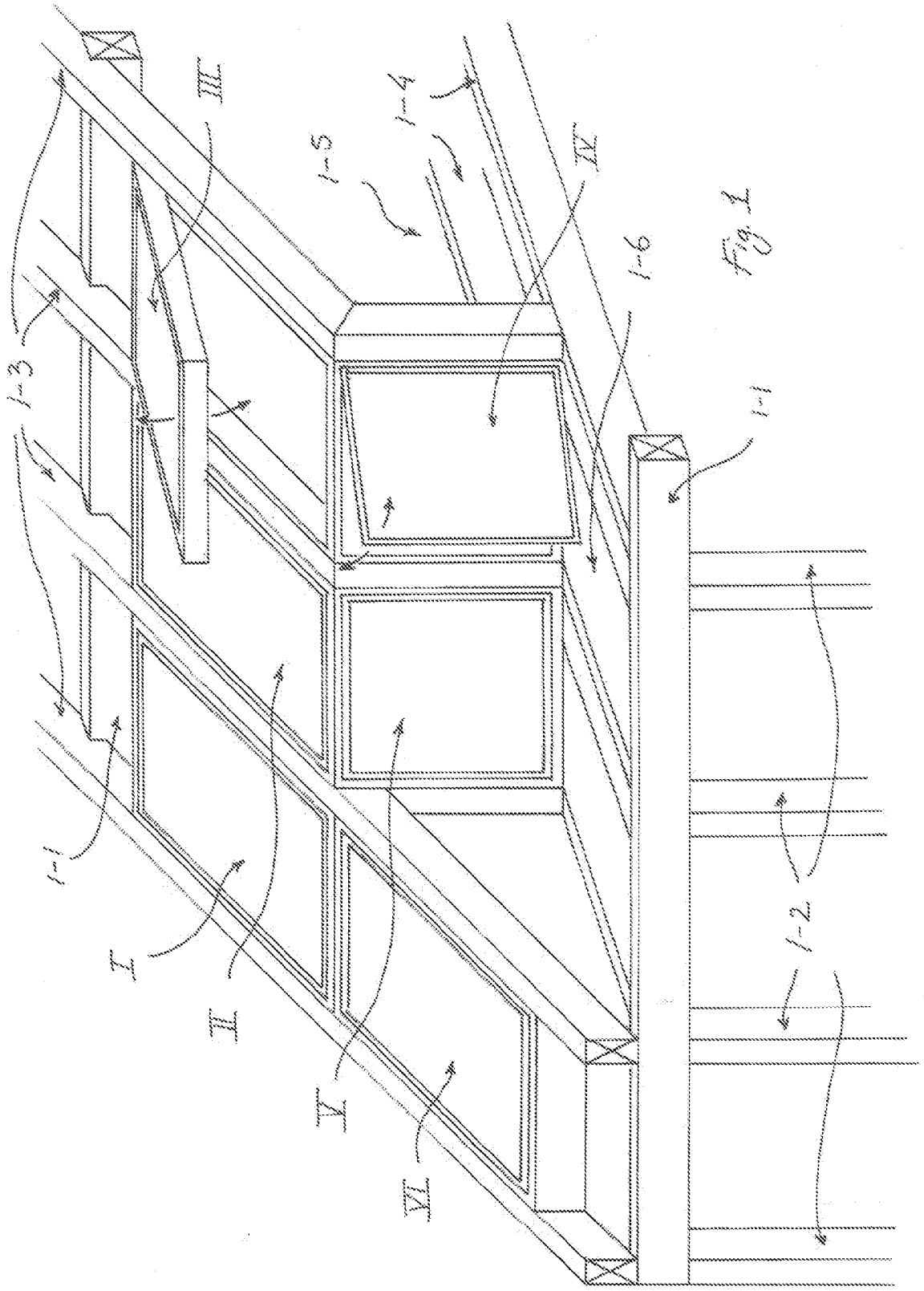

Fig. 1

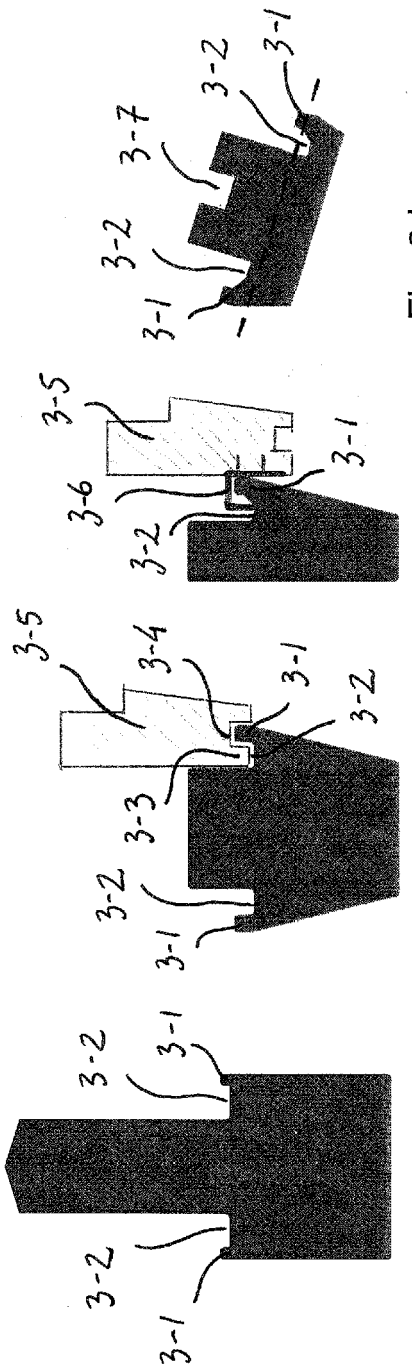
3-2
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Fig. 3a
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3-1
Fig. 3b
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Fig. 3c
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3-1
Fig. 3d

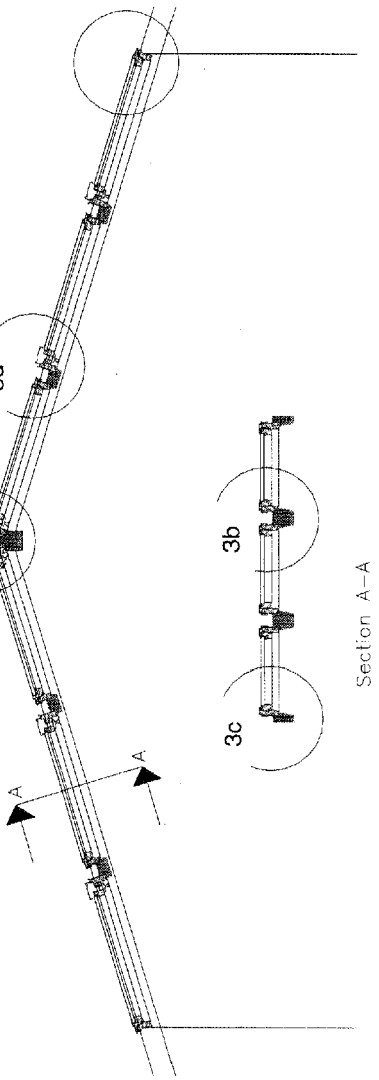
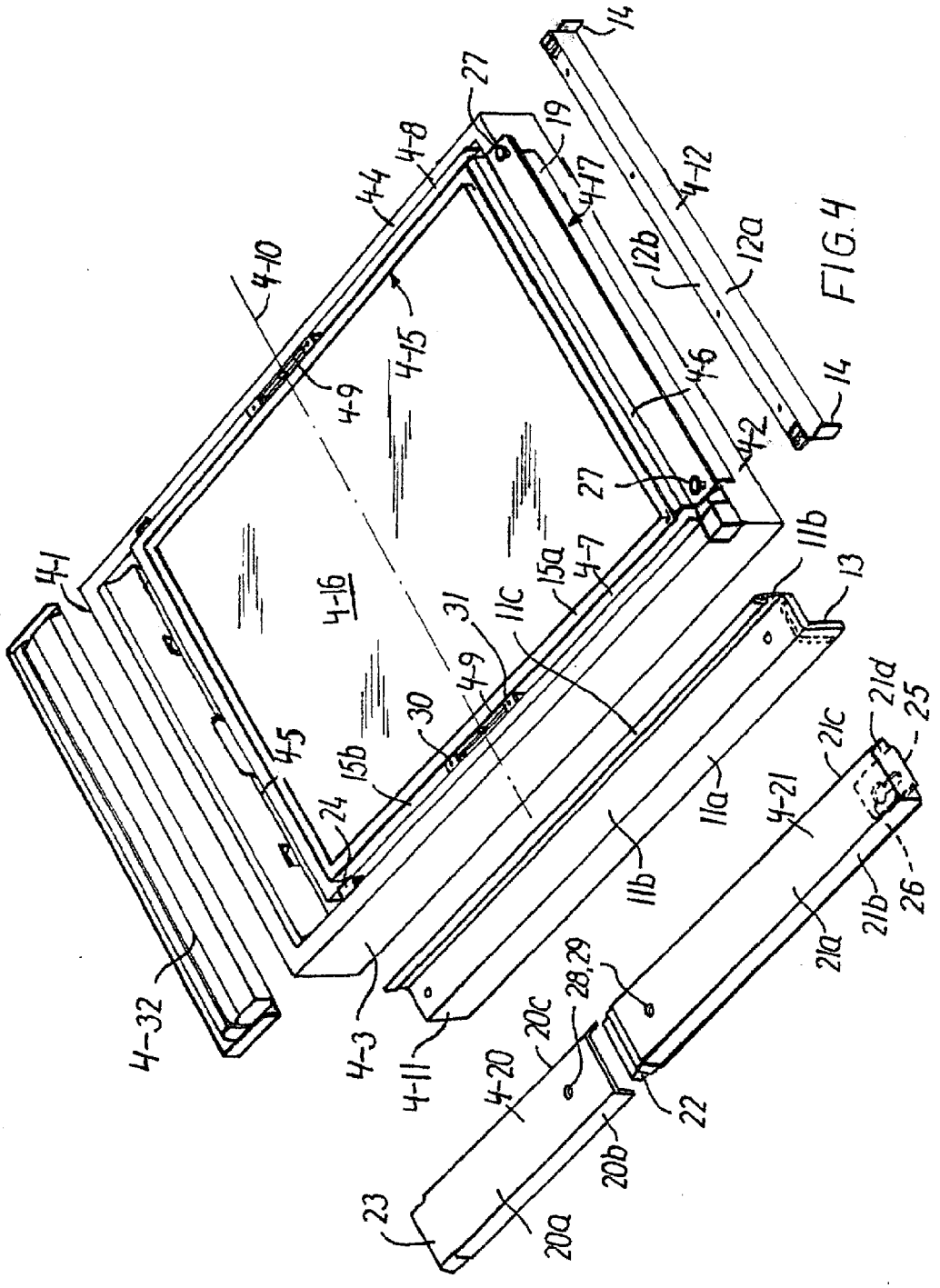

3a
3d
3b
3c
A
A
Section A–A

Fig. 2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11c
4-9
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21c
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11b
26
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22
20b
23
20a

FIG.4

Fig. 5

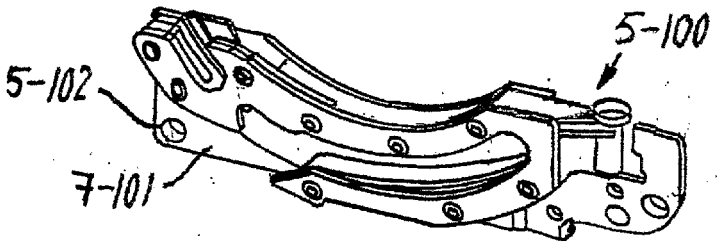


Fig. 6

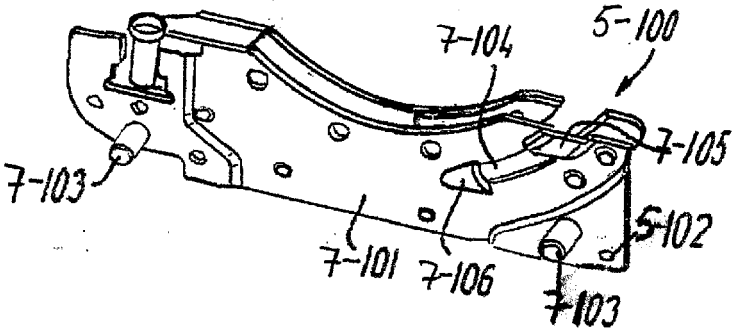
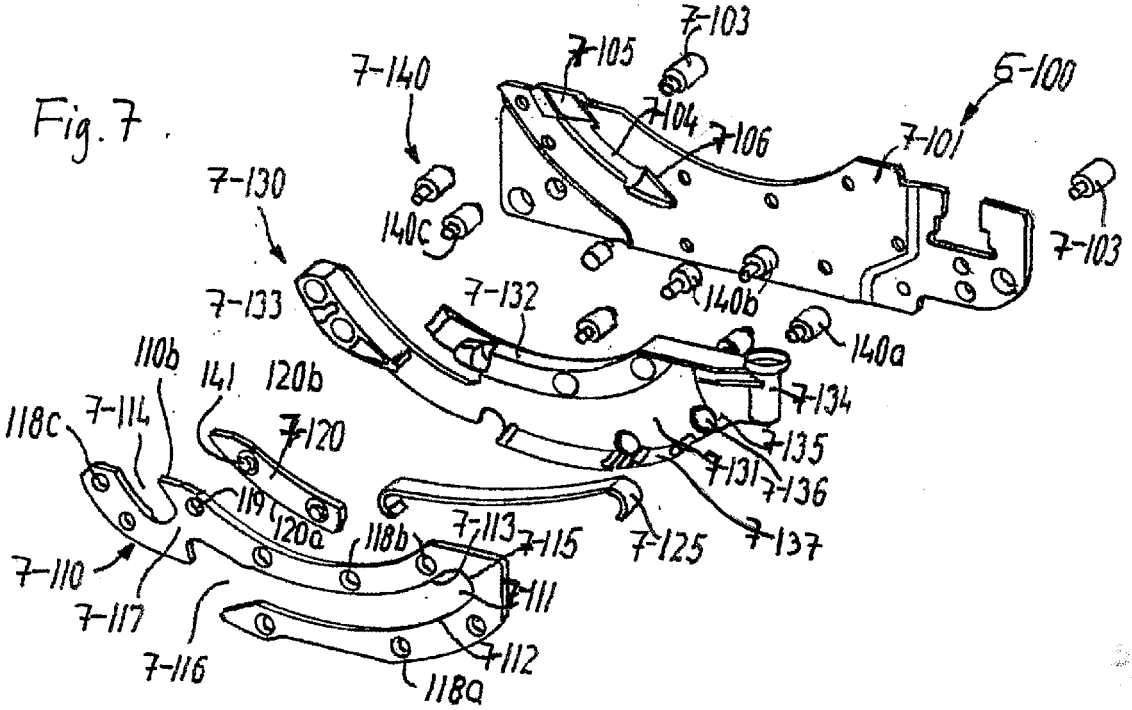


Fig. 7



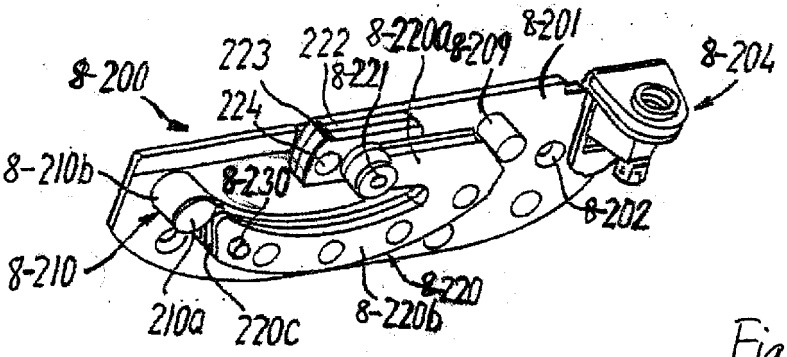

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Fig. 8

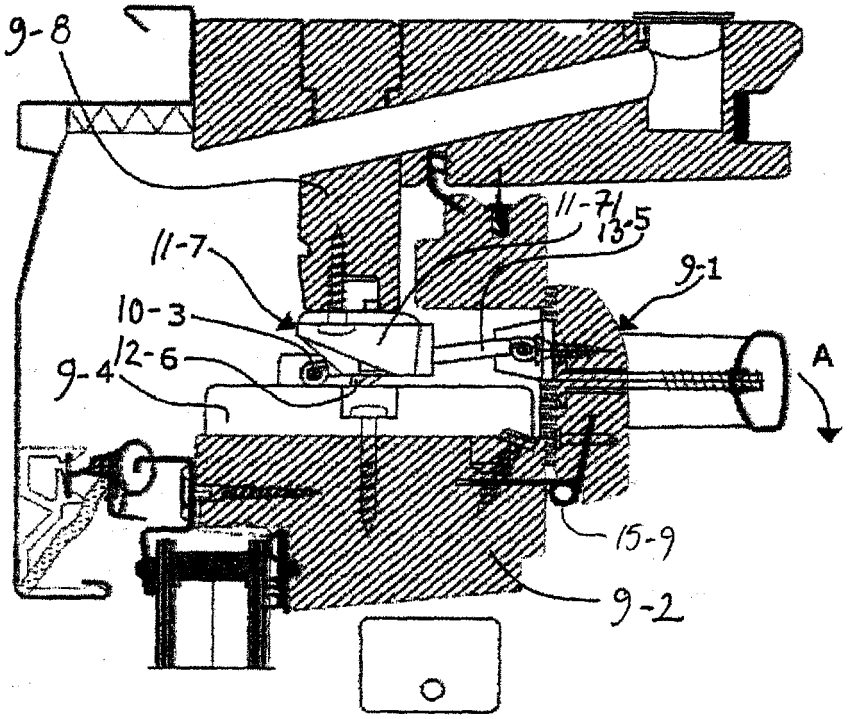
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Fig. 9

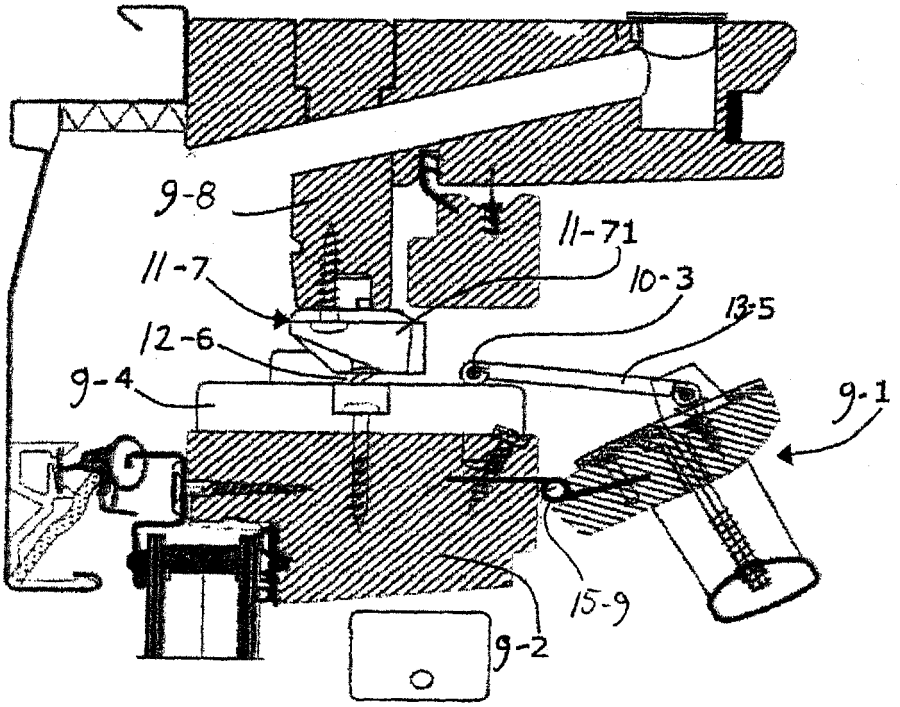
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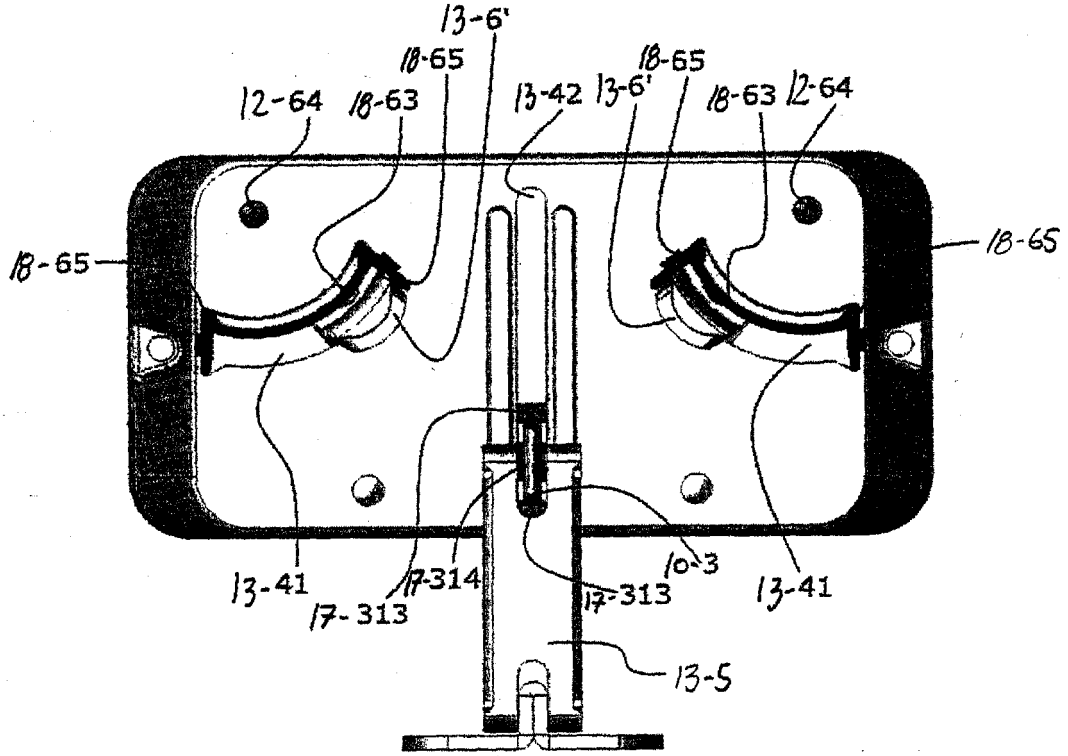
Fig. 10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13-5

Fig. 13

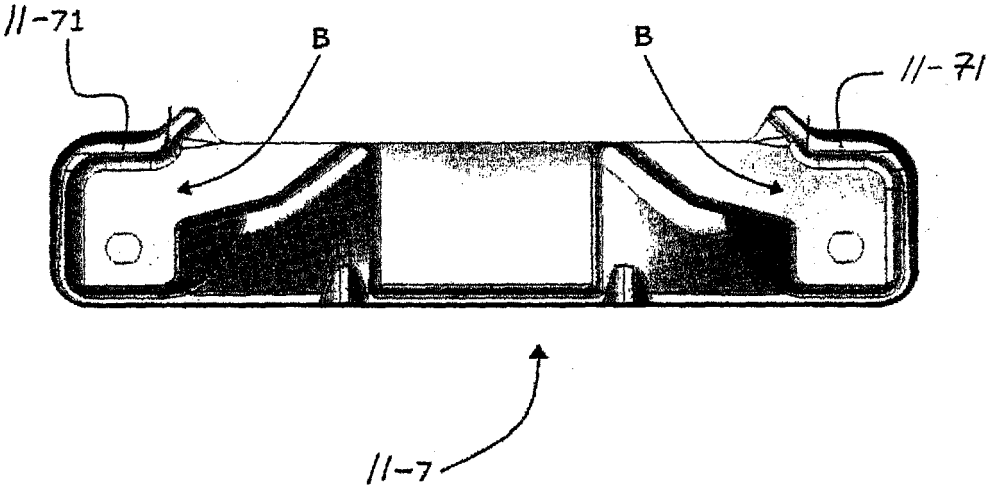
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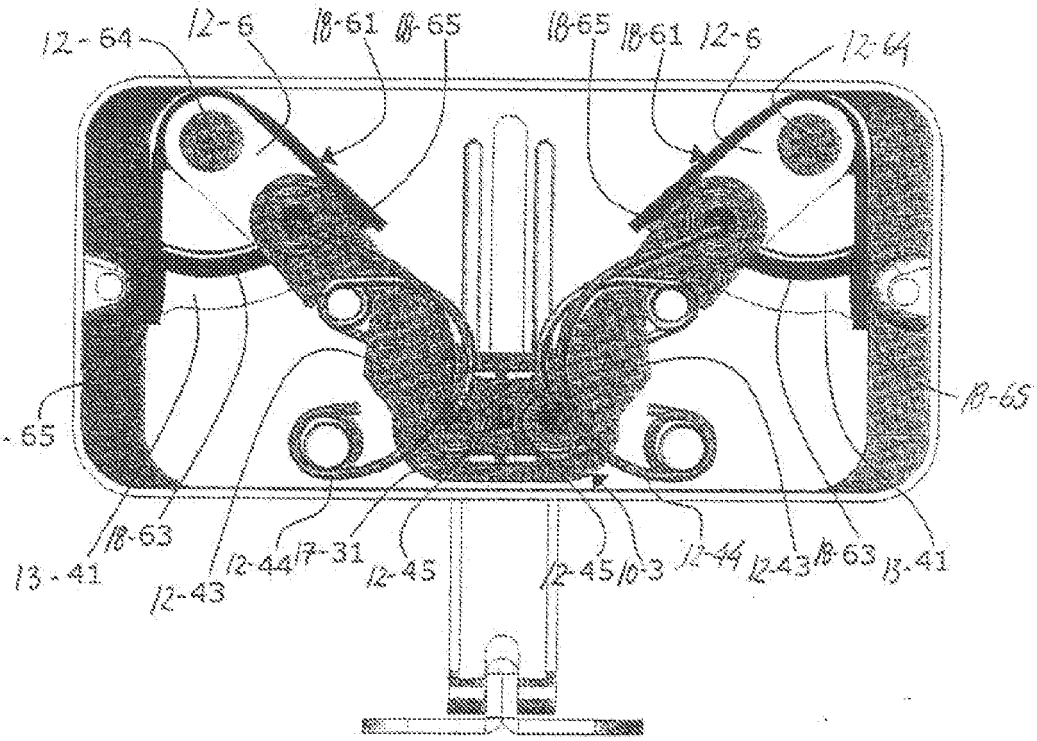
Fig. 11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12-45
10-3
12-44
12-43
18-63
13-41

Fig. 12

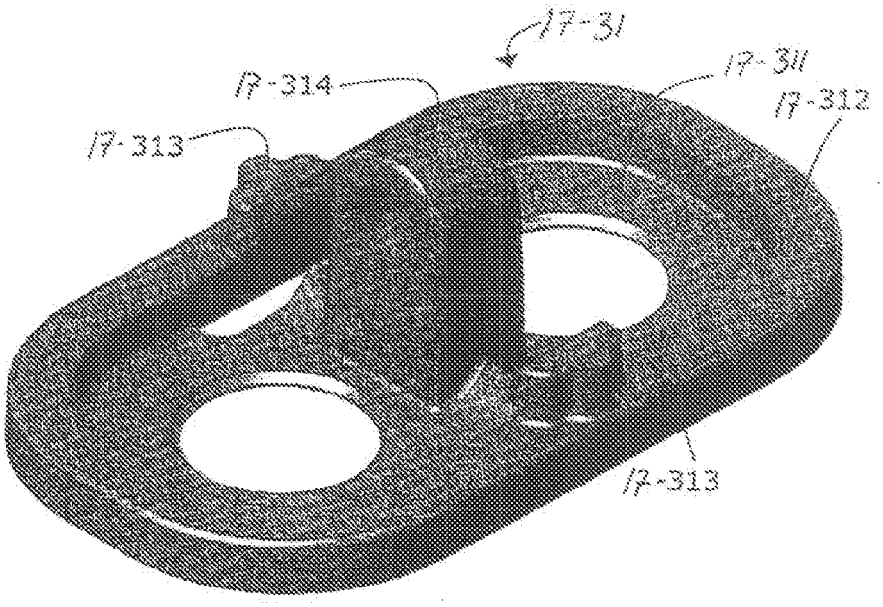
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Fig. 17

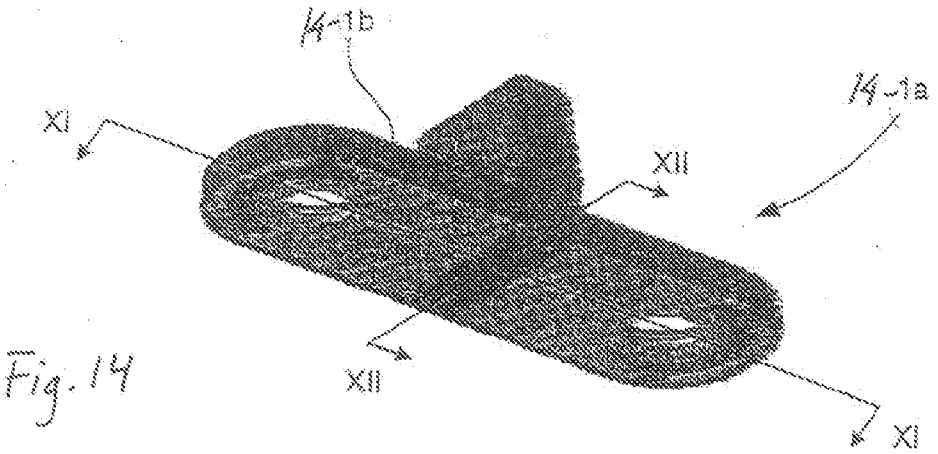


Fig. 14

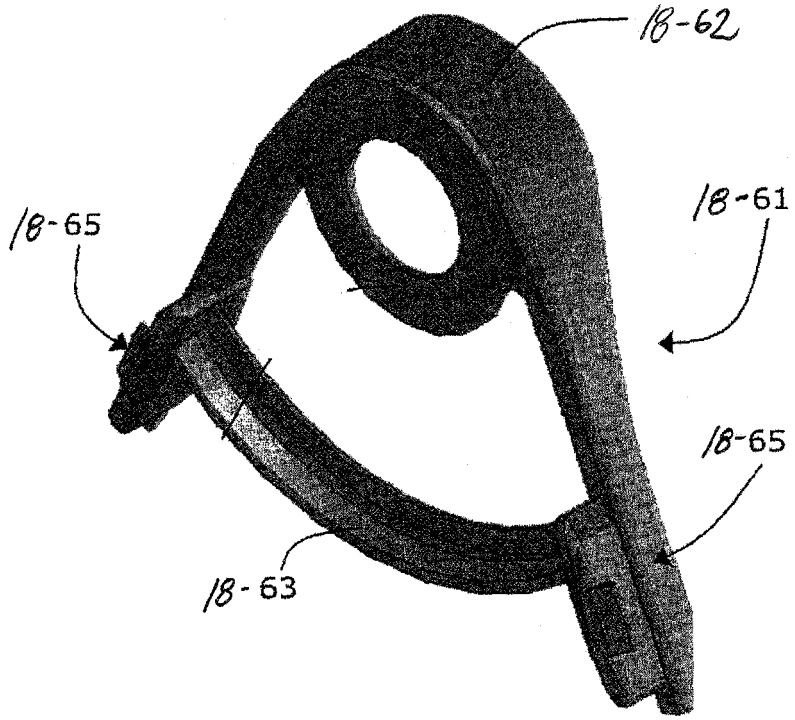
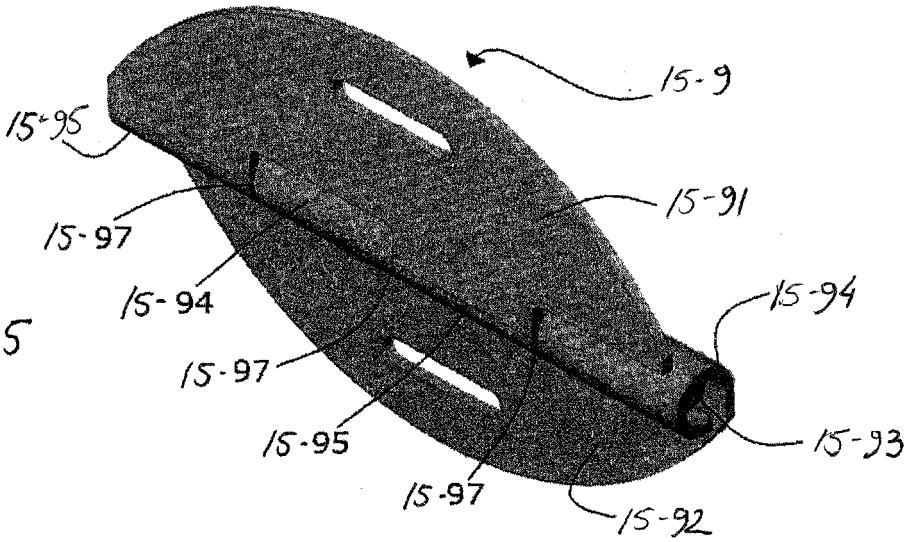


Fig. 18



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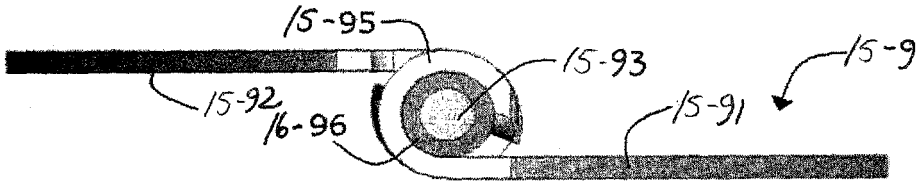

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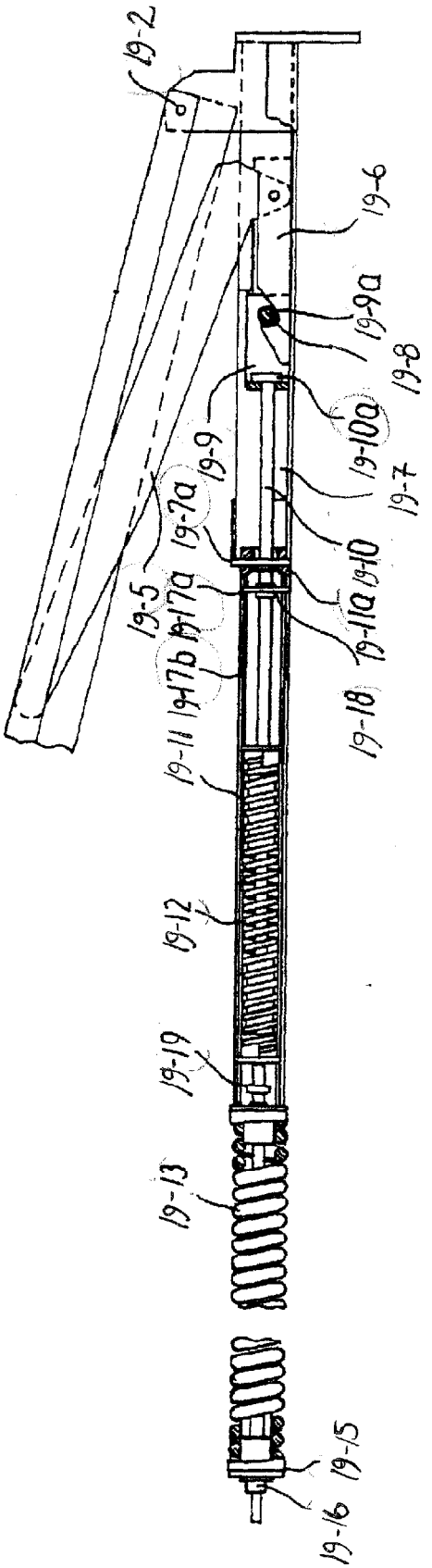
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Fig. 19

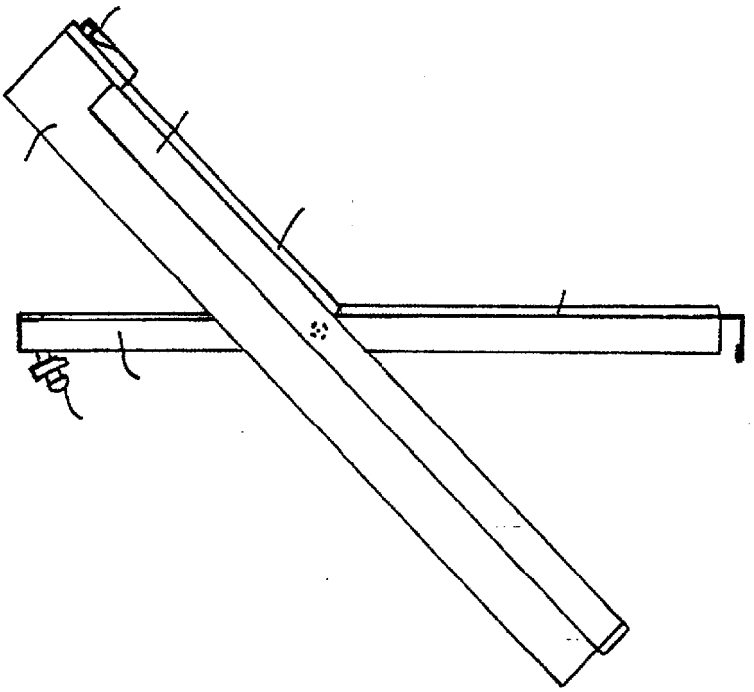
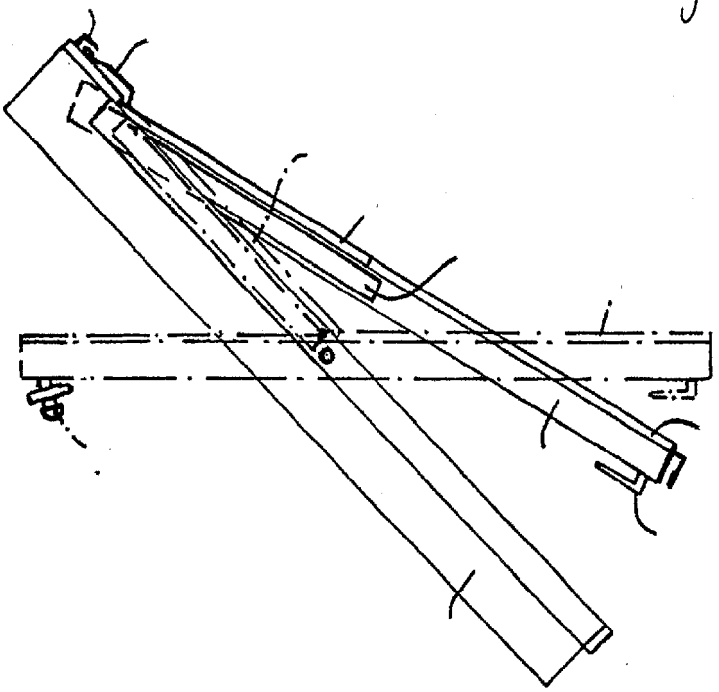


Fig 20



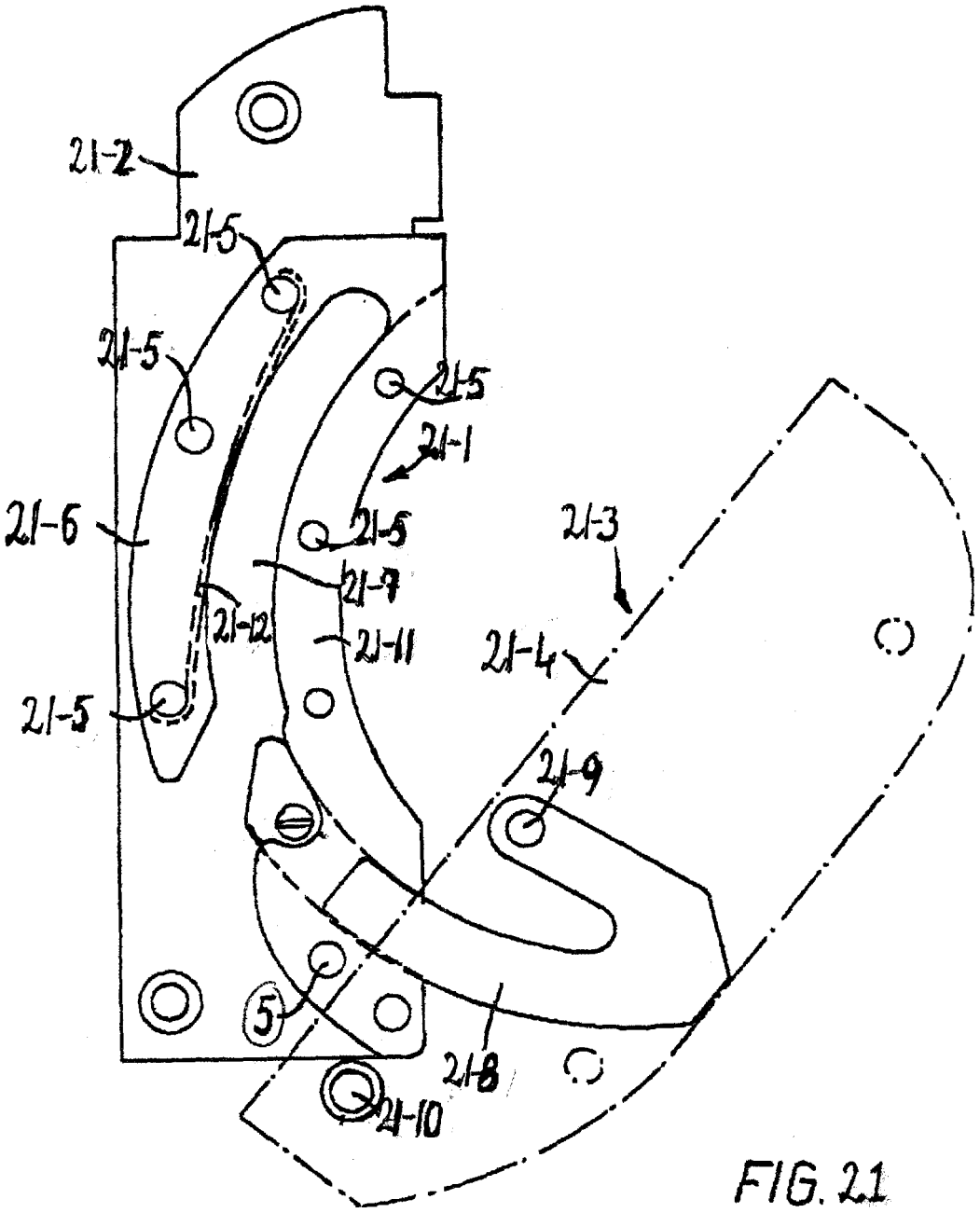

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FIG. 21

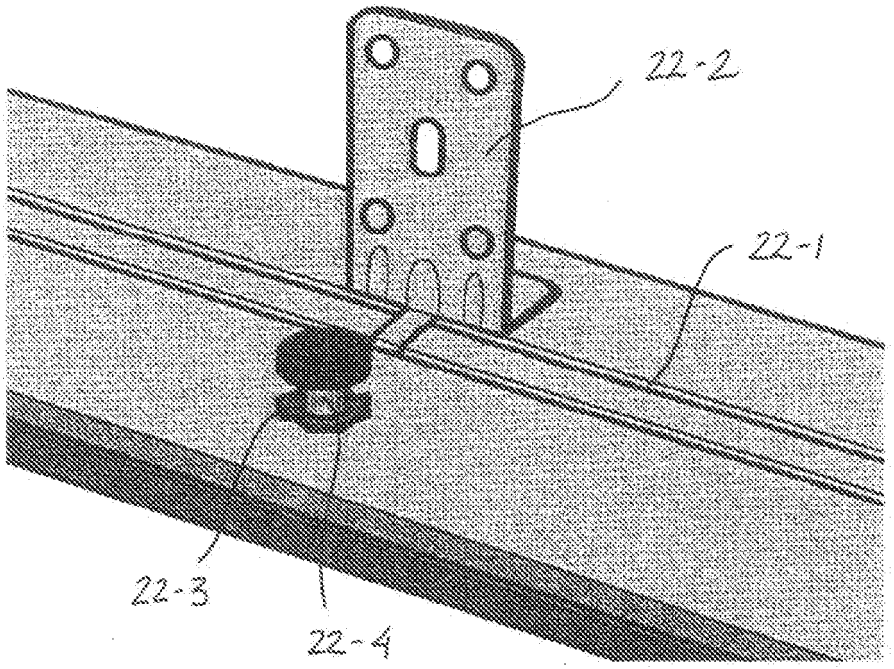
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Fig. 22

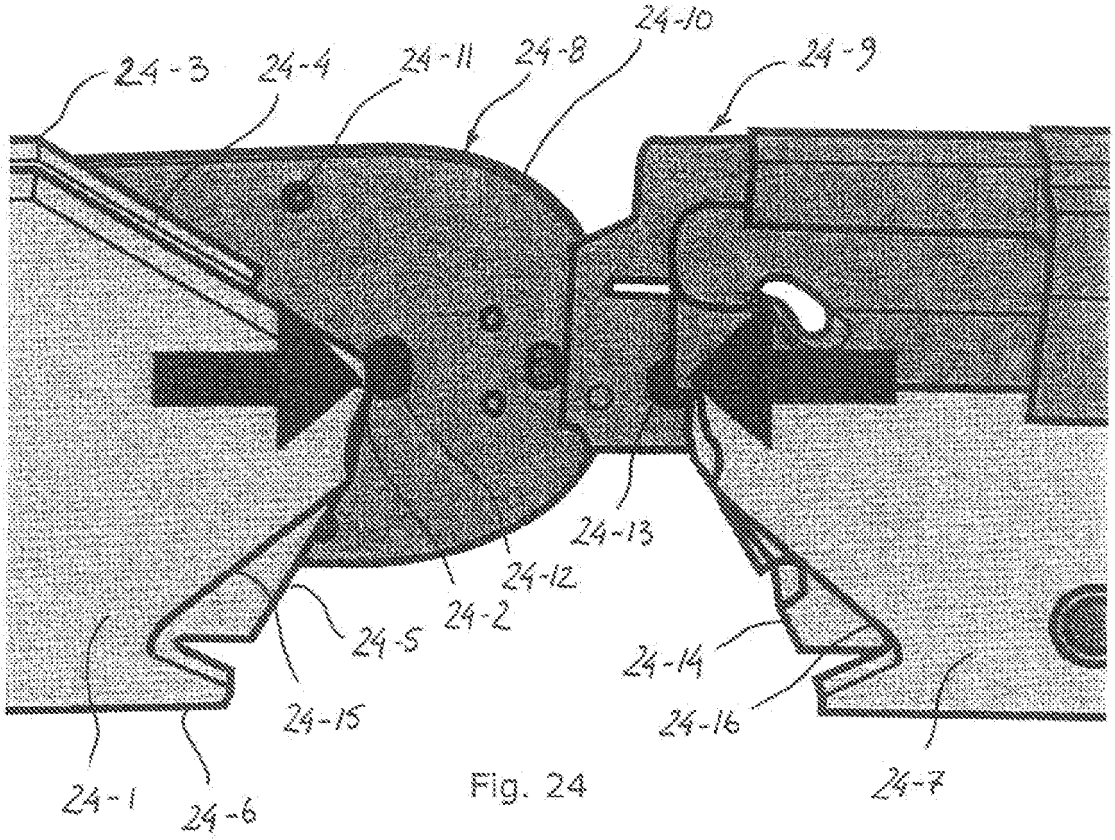
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Fig. 24

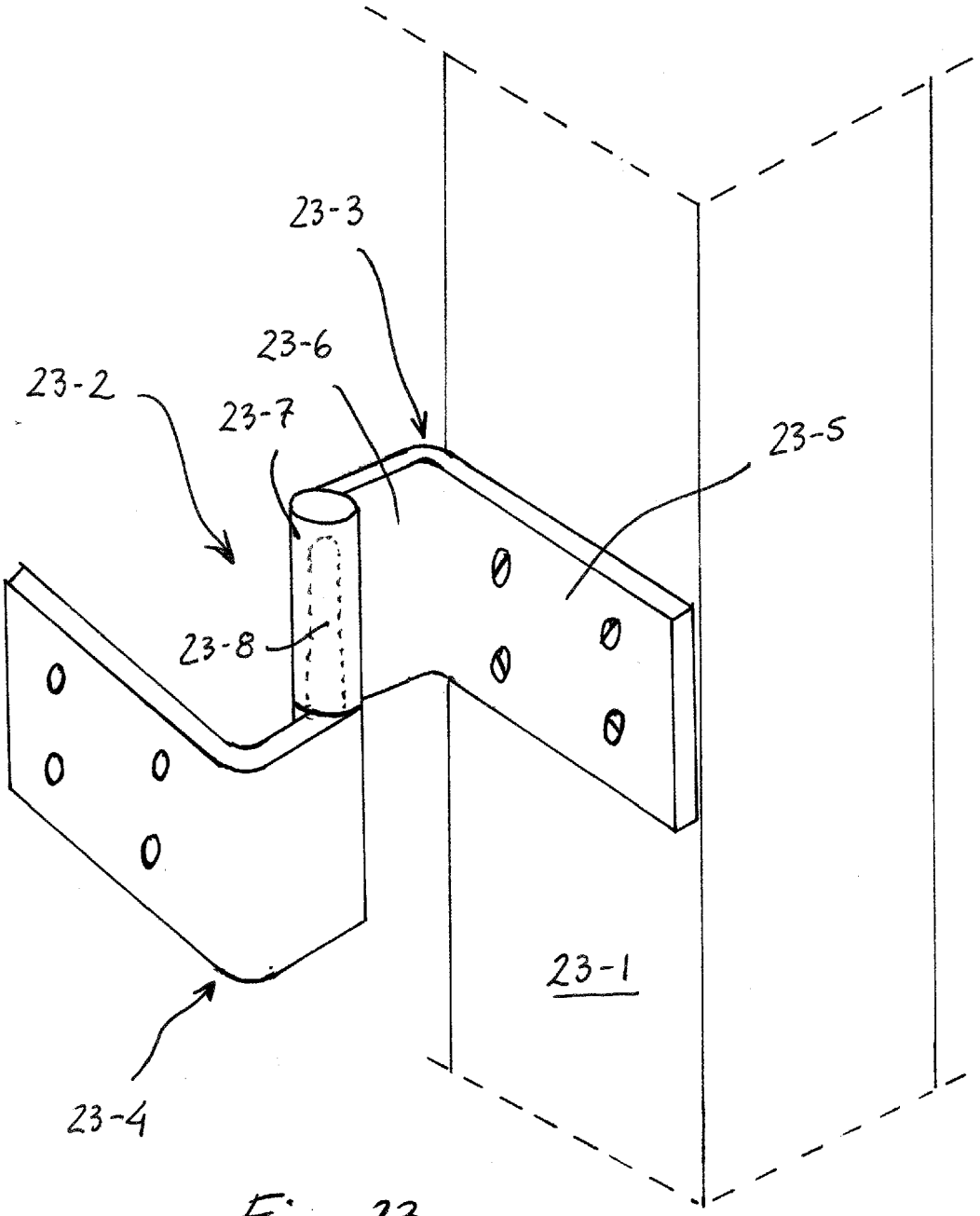

Fig. 23

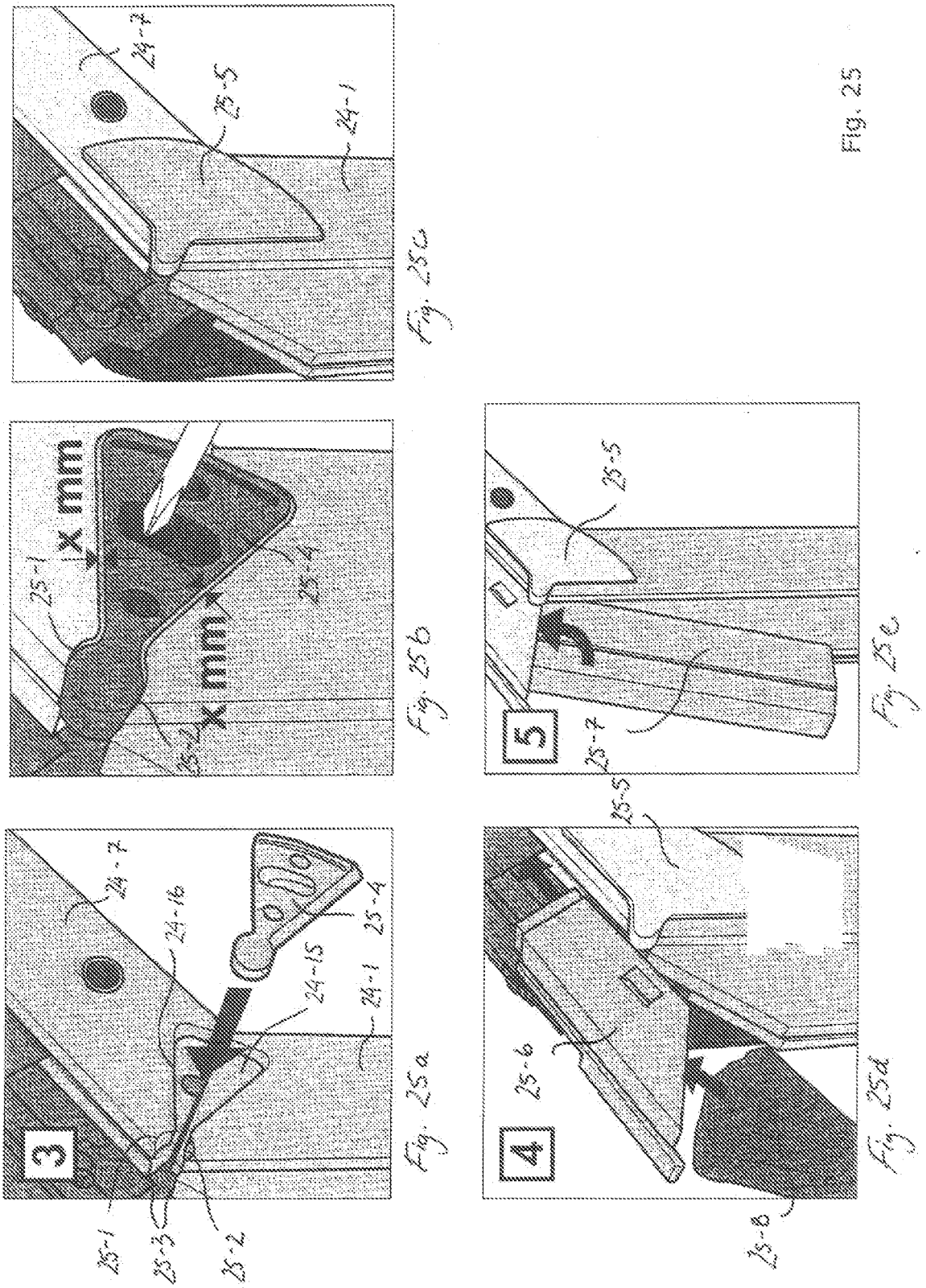

Fig. 25a Fig. 25b Fig. 25c

Fig. 25d Fig. 25e

Fig. 25

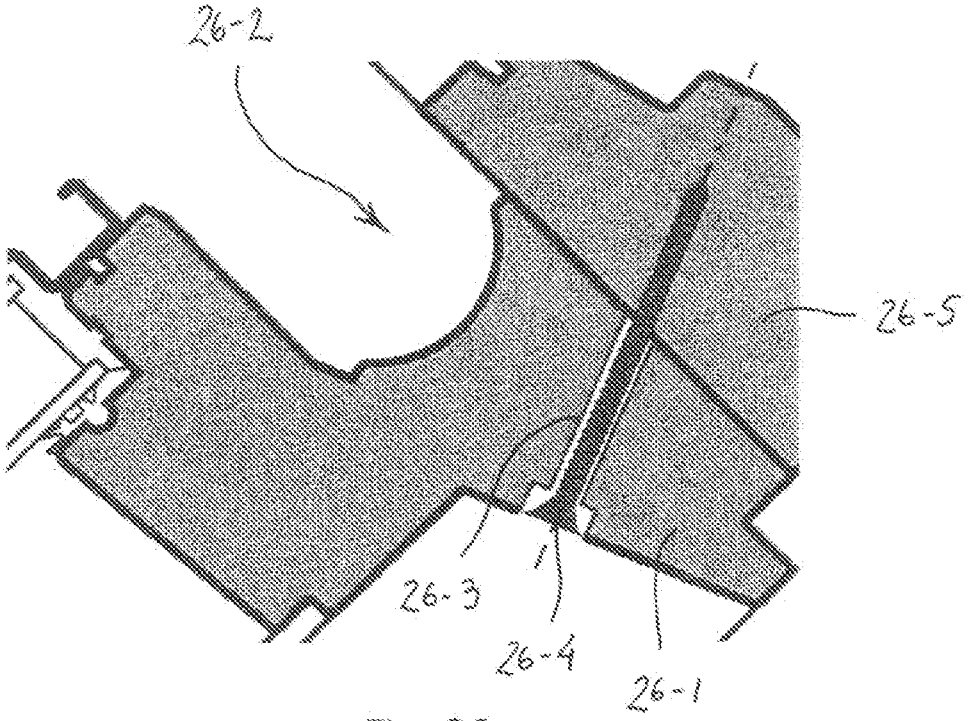

Fig. 26

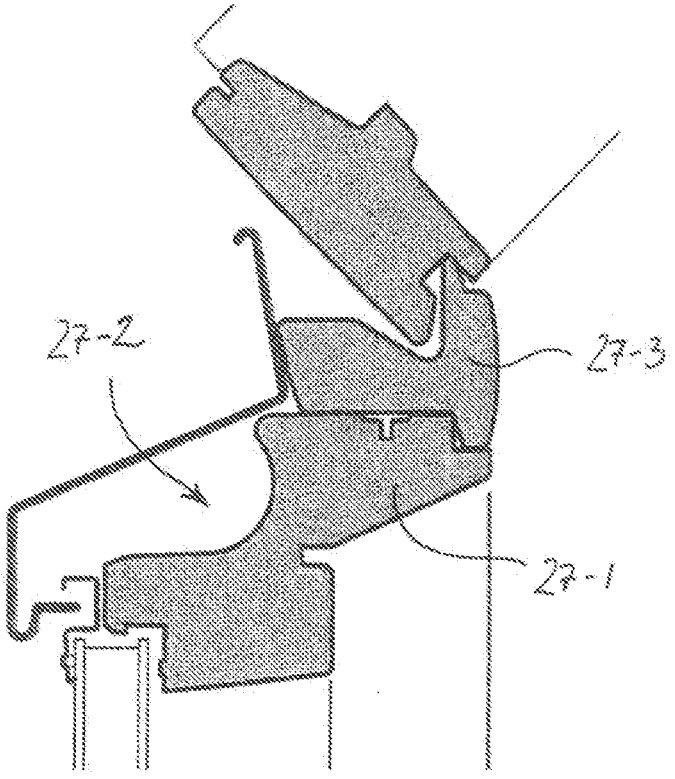

Fig. 27

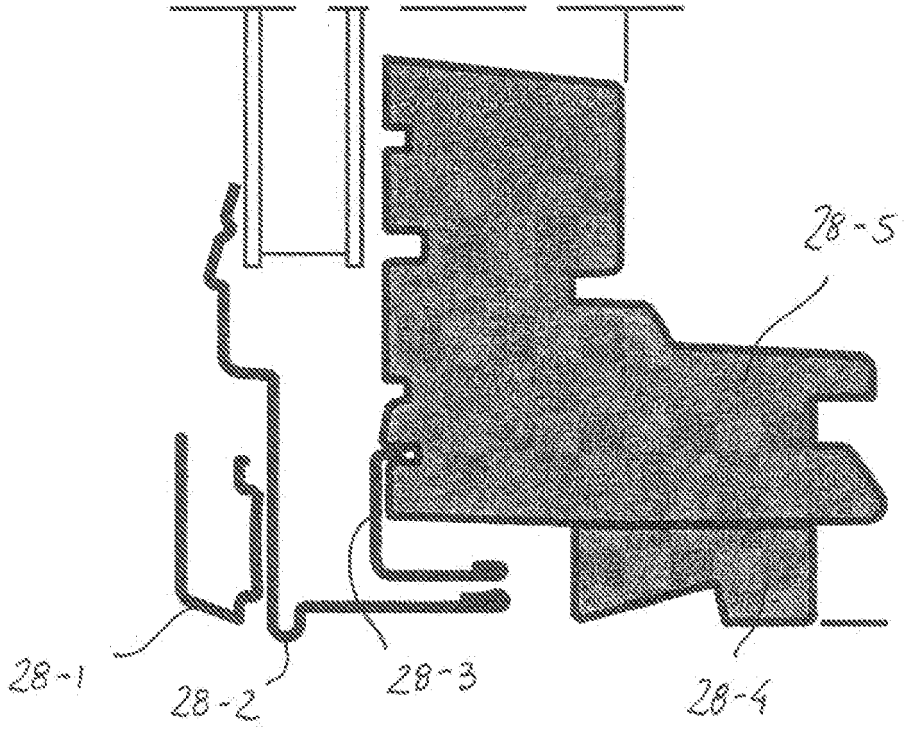

Fig. 28

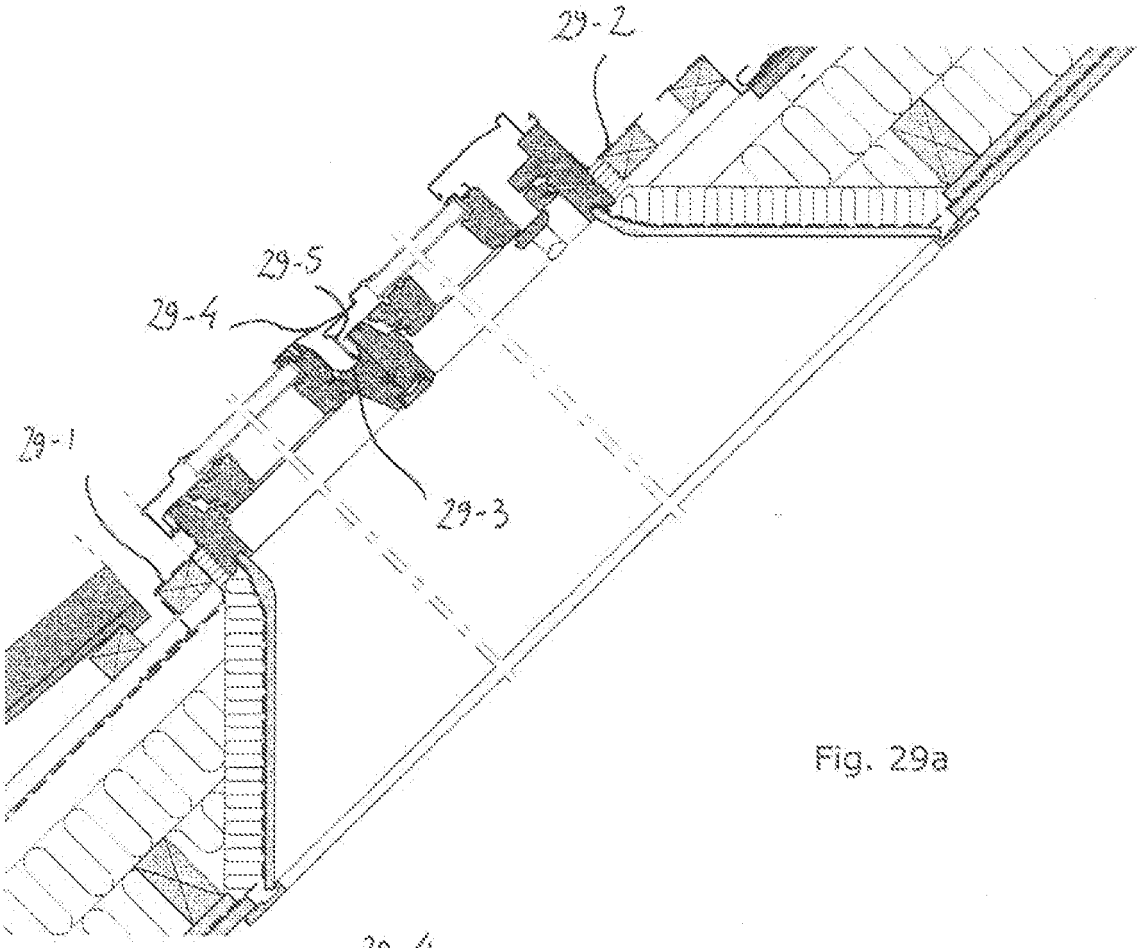

Fig. 29a

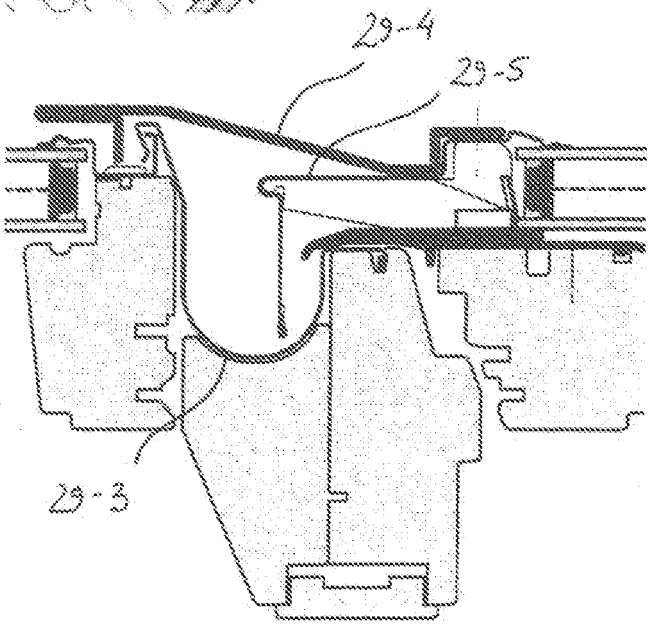

Fig. 29b

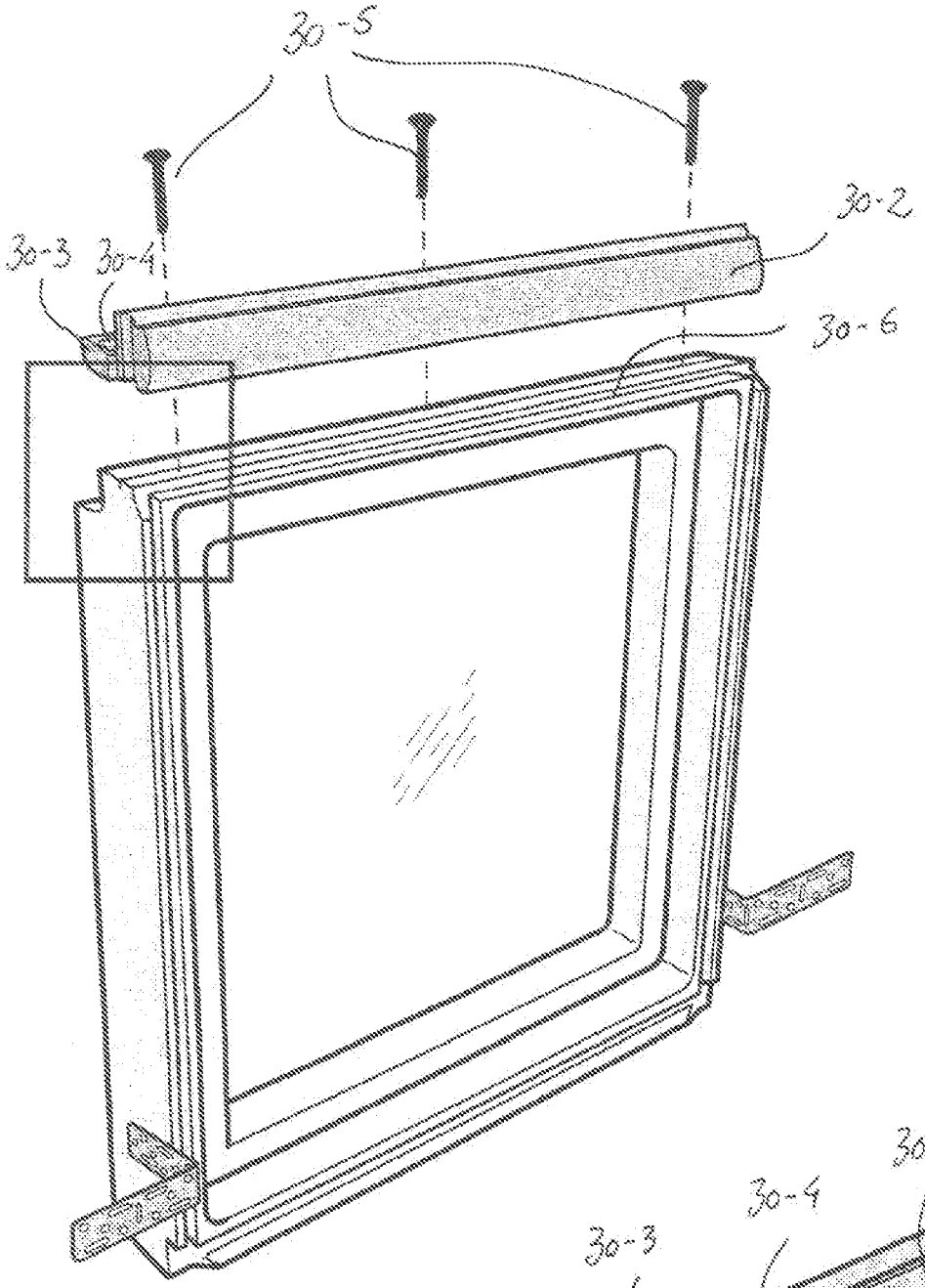

Fig. 30a

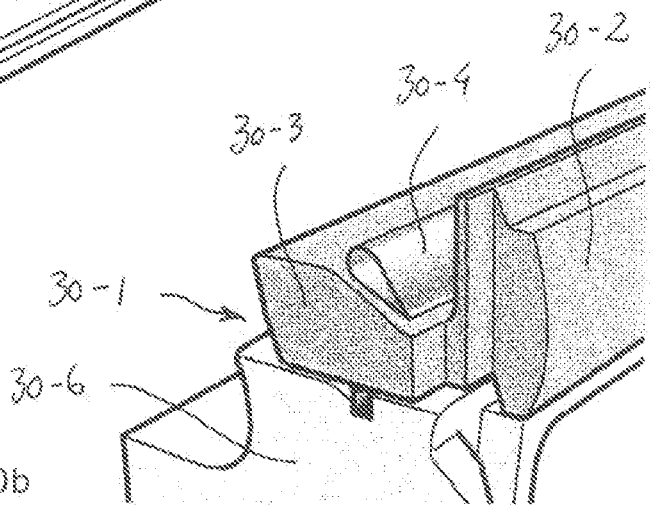

Fig. 30b

REFERENCES CITED IN THE DESCRIPTION

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