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(54) **OPENABLE GLASS STRUCTURE WITH PROTECTION PROFILES**

ÖFFNUNGSFÄHIGE GLASSTRUKTUR MIT SCHUTZPROFILEN

STRUCTURE EN VERRE OUVRABLE COMPRENANT DES PROFILS DE PROTECTION

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Description**Technical Domain of the Invention**

- 5 **[0001]** The present invention relates to a glass structure comprising at least one openable sliding frameless glass casement with an insulated glass unit.

Background of the Invention

- 10 **[0002]** The sufficient natural illumination of interior spaces, especially buildings, is one of key parameters for creating pleasant and healthy environment for people. The daylight is the most interesting source of such illumination and it is important to have some transparent parts in building envelopes, to bring this light to the interior of the building. Therefore, it is important to improve the Window to Wall Ratio (WWR). However, WWR is in general negatively influenced by new structures of windows and frames. Modern window frames provide usually better thermal insulation than traditional frame.
- 15 Such insulated frames have larger sections than traditional windows and thus have again negative impact on natural illumination. The frame size is even more problematic for openable windows and facade segments, since the frame consists of two parts, a fixed frame and an openable casement or wing.

- 20 **[0003]** One solution to increase the WWR is to reduce the non-transparent part of the frame, by eliminating the openable casement frame and integrating window hardware into the Insulating Glass Unit (IGU). This technique of frameless glass casement, uses the structural capacity of the glazing to avoid the classical double frame structure of an openable window. Along with the improvement in transparency, it also improves window's aesthetics, by giving the window an appealing glassy look.

- 25 **[0004]** Since the openable casement frame has been removed or largely reduced, window hardware or fittings (being the metallic parts such as hinges, levers, sliding support, ...) which are, in traditional windows, positioned between the casement frame and fixed frame, and by means of which the casement can be opened or closed, must accordingly be positioned within the frameless glass casement. Typical frameless glass door or window casement with insulating glass unit comprises at least a first and a second glass plates separated by a spacer which is gas-tightly inserted generally along the periphery of the IGU between the first and second glass plates creating an insulated cavity, a cordon of sealant securing said glass plates together, and an outwardly opening generally U-shaped profile. Such profile is positioned between the
- 30 glass plates for receiving window hardware. See for example, WO2016/050839 that describes U-shaped profile separated from the spacer and concealed completely between the first and the second glass plates, the outermost edges of the profile being positioned inside the periphery of said glass plates.

- 35 **[0005]** Different types of door and windows exist on the market such as the tilt and turn, the upper supported sliding, the lower supported sliding such as lift-and-slide or tilt-and-slide doors or windows. There is a demand to apply the frameless technologies to these different types of windows or doors, particularly for sliding doors. By upper supported sliding door is meant that the glazing is mechanically anchored to the bearing structure by its upper edge and the weight of the glazing is supported by this upper mechanism. By lower supported sliding door, is meant that the glazing is anchored to the bearing structure by its lower edge and the weight of the glazing is supported by this mechanism.

- 40 **[0006]** It is, however, particularly challenging to accommodate the frameless technology in the lower supported lift-and-slide door or window. Indeed, one technical problem that occurs with those frameless glass casements is that their bottom edge is not protected by frame elements anymore and thereby is prone to damages. Would there be any piece of hard material such as a small stone or piece of hard dirt located at the place onto which the frameless glass casement is lowered to a rest position, there would be a high risk of the glass plates breakage. The edges of the glass plates are indeed very sensitive to breakage, even for tempered glass plates.

- 45 **[0007]** EP 822 310B describes an upper supported sliding door assembly comprising a casement with at least two glass panes, with a support element and/or an edge terminating element arranged in the edge region of the casement and which is overlapped at least partly by at least one of the panes in the viewing direction perpendicular to the plane of the leaf, wherein a spacer is provided between the glass panes, separated from the support element and/or the edge terminating element. Such casement is moved and guided in the horizontal direction in a running rail above the casement via a sliding runner. The sliding runner has an anchoring part which engages into the support element and/or the edge terminating element arranged in the region of the upper leaf edge for the suspension of the casement. The edge termination element at the bottom of the glass panes can partially cover the bottom edges of the glass panes. DE 20 2016 000 526 U1 describes as well, an upper supported sliding door assembly comprising a frameless insulated glazing unit. This sliding door comprises two movable center panels having at their lower edge a guide profile which is Hat-shaped in cross section and runs on a
- 50 bottom-mounted guide rail.

- 55 **[0008]** However, since the door assemblies disclosed in these prior art documents are upper supported sliding doors and not lower supported sliding doors, the technical problem of potential glass plates breakage when the door is lowered on its rest position, does not occur in these door assemblies.

[0009] Further openable glass structures are known from EP 3 187 678 A1 or WO 2010/097776 A1 that disclose lift-and-slide windows, the latter representing the closest prior art to the present invention.

Summary of the Invention

[0010] The present invention relates to an openable glass structure, extending along a plane, P, defined by a longitudinal axis, X, and a vertical axis, Z, and comprising:

(a) a fixed frame comprising a lower support element;

(b) at least one sliding frameless glass casement with an insulating glass unit, mounted in the fixed frame and comprising a lower edge; said sliding frameless glass casement comprising:

- at least a first glass plate and a second glass plate comprising a first and second bottom edges, respectively, extending along the longitudinal axis, X, a first and second inner plate faces, respectively, and a first and second outer plate faces, respectively,
- at least a spacer coupled to the first and second inner plate faces, recessed from the first and second bottom edges, and defining an interspace extending between the first and second inner plate faces from the spacer to the first and second bottom edges,
- an outwardly open U-shaped profile comprising a first lateral wall adjacent to the first glass plate, which comprises a bottom edge extending along the longitudinal axis, X, inner and outer faces and a second lateral wall adjacent to the second glass plate, which comprises a bottom edge extending along the longitudinal axis, X, inner and outer faces, respectively,

and being positioned within the interspace, with at least one of the bottom edges of the first and/or second lateral walls protruding out of at least one of the first and/or second bottom edges of the first and second glass plates,

(c) a moving mechanism for opening and closing the glass structure comprising the following steps:

- lifting along the vertical axis, Z, the sliding frameless glass casement from a first rest position, wherein the lower edge of the sliding frameless glass casement rests on the lower support element to a first translating position allowing the translation thereof along the longitudinal axis, X,
- sliding the sliding frameless glass casement along the longitudinal axis, X, to a second translating position,
- lowering the sliding frameless glass casement along the vertical axis, Z, to a second rest position,

wherein the sliding frameless glass casement further comprises a first and second protective profiles, which are distinct elements from the outwardly open U-shaped profile and which cover an entirety of the first and second bottom edges of the first and second glass plates, respectively,

characterized in that the protective profiles are either

- L-shaped with a horizontal portion covering the entirety of the corresponding first and/or second bottom edges of the first and second glass plates, and a lateral portion extending along the vertical axis, Z, and coupled to either:
 - the corresponding first and/or second inner or outer plate faces, or
 - the corresponding outer face of the first and/or second lateral walls;

or positioned within a space between, on the one hand, the corresponding first and/or second inner plate faces and, on the other hand, the corresponding outer face of the first and/or second lateral walls,

or

- U-shaped with a horizontal portion covering the entirety of the corresponding first and/or second bottom edges of the first and second glass plates, and a first and second lateral portions extending along the vertical axis, Z, wherein the first lateral portion is coupled to either:
 - the corresponding first and/or second inner plate faces, or
 - the corresponding outer face of the first and/or second lateral walls;

or positioned within a space between, on the one hand, the corresponding first and/or second inner plate faces and, on the other hand, the corresponding outer face of the first and/or second lateral walls, and the second lateral portion (62, 72) is coupled to the corresponding first and/or second outer plate faces (13, 23).

Brief description of drawings**[0011]**

Figure 1A shows a front view of a glass structure comprising an openable lower supported sliding frameless glass casement that is a lift-and-slide glass structure. Figure 1B is a A-A' cross section of the glass structure of Figure 1A.

Figure 2 shows a cross sectional view of a sliding frameless glass casement of a glass structure not according to the present invention.

Figure 3A shows a cross sectional view of a sliding frameless glass casement with L-shaped protective profiles that is not part of the invention.

Figures 3B and **3C** show cross sectional views of a sliding frameless glass casement with L-shaped protective profiles according to embodiments of the present invention.

Figure 4 shows a cross sectional view of a sliding frameless glass casement with a U-shaped protective profile according to one embodiment of the present invention.

Figure 5 shows a perspective view of a sliding frameless glass casement with transversal protective profiles that is not part of the invention.

Figure 5A shows a perspective view of a sliding frameless glass casement with transversal protective profiles.

Figure 6 shows a cross sectional view of a sliding frameless glass casement with a L-shaped protective profile and a sealing element according to one embodiment of the present invention.

Figure 7 shows a cross sectional view of a sliding frameless glass casement with a L-shaped protective profile and a resilient layer according to one embodiment of the present invention.

Figure 8 shows a cross sectional view of a sliding frameless glass casement with a third glass pane according to one embodiment of the present invention.

Detailed description of the invention

[0012] Accordingly, it is an object of the present invention to provide an openable lower supported sliding glass structure, particularly a lift-and-slide glass structure comprising a sliding frameless door or window casement arrangement with an insulating glass unit (IGU), which is protected against breakage that might occur during the lowering of the frameless glass casement to a rest position.

[0013] The present invention relates to an openable glass structure (100), extending along a plane, P, defined by a longitudinal axis, X, and a vertical axis, Z, and comprising:

- (a) a fixed frame (110) comprising a lower support element (120);
- (b) at least one sliding frameless glass casement (130) with an insulating glass unit, mounted in the fixed frame and comprising a lower edge (140); and
- (c) a moving mechanism for opening and closing the glass structure by the following steps:

- lifting along the vertical axis, Z, the sliding frameless glass casement from a first rest position, wherein the lower edge of the sliding frameless glass casement rests on the lower support element to a first translating position allowing the translation thereof along the longitudinal axis, X,
- sliding the sliding frameless glass casement along the longitudinal axis, X, to a second translating position,
- lowering the sliding frameless glass casement along the vertical axis, Z, to a second rest position.

[0014] The glass structure of the present invention is a lift-and-slide lower supported glass structure as illustrated in Figure 1A and Figure 1B. The hardware for such lift-and-slide structure comprises rolls and lifting plates. In the rest position to achieve water tightness, the glass casement is resting on the lower support element, the lifting plates being in a low position. When lifted to a translating position, the lifting plates are moved to their high position, lifting thereby the glass casement which now rests on the rolls. The glass casement in its translating position can be directly re-lowered to its initial

rest position. In this case, the first and second rest positions are the same. It can alternatively be slid to any other translation position within the glass structure. Generally, the glass casement is then lowered to a second rest position to avoid any further translating movement. In this alternative case, the first and second rest positions are different.

[0015] By casement, it is meant the openable component which is connected to the fixed frame through hardware means, and fills the opening defined by the static frame. The hardware means include all the devices, fittings, or assemblies, necessary to operate the window or door as intended. The casement is made of an infill panel, such as glass or glazing in case of a glass window or door arrangement, and generally a mobile frame, which is mounted around the edges of the infill panel.

[0016] By frameless glass casement, it is meant that the casement of the glass structure has a higher transparent surface than a standard one by elimination of some or all the frame elements of the casement. In standard doors or windows, fastening or fixing means are positioned between the casement frame and fixed frame. Such fastening or fixing means are doors or windows hardware. In frameless glass casement according to the present invention, fastening or fixing means are positioned between the glass plates allowing to eliminate frame parts of the casement. It means that the casement shape and volume is fully defined by the glass plates of the glazing.

[0017] As depicted in **Figure 2**, the sliding frameless glass casement with an insulated glass unit comprises at least a first glass plate (10) and a second glass plate (20) comprising a first (11) and second (21) bottom edges, respectively, extending along the longitudinal axis, X, and which rest on the lower support element (120). The first and second glass plates comprise further a first (12) and second (22) inner plate faces, respectively, and a first (13) and second (23) outer plate faces, respectively. The sliding frameless glass casement comprises at least a spacer (4) coupled to the first and second inner plate faces, recessed from the first and second bottom edges, and defining an interspace (5) extending between the first and second inner plate faces from the spacer to the first and second bottom edges. The sliding frameless glass casement comprises an outwardly open U-shaped profile (30) comprising a first lateral wall (31) adjacent to the first glass plate, which comprises inner (311) and outer (312) faces and a bottom edge (313), and second lateral wall (32) adjacent to the second glass plate, which comprises inner (321) and outer (322) faces, respectively and a bottom edge (323). The outwardly open U-shaped profile is positioned within the interspace, so that at least one of the bottom edges of the first and/or second lateral walls protruding out of at least one of the first and/or second bottom edges. The sliding frameless glass casement further comprises a first (60) and second (70) protective profiles covering an entirety of the first and second bottom edges, respectively.

[0018] As described herein, within the insulated glass unit of the sliding frameless glass casement, the inner faces of the glass plates (12, 22) are meant to be the faces of the glass plates facing the interspace (5). In contrast, the outer faces of the glass plates (13, 23) are meant to be the faces of the glass plates facing the outside of the insulated glass unit. The inner faces of the lateral walls (311, 321) of the outwardly open U-shaped profile are meant to be facing the internal volume defined within the U-shaped profile (30) whereas the outer faces of the lateral walls (312, 322) of the outwardly open U-shaped profile are facing the interspace (5).

[0019] The glass plates (10, 20) will be chosen among all flat glass technologies, among them: float clear, extra-clear or colored glass. The glass plates can be safety glass of following types: thermally or chemically tempered glass or laminated glass, which are known to the skilled people. The glass plates can optionally be edge-ground. Edge grinding renders sharp edges into smooth edges which are much safer for people who could come in contact with the casement, in particular with the edge of the casement. Other options, such as heat insulation with low-e coatings, solar control coatings, reinforced acoustic insulation with acoustic laminated glass are also compatible with the present concept to improve the performances of the window or door. Glass plates with electrochromic, thermochromic, photochromic or photovoltaic elements are also compatible with the present invention. The first and second glass plates of the sliding frameless glass casement of the present invention can be of the same or of a different type. The glass plates can be painted (or partially painted). Painting parts of the surface of insulating glass unit is a well-known technique to hide unaesthetical elements located behind the glass. The opaque layer can be used to hide hardware or other window/door parts like tightness joints. Opaquer is the paint, less the window hardware and tightness elements are visible to the building occupants. Preferably, the paint will be located on an inner surface of the glazing, so that it is protected from direct external ageing and wear factors (rain, sun, abrasion...). More preferably it will extend from the edge of the glass to the level of the spacer. The paint can be of various types, organic or inorganic.

[0020] In a preferred embodiment of the present invention, the glass plates of the insulated glass unit of the sliding frameless glass casement are tempered for users' safety. Moreover, it has been found that the protecting the bottom edges of the glass plates such as in the present invention, is even beneficial for tempered glass plates since while the faces of tempered glass plates are more resistant than those of non-tempered glass, the edges on the other hand, are less impacts resistant than its faces.

[0021] The insulated glass unit of the sliding frameless glass casement of the present invention further comprises at least a spacer (4) coupled to the first and second inner plate faces, recessed from the first and second bottom edges, and defining an interspace (5) extending between the first and second inner plate faces from the spacer to the first and second bottom edges. The spacer has consequently a surrounding shape which spaces apart the glass plates on their periphery. It

can be made of one piece or can alternatively comprise a plurality of elements having their extremities abutted to form the surrounding shape. The spacer can be metallic, polymeric, a composite material reinforced by glass fibres or a mix of several of these materials. The spacer can be hollow in order to be able to receive for example some drying material. Such spacer is then perforated to allow the drying material to trap water vapor that is coming in the cavity of the IGU.

[0022] As is usual with insulated glazing, the spacer is inserted between the glass plates generally by means of butyl or silicone adhesive strips. Thereby, formed is an encompassing surrounding edge joint, such as is usual for insulated glazing, which is provided with a cordon of sealant. Thus, the cavity between the glass plates is sealed with respect to the exterior in a gas and moisture-sealed type manner. The cavity, as is known per se, can be filled with dry air or an insulating gas such as argon, krypton or mixtures thereof or it can be (partially) evacuated.

[0023] Use of warm-edge spacers, often made of plastics tightened and/or reinforced with a metallic foil, is preferred to reduce thermal fluxes at the periphery of the insulating glass what is indeed particularly critical for frameless glass casements since the periphery of the glazing is not embedded in a frame.

[0024] The profile (30) of the sliding frameless glass casement of the present invention is outwardly opening with a general U-shape, whose cavity is oriented generally in parallel to the glass plates, and is carefully dimensioned to receive window hardware. By U-shaped it is herein meant that the profile has a cross section comprising a base, a first lateral wall (31) and a second lateral wall (32) protruding out of the base and facing each other.

[0025] As illustrated in **Figure 2**, the outwardly open U-shaped profile (30) comprises a first lateral wall (31) adjacent to the first glass plate, which comprises inner (311) and outer (312) faces and a bottom edge (313), and second lateral wall (32) adjacent to the second glass plate, which comprises inner (321) and outer (322) faces and a bottom edge (323), respectively. The bottom edges are extending along the longitudinal axis, X. The profile is positioned within the interspace, with at least one of the bottom edges of the first and/or second lateral walls protruding out of at least one of the first and/or second bottom edges.

[0026] The outwardly open U-shaped profile receiving the hardware can run all along the insulating glass periphery as one single and continuous framing structure or as strongly connected segments forming a continuous framing structure, thereby serving as a receptacle for the window or door hardware and as well providing a significant structural function. In another embodiment, the outwardly open U-shaped profile can be made of several segments, segment lengths and shapes can be various.

[0027] The outwardly open U-shaped profile (30) is usually made of material with high bending strength, high Young modulus, thermal expansion closest to the glass, low water intake, temperature resistance between -20°C and 90°C and reasonable level of thermal conductivity.

[0028] High bending strength helps the profile to sustain all loads applied to the casement (self-weight, racking, torsion...). High Young modulus avoids the creation of slacks between the casement and the supporting structure due to repeated mechanical loads applied during the product lifecycle. Similarly, a low thermal expansion avoids the creation of slacks between the profile and the glazing due to cooling/heating cycles undergone by the product. Low water intake and temperature resistance ensures that the profile keeps its characteristics and performances all along the product lifecycle. Reasonable level of thermal conductivity allows to reduce thermal fluxes at the edge of the glazing, what is called the Psi-value of the glazing. Preferably, the profile is made from a material selected from: thin walled stainless steel, hardwood (i.e. oak), wood plastic composite (i.e. 60 wood /40 Polypropylene (PP) or 60 wood /40 High Density Polyethylene (HDPE)), stiff plastic (PolyEtherEtherKetone (PEEK), Polyamide (PA), Polyphenylene Sulfide (PPS), Polybutylene Terephthalate (PBT)), glass fiber (GF) reinforced plastic (PEEK GF30, PPS GF40, PBT GF30, PA6 GF30, PolyEster GF73 (weight)).

[0029] Preferably the outwardly open U-shaped profile is bonded to both the first and second glass plates. Suitable types of bonding means (18) are sealants or double side adhesive tapes, preferably those demonstrating good adherence, with or without primer, on both glass and profile surfaces, suitable mechanical properties, and suitable chemical resistance, especially to UVs, water and temperature. Examples of sealants are silicone, modified silicone, and polyurethane. One example of double-sided adhesive tape is VHB® tape.

[0030] The sliding frameless glass casement further comprises a first (60) and second (70) protective profiles covering the entirety of the first (11) and second (21) bottom edges of the first and second glass plates, respectively, as depicted in **Figure 2**.

[0031] It is indeed, particularly challenging to accommodate the frameless technology in a lower supported lift-and-slide door or window. Indeed, one technical problem that occurs with those sliding frameless glass casements is that their bottom edge is not protected by frame elements anymore and thereby is prone to damages. Would there be any piece of hard material such as a small stone or piece of hard dirt located at the place onto which the sliding frameless glass casement is lowered to a rest position, it would be a high risk of the glass plates breakage. The edges of the glass plates are indeed very sensitive to breakage. It has been surprisingly found that protecting the entirety of the bottom edge of the glass plates forming the insulated glass unit within the sliding frameless glass casement, provides substantially increased resistance to breakage when it is lowered to its resting position on the lower support element of the glass structure.

[0032] In order to maximize the surface of the glass plates within the sliding frameless glass casement and thereby the glassy look, the bottom edges of the first and second glass plates must be as close as possible to the lower support

element. The closer the glass plates are to the lower support element, the higher will be the risk of glass plate breakage in case any piece of hard material such as a small stone or piece of hard dirt would be located at the place onto which the frameless glass casement is lowered to a rest position.

[0033] According to the present invention each protective profile is distinct from the outwardly open U-shaped profile and is L-shaped or U-shaped.

[0034] When the protective profile is L-shaped, it has a horizontal portion covering the entirety of the corresponding first and second bottom edges, and a first lateral portion (61, 71) extending along the vertical axis, Z. The first lateral portion can be coupled to either: the corresponding first and second inner (12, 22) or outer plate faces (13, 23), or the corresponding outer face (312, 322) of the first and second lateral walls. The lateral portion can also be positioned within the space between, on the one hand, the corresponding first and second inner plate faces (12, 22) and, on the other hand, the corresponding outer face of the first and second lateral walls (312, 322).

[0035] One embodiment that is not part of the invention is shown in **Figure 3A** wherein the sliding frameless glass casement comprises a first glass plate (10) and a second glass plate (20), each comprising a first (11) and second (21) bottom edge; a spacer (4) coupled to the first and second inner plate faces (12, 22), recessed from the first and second bottom edges (11, 21), and defining an interspace (5) extending between the first and second inner plate faces from the spacer to the first and second bottom edges. The sliding frameless glass casement comprises an outwardly open U-shaped profile (30) positioned within the interspace. The protective profile has a L-shape wherein the lateral portion (61) of the first protective profile (60) is coupled to the inner face (311) of the first lateral wall (31) of the outwardly open U-shaped profile (30). Similarly, the lateral portion (71) of the second protective profile (70) is coupled to the inner face (321) of the first lateral wall (32) of the outwardly open U-shaped profile (30). In Figure 3A, no bottom edge of the first and/or second lateral walls of the U-shaped profile is protruding out of at least one of the first and/or second bottom edges of the glass plates (11,21).

[0036] **Figure 3B** depicts an embodiment of the sliding frameless glass casement wherein the lateral portions (61, 71) of the protective profiles (60, 70) are positioned within a space between, on the one hand, the corresponding first (12) and second (22) inner plate faces and, on the other hand, the corresponding outer face of the first (312) and second (322) lateral walls.

[0037] **Figure 3C** depicts an embodiment of the sliding frameless glass casement wherein the lateral portions (61, 71) of the protective profiles (60, 70) are coupled to the corresponding outer face of the first (312) and second (322) lateral walls.

[0038] When the protective profile is U-shaped, it has a horizontal portion covering the entirety of the corresponding first and second bottom edges, and a first and a second lateral portions extending along the vertical axis, Z. The first lateral portion (61, 71) is coupled to either the corresponding first and second inner plate faces (12,22), or the corresponding outer face (312, 322) of the first and second lateral walls or is positioned within the space between the corresponding first and second inner plate face and the corresponding outer face of the first and second lateral walls. The second lateral portion (62, 72) is coupled to the corresponding first and second outer plate faces (13,23).

[0039] **Figure 4** shows a sliding frameless glass casement according to the present invention wherein the bottom edges of the glass plates are protected with U-shaped protective profiles. The first and second lateral portions (61, 71) of the first and second protecting profiles (60, 70) are coupled with the corresponding first and second inner plate faces (12, 22). The second lateral portions (62, 72) are coupled to the corresponding first and second outer plate faces (13, 23).

[0040] In a preferred embodiment of the present invention, the protective profile (60, 70) has a L-shape or U-shape wherein the first lateral position (61, 71) is coupled to either the corresponding first and second inner plate faces (12, 22), or is positioned within the space between the corresponding first and second inner plate face (12, 22) and the corresponding outer face of the first and second lateral walls (312, 322).

[0041] In the method of production of the frameless glass statement of the present invention, when the protective profiles of the present invention are positioned within the bonding mean of the insulated glass unit, L-shaped or U-shaped protective profiles are used since their lateral, first and/or second lateral portions (61, 62, 71, and/or 72) can guide precisely the positioning of the protective profile within the IGU.

[0042] According to the invention, the protective profiles are distinct elements from the outwardly open U-shaped profile. Therefore, such distinct protective profiles can be made of a different material than the outwardly open U-shaped profile. This is highly beneficial since the protective profiles and the outwardly open U-shaped profile having different functions, must respond to different thermo - mechanical constraints and therefore could be made from different specific materials better suited to their function. In addition, such independent protective profiles can be standardized and used for any sliding frameless glass casement independently of the glass plates spacing, such spacing being defined by the spacer.

[0043] In an alternative example not according to the invention, the first and second protective profiles (60, 70) can form an integral part of the outwardly open U-shaped profile (30), and preferably comprises a first and second lateral portions coupled to the corresponding first and second outer plate faces.

[0044] In another preferred embodiment of the present invention, the first glass plate (10) and the second glass plate (20) comprise a first (14) and second (24) transversal edges extending along the vertical axis, Z and at least one of the transversal edges of the first and second glass plates (14, 24) are further protected by corresponding first (63) and second

(73) transversal protective profiles, covering at most 15cm, preferably at most 5cm, more preferably at most 2cm from the corresponding bottom edges, of the first and second lateral edges respectively.

[0045] In the openable glass structure of the present invention, it is even preferred to protect the transversal edge (14, 24) of the sliding frameless glass casement present on the transversal locking edge (150) (Figure 1A). Indeed, it could happen to have a piece of hard material such as a small stone or piece of hard dirt located in the bottom corner of glass structure, that could come in contact with the transversal locking edge of the first and/or second glass plates when the sliding frameless glass casement is translated towards the fixed frame of the glass structure.

[0046] **Figure 5A** shows an example of the present invention where no lateral portion of the protective profile is represented and wherein the sliding frameless glass casement comprises a first glass plate (10) and a second glass plate (20), each comprising a first (11) and second (21) bottom edges; a spacer (4) coupled to the first and second inner plate faces, recessed from the first and second bottom edges, and defining an interspace (5) extending between the first and second inner plate faces from the spacer to the first and second bottom edges. The sliding frameless glass casement comprises an outwardly open U-shaped profile (30) positioned within the interspace. The entirety of the bottom edges of the first and second glass plates (11, 21) are protected by a protective profile (60, 70). The transversal edges of the first and second glass plates (14, 24) are further protected by corresponding transversal protective portions (63, 73).

[0047] **Figure 5** shows an embodiment that is not part of the invention. In Figure 5, no bottom edge of the first and/or second lateral walls of the U-shaped profile is protruding out of at least one of the first and/or second bottom edges of the glass plates (11,21).

[0048] The L-shaped or U-shaped protective profile protecting the first bottom edge can be the same or different than the L-shaped, or U-shaped protective profile protecting the second bottom edge. In a preferred embodiment the first and second bottom edges are protected with the same protecting shaped profiles.

[0049] In one embodiment, the protective profile used in the sliding frameless glass casement of the present invention, is made of a material selected from the group consisting of metal, polymer, composite materials such composite materials with a polymer matrix, and/or mixtures thereof, preferably is made of a material selected from the group consisting of stainless steel and/or aluminum.

[0050] The protective profile (60, 70) of the sliding frameless glass casement of the present invention can be bonded to both corresponding bottom edges (11, 21) of the first and second glass plates (10, 20) with the bonding mean.

[0051] The sliding frameless glass casement of the present invention can further comprise a first and/or second sealing element (8) extending along the longitudinal axis, X, positioned along the outer faces of the glass plates (13, 23) and the corresponding protective profile (60, 70).

[0052] In one embodiment, the sealing element can be positioned between the first and second bottom edges (11, 21) and the corresponding horizontal protective profile (60, 70), preferably adjacent to the corresponding first and second outer plate faces (13, 23). **Figure 6** illustrates a frameless casement of the present invention comprising a first glass plate (10) with a first bottom edge (11), a first inner face plate (12) and a first outer face plate (13); a second glass plate (20) with a second bottom edge (21), a second inner face plate (22) and a second outer face plate (23); a spacer (4), an interspace (5) and an outwardly open U-shaped profile (30) with a first and second lateral walls (31, 32) and corresponding first and second, inner faces (311,321) and outer faces (312, 322). The protecting profiles (60, 70) are L-shaped with their corresponding lateral portion (61, 71) coupled to the outer faces of the corresponding first or second lateral wall (312,322) of the outwardly open U-shaped profile. The illustrated embodiment presents a sealing element (8) extending along the longitudinal axis, X, between the first and second bottom edges (11, 21) and the corresponding horizontal protective profile (60, 70), adjacent to the corresponding first and second outer plate faces (13, 23).

[0053] In another embodiment, the sliding frameless glass casement of the present invention can also further comprise a first and second sealing elements extending along the longitudinal axis, X, between the corresponding first and second outer plate faces (13, 23) and lateral portions of the L- or U-shaped protective profile coupled to the corresponding first and second outer plate faces (13, 23).

[0054] Examples of sealant materials, that can be used for the sealing element (8) are silicone, modified silicone, polyurethane, double-sided adhesive (also known as double-sided tape). Preferred sealant materials are selected from silicone, because silicone materials are much less sensitive to light, and globally more stable than other cited materials.

[0055] In a further embodiment, the sliding frameless glass casement can further comprise a resilient layer (9) sandwiched between the first and/or second protective profiles (60,70) and the first and/or second protected edges (11, 21). Said resilient layer has preferably a thickness of at 0.2 mm, more preferably comprised between 0.2 mm and 2 mm, even more preferably between 0.5mm and 1mm. Depending on the choice of the material of the protective profile, the material of the resilient layer will be chosen amongst materials that are more deformable than the protective profile material. Examples of suitable materials for the resilient layer are rubber, foam, non-woven, woven fabric. It has been surprisingly found that the presence of such resilient layer can more easily accommodate the mechanical constraints that can be caused by a piece of hard material located at the bottom edges (11, 21) of the glass plates and at the protective profiles (60, 70), even more so-when the protective profiles are made of materials with low deformability.

[0056] **Figure 7** illustrates a frameless casement of the present invention comprising a first glass plate (10) with a first

bottom edge (11), a first inner face plate (12) and a first outer face plate (13); a second glass plate (20) with a second bottom edge (21), a second inner face plate (22) and a second outer face plate (23); a spacer (4), an interspace (5) and an outwardly open U-shaped profile (30) with a first and second lateral walls (31, 32) and corresponding first and second, inner faces (311, 321) and outer faces (312, 322). The protecting profiles (60, 70) are L-shaped with their corresponding lateral portion (61, 71) coupled the outer faces of the lateral walls (312, 322) of the outwardly open U-shaped profile (30). The illustrated embodiment presents a resilient layer (9) sandwiched between the first and second bottom edges (11, 21) and the protective profiles (60, 70), respectively.

[0057] In the embodiments of the present invention wherein that such resilient layer is made of a material with low water resistance, it is then preferred that the glass structure further comprise a sealing element (8) protecting the resilient layer from the exterior atmosphere.

[0058] According to one aspect of the invention, the sliding frameless glass casement is characterized in that the insulating glass unit is a double glazing. According to another aspect of the invention, the sliding frameless glass casement is characterized in that the insulating glass unit is a triple glazing.

[0059] Triple glazing unit is usually more thermally insulating than a double glazing unit with Ug values that can easily reach 0,6 W/m²>K or even 0,5 W/m²>K.

[0060] The sliding frameless glass casement comprising a triple insulating glass unit comprises a first glass plate (10), a second glass plate (20) and a third glass plate (15). The third glass plate can be positioned either in the interspace (5) or externally of the IGU formed by the first and second glass plates, parallelly facing the outer face of the first or second glass plate. When the third glass plate is positioned in the interspace, the edges of third glass plate are preferably recessed from the edges of the first and second glass plates and further recessed from the outwardly open U-shaped profile.

[0061] In a preferred embodiment, the sliding frameless glass casement is characterized in that the two spacers of the triple glazing have the same size and are positioned at the same level inside the IGU. Resulting aesthetics is much more pleasant to building occupants.

[0062] According to a further aspect of the invention, the openable frameless door or window casement arrangement is characterized in that the middle glass pane of the triple glazing is a thin glass plate with thickness lower than 2mm. Reduction of weight of windows has become an important care, especially for window installers. Indeed, reducing the weight allows to use less people to install a window or to use less hindering equipment to mount the window. A way to reduce window weight is to use thinner glass. The thin glass plate can be a thermally or chemically tempered glass, preferably a chemically tempered glass.

[0063] Figure 8 illustrates an embodiment of a frameless glass casement with an insulated glass unit having triple glazing. The frameless glass casement comprises a first glass plate (10), a second glass plate (20) and an outwardly open U-shaped profile (30) positioned between the inner plates faces (12, 22) of the first and second glass plates (10, 20). The third glass plate (15) is positioned between the first and second glass plates with a first inner face (152) facing the first inner plate face and a second inner face (153) facing the second inner plate face and its bottom edge (151) is recessed from the top edge of the outwardly open U-shaped profile (30). The spacer (4) of the frameless glass casement is formed by a first spacer (4a) coupling the first inner plate face (12) to the first inner face of the third plate (152) and a second spacer (4b) coupling the second inner face of the third plate (153) to the second inner plate face (22). The interspace (5) extends between the first and second inner plate face plate (12, 22), from the first spacer (4a), the third bottom edge (151), the second spacer (4b) to the first and second bottom edges (11, 21). In this illustrated embodiment, the protective profile is L-shaped with the first and second lateral portions (61, 71) of the corresponding first and second protective profile (60, 70) being coupled to the corresponding outer faces of the first and second lateral walls (312, 322) of the outwardly open U-shaped profile (30). The protective profiles (60, 70) further comprise a resilient layer (9) in contact with the first and second bottom edges (11, 21) and a sealing element (8) extending along the longitudinal axis, X, between the first and second bottom edges (11, 21) and the corresponding horizontal protective profile (60, 70), adjacent to the corresponding first and second outer plate faces (13, 23). The illustrated embodiment further comprises an opaque layer (17) covering a peripheral zone of the first and second inner face plates (12, 22), extending from the first and second bottom edges to above the spacers (4, 4b). The interspace (5) is filled with a sealant (18).

Ref.#	Feature
100	Openable glass structure
110	Fixed frame
120	Lower support element
130	Sliding frameless glass casement
140	Lower edge of the sliding frameless glass casement
150	Lateral locking edge of the sliding frameless casement

EP 3 737 819 B1

(continued)

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Ref.#	Feature
10	First glass plate
11	First bottom edge
12	First inner plate face
13	First outer plate face
14	First transversal edge
20	Second glass plate
21	Second bottom edge
22	Second inner plate face
23	Second outer plate face
24	Second transversal edge
30	Outwardly open U-shaped profile
31	First lateral wall
311	Inner face of the first lateral wall
312	Outer face of the first lateral wall
313	Bottom edge of the first lateral wall
32	Second lateral wall
321	Inner face of the second lateral wall
322	Outer face of the second lateral wall
323	Bottom edge of the second lateral wall
4	Spacer
5	Interspace
60	First protective profile
61	Lateral portion of the first protective profile
62	Second lateral portion of the first protective profile
63	Transversal portion of the first protective profile
70	Second protective profile
71	Lateral portion of the second protective profile
72	Second lateral portion of the second protective profile
73	Transversal portion of the second protective profile
8	Sealing element
9	Resilient layer
15	Third glass plate
151	Third bottom edge
152	First inner face of the Third plate, facing the first inner plate face
153	Second inner face of the Third plate, facing the second inner plate face
16	Protective profile of the third glass pane
4a	First spacer
4b	Second spacer
30b	Second outwardly open U-shaped profile

(continued)

Ref.#	Feature
17	Opaque layer
18	Sealant

Claims

1. An openable glass structure (100), extending along a plane, **P**, defined by a longitudinal axis, X, and a vertical axis, Z, and comprising:

(a) a fixed frame (110) comprising a lower support element (120);

(b) at least one sliding frameless glass casement (130) with an insulating glass unit, mounted in the fixed frame and comprising a lower edge (140); said sliding frameless glass casement comprising:

- at least a first glass plate (10) and a second glass plate (20) comprising a first (11) and second (21) bottom edges, respectively, extending along the longitudinal axis, X, a first (12) and second (22) inner plate faces, respectively, and a first (13) and second (23) outer plate faces, respectively,

- at least a spacer (4) coupled to the first and second inner plate faces, recessed from the first and second bottom edges, and defining an interspace (5) extending between the first and second inner plate faces from the spacer to the first and second bottom edges,

- an outwardly open U-shaped profile (30) comprising a first lateral wall (31) adjacent to the first glass plate, which comprises a bottom edge (313) extending along the longitudinal axis, X, inner (311) and outer (312) faces and a second lateral wall (32) adjacent to the second glass plate, which comprises a bottom edge (323) extending along the longitudinal axis, X, inner (321) and outer (322) faces, respectively,

and being positioned within the interspace, with at least one of the bottom edges of the first and/or second lateral walls protruding out of at least one of the first and/or second bottom edges of the first and second glass plates, (c) a moving mechanism for opening and closing the glass structure comprising the following steps:

- lifting along the vertical axis, Z, the sliding frameless glass casement from a first rest position, wherein the lower edge of the sliding frameless glass casement rests on the lower support element to a first translating position allowing the translation thereof along the longitudinal axis, X,

- sliding the sliding frameless glass casement along the longitudinal axis, X, to a second translating position, - lowering the sliding frameless glass casement along the vertical axis, Z, to a second rest position,

wherein the sliding frameless glass casement further comprises a first (60) and second (70) protective profiles, which are distinct elements from the outwardly open U-shaped profile and which cover an entirety of the first and second bottom edges of the first and second glass plates, respectively,

characterized in that the protective profiles (60,70) are either

- L-shaped with a horizontal portion covering the entirety of the corresponding first and/or second bottom edges of the first and second glass plates, and a lateral portion (61,71) extending along the vertical axis, Z, and coupled to either:

- the corresponding first and/or second inner (12, 22) or outer (13, 23) plate faces, or
- the corresponding outer face (312, 322) of the first and/or second lateral walls;

or positioned within a space between, on the one hand, the corresponding first and/or second inner plate faces (12, 22) and, on the other hand, the corresponding outer face of the first and/or second lateral walls (312, 322),

or

- U-shaped with a horizontal portion covering the entirety of the corresponding first and/or second bottom edges of the first and second glass plates, and a first and second lateral portions extending along the vertical axis, Z, wherein the first lateral portion (61, 71) is coupled to either:

- the corresponding first and/or second inner (12, 22) plate faces, or
 - the corresponding outer face (312, 322) of the first and/or second lateral walls;
or positioned within a space between, on the one hand, the corresponding first and/or second inner plate faces (12, 22) and, on the other hand, the corresponding outer face of the first and/or second lateral walls (312, 322),
and the second lateral portion (62, 72) is coupled to the corresponding first and/or second outer plate faces (13, 23).
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2. A glass structure according to claim 1 wherein the first lateral portion is coupled to the outer faces of the corresponding first and second lateral walls (312, 322).
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3. A glass structure according to any one of the preceding claims, wherein the first glass plate and the second glass plate comprise a first (14) and second (24) transversal edges extending along the vertical axis, Z and comprising further a first (63) and second (73) transversal protective profiles, respectively, covering at most 15 cm, preferably at most 5 cm, more preferably at most 2 cm of the first and second transversal edges, respectively, from the corresponding bottom edge of the first and second glass plates.
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4. A glass structure according to any one of the preceding claims, wherein the protective profile is made of a material selected from the group consisting of metal, polymer, composite materials such composite materials with a polymer matrix, and/or mixtures thereof, preferably is made of a material selected from the group consisting of stainless steel and/or aluminum.
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5. A glass structure according to any one of the preceding claims wherein the sliding frameless glass casement further comprises a first and second sealing element extending along the longitudinal axis, X, between the first and second bottom edges of the first and second glass plates and the corresponding horizontal protective profile, preferably adjacent to the corresponding first and second outer plate faces.
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6. A glass structure according to any one of claims 1 to 4 wherein the sliding frameless glass casement further comprises a first and second sealing elements extending along the longitudinal axis, X, between the corresponding first and second outer plate faces and lateral portions of the L- or U-shaped protective profile coupled to the corresponding first and second outer plate faces.
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7. A glass structure according to any one of the preceding claims further comprising a resilient layer sandwiched between at least one of the first and/or second protective profiles and the corresponding first and second bottom edges of the first and second glass plates, said resilient layer having preferably a thickness of at least 0.5mm, more preferably comprised between 0.5 mm and 1 mm, more preferably comprised between 0.5 mm and 2 mm.
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8. A glass structure according to claim 7 wherein the resilient layer of a material selected from the group consisting of rubber, foam, non-woven fabric, woven fabric.
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9. A glass structure according to any one of the preceding claims wherein the sliding frameless glass casement further comprises a third glass plate located between the first and second plates.
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10. A glass structure according to claim 9, wherein said frameless glass casement further comprises a third glass plate (15) comprising a third bottom edge (151), extending along the longitudinal axis, X, and being recessed from the first and second bottom edges of the first and second glass plates (11, 21); a first inner plate face (152) facing the first inner plate face (12); and a second inner plate face (153) facing the second inner plate face (13);
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- wherein the spacer (4) is formed by a first spacer (4a) coupling the first inner plate face (12) to the first inner face of the third plate (152) and a second spacer (4b) coupling the second inner face of the third plate (153) to the second inner plate face (22),
wherein the interspace (5) extends between the first and second inner plate faces (12, 22), from the first spacer (4a), the third bottom edge (151), the second spacer (4b) to the first and second bottom edges of the first and second glass plates (11, 21);
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- wherein the outwardly open U-shaped profile (30) comprises a top edge; and
wherein the third bottom edge (151) is recessed from the top edge of the outwardly open U-shaped profile.

Patentansprüche

1. Öffnungsfähige Glasstruktur (100), die sich entlang einer Ebene P erstreckt, die von einer Längsachse X und einer Vertikalachse Z definiert ist und Folgendes umfasst:

- (a) einen festen Rahmen (110), der ein unteres Tragelement (120) umfasst;
 (b) wenigstens einen verschiebbaren rahmenlosen Glasflügel (130) mit einer Isolierglaseinheit, der im festen Rahmen montiert ist und eine untere Kante (140) umfasst; wobei der verschiebbare rahmenlose Glasflügel Folgendes umfasst:

- wenigstens eine erste Glasscheibe (10) und eine zweite Glasscheibe (20), die eine erste (11) bzw. zweite (21) Unterkante, die sich entlang der Längsachse X erstrecken, eine erste (12) bzw. zweite (22) Scheibeninnenseite und eine erste (13) bzw. zweite (23) Scheibenaußenseite umfassen,
- wenigstens einen Abstandshalter (4), der an die erste und zweite Scheibeninnenseite gekoppelt ist, der von der ersten und zweiten Unterkante zurückgesetzt ist und einen Zwischenraum (5) definiert, der sich zwischen der ersten und zweiten Scheibeninnenseite von dem Abstandshalter zur ersten und zweiten Unterkante erstreckt,
- ein nach außen offenes U-förmiges Profil (30), umfassend eine erste Seitenwand (31) angrenzend an die erste Glasscheibe, die eine Unterkante (313), die sich entlang der Längsachse X erstreckt, Innen- (311) und Außenseiten (312) umfasst, bzw. eine zweite Seitenwand (32) angrenzend an die zweite Glasscheibe, die eine Unterkante (323), die sich entlang der Längsachse X erstreckt, Innen- (321) und Außenseiten (322) umfasst, und innerhalb des Zwischenraums positioniert ist, wobei wenigstens eine der Unterkanten der ersten und/oder zweiten Seitenwand aus wenigstens einer von der ersten und/oder zweiten Unterkante der ersten und zweiten Glasscheibe hervorsteht,

- (c) einen Bewegungsmechanismus zum Öffnen und Schließen der Glasstruktur umfassend die folgenden Schritte:

- Anheben des verschiebbaren rahmenlosen Glasflügels aus einer ersten Auflageposition entlang der Vertikalachse Z, wobei die untere Kante des verschiebbaren rahmenlosen Glasflügels auf dem unteren Tragelement aufliegt, in eine erste Translationsposition, was dessen Translation entlang der Längsachse X ermöglicht,
- Verschieben des verschiebbaren rahmenlosen Glasflügels entlang der Längsachse X in eine zweite Translationsposition,
- Absenken des verschiebbaren rahmenlosen Glasflügels entlang der Vertikalachse Z in eine zweite Auflageposition,

wobei der verschiebbare rahmenlose Glasflügel ferner ein erstes (60) und zweites (70) Schutzprofil umfasst, die von dem nach außen offenen U-förmigen Profil gesonderte Elemente sind und die eine Gesamtheit der ersten und zweiten Unterkante der ersten bzw. zweiten Glasscheibe bedecken, **dadurch gekennzeichnet, dass** die Schutzprofile (60, 70) entweder

- L-förmig sind, mit einem horizontalen Abschnitt, der die Gesamtheit der entsprechenden ersten und/oder zweiten Unterkante der ersten und zweiten Glasscheibe bedeckt, und einem seitlichen Abschnitt (61, 71), der sich entlang der Vertikalachse Z erstreckt und gekoppelt ist, entweder an:

- die entsprechenden erste und/oder zweite Scheibeninnen- (12, 22) oder -außenseite (13, 23), oder
 - die entsprechende Außenseite (312, 322) der ersten und/oder zweiten Seitenwand;
- oder innerhalb eines Raumes zwischen einerseits der entsprechenden ersten und/oder zweiten Scheibeninnenseite (12, 22) und andererseits der entsprechenden Außenseite der ersten und/oder zweiten Seitenwand (312, 322) positioniert ist, oder

- U-förmig sind, mit einem horizontalen Abschnitt, der die Gesamtheit der entsprechenden ersten und/oder zweiten Unterkante der ersten und zweiten Glasscheibe bedeckt, und einem ersten und zweiten seitlichen Abschnitt, die sich entlang der Vertikalachse Z erstrecken, wobei der erste seitliche Abschnitt (61, 71) gekoppelt ist, entweder an:

- die entsprechende erste und/oder zweite Scheibeninnenseite (12, 22), oder
- die entsprechende Außenseite (312, 322) der ersten und/oder zweiten Seitenwand;

oder innerhalb eines Raumes zwischen einerseits der entsprechenden ersten und/oder zweiten Scheibeninnenseite (12, 22) und andererseits der entsprechenden Außenseite der ersten und/oder zweiten Seitenwand (312, 322) positioniert ist, und der zweite seitliche Abschnitt (62, 72) an die entsprechende erste und/oder zweite Scheibenaußenseite (13, 23) gekoppelt ist.

2. Glasstruktur nach Anspruch 1, wobei der erste seitliche Abschnitt an die Außenseiten der entsprechenden ersten und zweiten Seitenwand (312, 322) gekoppelt ist.
3. Glasstruktur nach einem der vorhergehenden Ansprüche, wobei die erste Glasscheibe und die zweite Glasscheibe eine erste (14) und zweite (24) Querkante umfassen, die sich entlang der Vertikalachse Z erstrecken, und ferner ein erstes (63) bzw. zweites (73) Querschutprofil umfassen, das höchstens 15 cm, vorzugsweise höchstens 5 cm und besser noch höchstens 2 cm der ersten bzw. zweiten Querkante von der entsprechenden Unterkante der ersten und zweiten Glasscheibe bedecken.
4. Glasstruktur nach einem der vorhergehenden Ansprüche, wobei das Schutzprofil aus einem Material hergestellt ist, das aus der Gruppe ausgewählt ist, die aus Metall, Polymer, Verbundmaterialien wie Verbundmaterialien mit einer Polymermatrix und/oder Gemischen daraus besteht, vorzugsweise aus einem Material hergestellt ist, das aus der Gruppe ausgewählt ist, die aus rostfreiem Stahl und/oder Aluminium besteht.
5. Glasstruktur nach einem der vorhergehenden Ansprüche, wobei der verschiebbare rahmenlose Glasflügel ferner ein erstes und zweites Dichtungselement umfasst, das sich entlang der Längsachse X zwischen der ersten und zweiten Unterkante der ersten und zweiten Glasscheibe und dem entsprechenden horizontalen Schutzprofil erstrecken, vorzugsweise angrenzend an die entsprechende erste und zweite Scheibenaußenseite.
6. Glasstruktur nach einem der Ansprüche 1 bis 4, wobei der verschiebbare rahmenlose Glasflügel ferner ein erstes und zweites Dichtungselement umfasst, die sich entlang der Längsachse X zwischen der entsprechenden ersten und zweiten Scheibenaußenseite und seitlichen Abschnitten des L- oder U-förmigen Schutzprofils erstrecken, das an die entsprechende erste und zweite Scheibenaußenseite gekoppelt ist.
7. Glasstruktur nach einem der vorhergehenden Ansprüche, ferner umfassend eine nachgiebige Schicht, die sandwichartig zwischen wenigstens einem von dem ersten und/oder zweiten Schutzprofil und der entsprechenden ersten und zweiten Unterkante der ersten und zweiten Glasscheibe angeordnet ist, wobei die nachgiebige Schicht vorzugsweise eine Dicke von mindestens 0,5 mm, besser noch zwischen 0,5 mm und 1 mm, besser noch zwischen 0,5 mm und 2 mm aufweist.
8. Glasstruktur nach Anspruch 7, wobei die nachgiebige Schicht aus einem Material hergestellt ist, das aus der Gruppe ausgewählt ist, die aus Gummi, Schaum, Vliesstoff, Gewebe besteht.
9. Glasstruktur nach einem der vorhergehenden Ansprüche, wobei der verschiebbare rahmenlose Glasflügel ferner eine dritte Glasscheibe umfasst, die sich zwischen der ersten und zweiten Scheibe befindet.
10. Glasstruktur nach Anspruch 9, wobei der rahmenlose Glasflügel ferner eine dritte Glasscheibe (15), die eine dritte Unterkante (151), die sich entlang der Längsachse X erstreckt und von der ersten und zweiten Unterkante der ersten und zweiten Glasscheibe (11, 21) zurückgesetzt ist; eine erste Scheibeninnenseite (152), die der ersten Scheibeninnenseite (12) zugewandt ist; und eine zweite Scheibeninnenseite (153), die der zweiten Scheibeninnenseite (13) zugewandt ist, umfasst;

wobei der Abstandshalter (4) von einem ersten Abstandshalter (4a), der die erste Scheibeninnenseite (12) an die erste Innenseite der dritten Scheibe (152) koppelt, und einem zweiten Abstandshalter (4b), der die zweite Innenseite der dritten Scheibe (153) an die zweite Scheibeninnenseite (22) koppelt, gebildet ist, wobei sich der Zwischenraum (5) zwischen der ersten und zweiten Scheibeninnenseiten (12, 22) vom ersten Abstandshalter (4a), der dritten Unterkante (151), dem zweiten Abstandshalter (4b) zur ersten und zweiten Unterkante der ersten und zweiten Glasscheibe (11, 21) erstreckt; wobei das nach außen offene U-förmige Profil (30) eine Oberkante umfasst; und

wobei die dritte Unterkante (151) von der Oberkante des nach außen offenen U-förmigen Profils zurückgesetzt ist.

5 Revendications

1. Structure vitrée ouvrante (100), s'étendant le long d'un plan, P, défini par un axe longitudinal, X, et un axe vertical, Z, et comprenant :

- 10 (a) un cadre fixe (110) comprenant un élément de support inférieur (120) ;
(b) au moins un châssis vitré sans cadre coulissant (130) avec une unité de vitrage isolant, monté dans le cadre fixe et comprenant un bord inférieur (140) ; ledit châssis de verre sans cadre coulissant comprenant :

- 15 - au moins une première plaque de verre (10) et une deuxième plaque de verre (20) comprenant un premier (11) et un deuxième (21) bord inférieur, respectivement, s'étendant le long de l'axe longitudinal, X, une première (12) et une deuxième (22) face de plaque intérieure, respectivement, et une première (13) et une deuxième (23) face de plaque extérieure, respectivement,
- au moins un espaceur (4) accouplé aux première et deuxième faces de plaque intérieures, en retrait des premier et deuxième bords inférieurs, et définissant un espace intermédiaire (5) s'étendant entre les
20 première et deuxième faces de plaque intérieures, depuis l'espaceur jusqu'aux premier et deuxième bords inférieurs,
- un profilé en forme de U ouvert vers l'extérieur (30) comprenant une première paroi latérale (31) adjacente à la première plaque de verre, qui comprend un bord inférieur (313) s'étendant le long de l'axe longitudinal, X, des faces intérieure (311) et extérieure (312) et une deuxième paroi latérale (32) adjacente à la deuxième
25 plaque de verre, qui comprend un bord inférieur (323) s'étendant le long de l'axe longitudinal, X, des faces intérieure (321) et extérieure (322), respectivement,

- 30 et étant positionné dans l'espace intermédiaire, avec au moins un des bords inférieurs de la première et/ou de la deuxième paroi latérale faisant saillie hors d'au moins un des premier et/ou deuxième bords inférieurs des première et deuxième plaques de verre,
(c) un mécanisme de déplacement pour ouvrir et fermer la structure vitrée comprenant les étapes suivantes :

- 35 - lever, le long de l'axe vertical, Z, le châssis de verre sans cadre coulissant d'une première position de repos, dans laquelle le bord supérieur du châssis de verre sans cadre coulissant repose sur l'élément de support inférieur, jusqu'à une première position de translation, permettant la translation de celui-ci le long de l'axe longitudinal, X,
- faire coulisser le châssis de verre sans cadre coulissant le long de l'axe longitudinal, X, vers une deuxième position de translation,
- abaisser le châssis de verre sans cadre coulissant le long de l'axe vertical, Z, jusqu'à une deuxième position
40 de repos,

- 45 le châssis de verre sans cadre coulissant comprenant en outre un premier (60) et un deuxième (70) profilé de protection, qui sont des éléments distincts du profilé en forme de U ouvert vers l'extérieur et qui recouvrent la totalité des premier et deuxième bords inférieurs des première et deuxième plaques de verre, respectivement,
caractérisée en ce que les profilés de protection (60, 70) sont soit :

- 50 - en forme de L avec une partie horizontale recouvrant la totalité des premier et/ou deuxième bords inférieurs correspondants des première et deuxième plaques de verre, et une partie latérale (61,71) s'étendant le long de l'axe vertical, Z, et accouplée soit :
• aux première et/ou deuxième faces de plaque intérieures (12, 22) ou extérieures (13, 23) correspondantes, soit
• à la face extérieure (312, 322) correspondante des première et/ou deuxième parois latérales ;

- 55 ou positionnée dans un espace entre, d'une part, les première et/ou deuxième faces de plaque intérieures (12, 22) correspondantes et, d'autre part, la face extérieure correspondante des première et/ou deuxième parois latérales (312, 322),
soit

- en forme de U avec une partie horizontale recouvrant la totalité des premier et/ou deuxième bords inférieurs correspondants des première et deuxième plaques de verre, et une première et une deuxième partie latérale s'étendant le long de l'axe vertical, Z, la première partie latérale (61, 71) étant accouplée soit :

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 - aux première et/ou deuxième faces de plaque intérieures (12, 22) correspondantes, soit
 - à la face extérieure (312, 322) correspondante des première et/ou deuxième parois latérales ;

ou positionnée dans un espace entre, d'une part, les première et/ou deuxième faces de plaque intérieures (12, 22) correspondantes et, d'autre part, la face extérieure correspondante des première et/ou deuxième parois latérales (312, 322),

 - 10et la deuxième partie latérale (62, 72) étant accouplée aux première et/ou deuxième faces de plaque extérieures (13, 23) correspondantes.
2. Structure vitrée selon la revendication 1, la première partie latérale étant accouplée aux faces extérieures des première et deuxième parois latérales (312, 322) correspondantes.
 153. Structure vitrée selon l'une quelconque des revendications précédentes, la première plaque de verre et la deuxième plaque de verre comprenant un premier (14) et un deuxième (24) bord transversal s'étendant le long de l'axe vertical, Z, et comprenant en outre un premier (63) et un deuxième (73) profilé de protection transversal, respectivement, recouvrant au maximum 15 cm, de préférence au maximum 5 cm, plus préférablement au maximum 2 cm des premier et deuxième bords transversaux, respectivement, à partir du bord inférieur correspondant des première et deuxième plaques de verre.
 204. Structure vitrée selon l'une quelconque des revendications précédentes, le profilé de protection étant réalisé en un matériau choisi dans le groupe constitué par un métal, un polymère, des matériaux composites tels que des matériaux composites avec une matrice polymère, et/ou des mélanges de ceux-ci, de préférence étant réalisé en un matériau choisi dans le groupe constitué par l'acier inoxydable et/ou l'aluminium.
 255. Structure vitrée selon l'une quelconque des revendications précédentes, le châssis de verre sans cadre coulissant comprenant un premier et un deuxième élément d'étanchéité s'étendant le long de l'axe longitudinal, X, entre les premier et deuxième bords inférieurs des première et deuxième plaques de verre et le profilé de protection horizontal correspondant, de préférence adjacent aux première et deuxième faces de plaque extérieures correspondantes.
 306. Structure vitrée selon l'une quelconque des revendications 1 à 4, le châssis de verre sans cadre coulissant comprenant en outre un premier et un deuxième élément d'étanchéité s'étendant le long de l'axe longitudinal, X, entre les première et deuxième faces de plaque extérieures correspondantes et les parties latérales du profilé de protection en forme de L ou de U accouplé aux première et deuxième faces de plaque extérieures correspondantes.
 357. Structure vitrée selon l'une quelconque des revendications précédentes, comprenant en outre une couche élastique prise en sandwich entre au moins l'un des premier et/ou deuxième profilés de protection, et les premier et deuxième bords inférieurs correspondants des première et deuxième plaques de verre, ladite couche élastique ayant de préférence une épaisseur d'au moins 0,5 mm, plus préférablement comprise entre 0,5 mm et 1 mm, plus préférablement comprise entre 0,5 mm et 2 mm.
 408. Structure vitrée selon la revendication 7, la couche élastique étant réalisée en un matériau choisi dans le groupe constitué par un caoutchouc, une mousse, un non-tissé, un tissé.
 459. Structure vitrée selon l'une quelconque des revendications précédentes, le châssis de verre sans cadre coulissant comprenant en outre une troisième plaque de verre située entre les première et deuxième plaques de verre.
 5010. Structure vitrée selon la revendication 9, ledit châssis de verre sans cadre comprenant en outre une troisième plaque de verre (15) comprenant un troisième bord inférieur (151), s'étendant le long de l'axe longitudinal, X, et en retrait des premier et deuxième bords inférieurs des première et deuxième plaques de verre (11, 21) ; une première face de plaque intérieure (152) faisant face à la première face de plaque intérieure (12) ; et une deuxième face de plaque intérieure (153) faisant face à la deuxième face de plaque intérieure (13) ;
 - 55l'espaceur (4) étant formé par un premier espaceur (4a) accouplant la première face de plaque intérieure (12) à la première face intérieure de la troisième plaque (152) et un deuxième espaceur (4b) accouplant la deuxième face intérieure de la troisième plaque (153) à la deuxième face de plaque intérieure (22),

EP 3 737 819 B1

l'espace intermédiaire (5) s'étendant entre les première et deuxième faces de plaque intérieures (12, 22) du premier espaceur (4a), du troisième bord inférieur (151), du deuxième espaceur (4b) aux premier et deuxième bords inférieurs des première et deuxième plaques de verre (11, 21) ;
le profilé en forme de U ouvert vers l'extérieur (30) comprenant un bord supérieur ; et
le troisième bord inférieur (151) étant en retrait du bord supérieur du profilé en forme de U ouvert vers l'extérieur.

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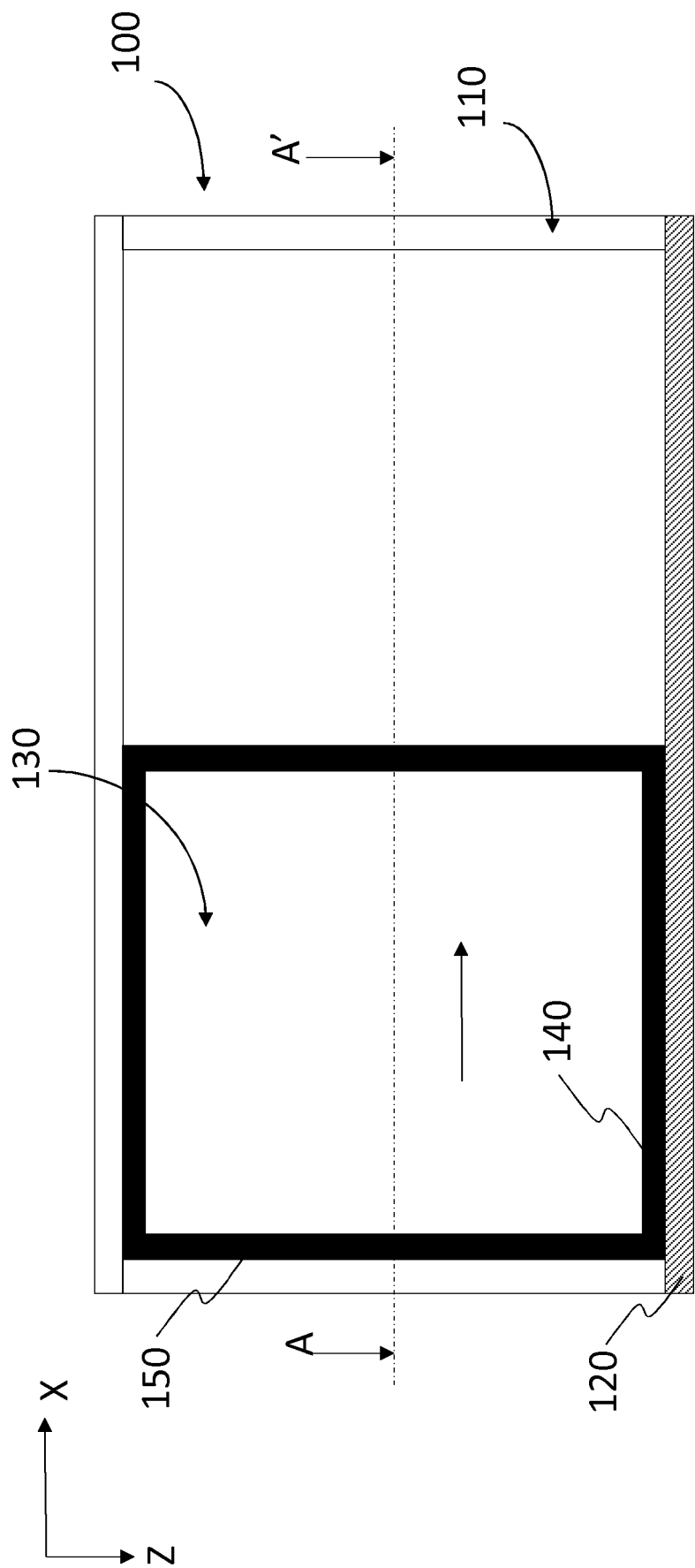


Figure 1A

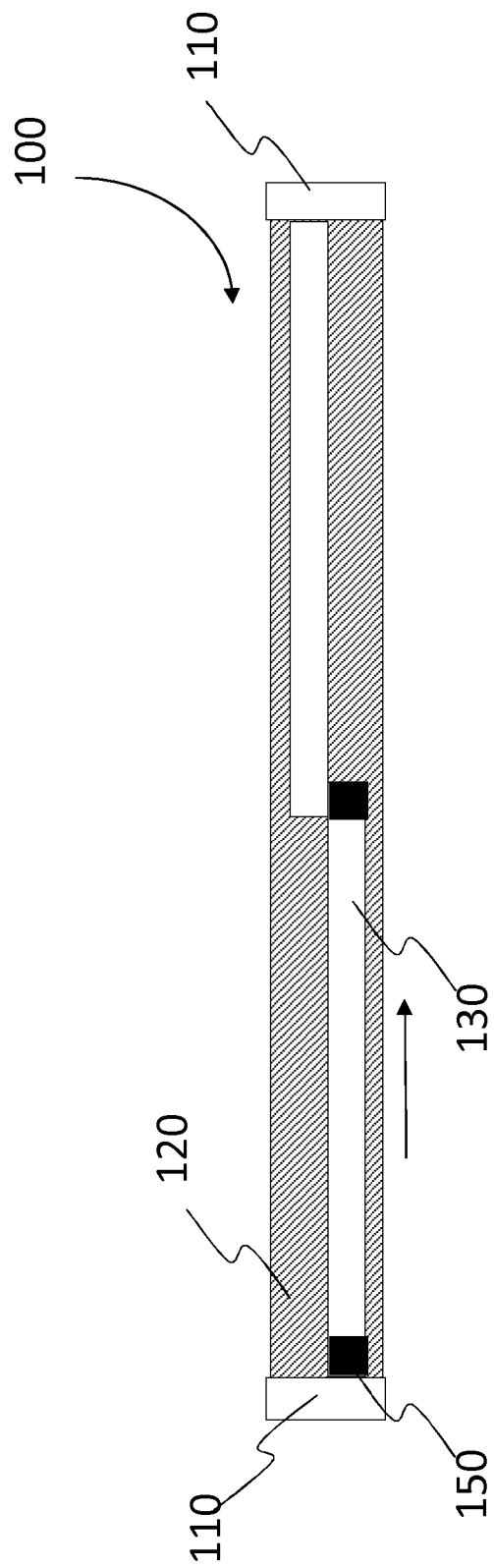


Figure 1B

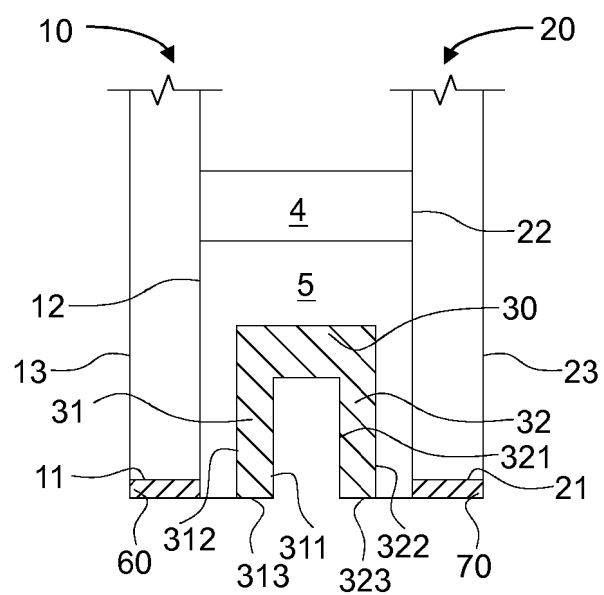


Figure 2

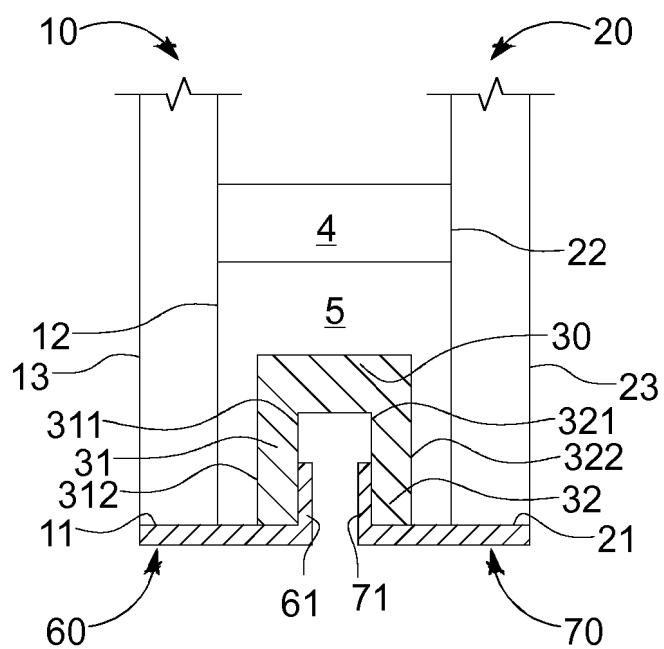


Figure 3A

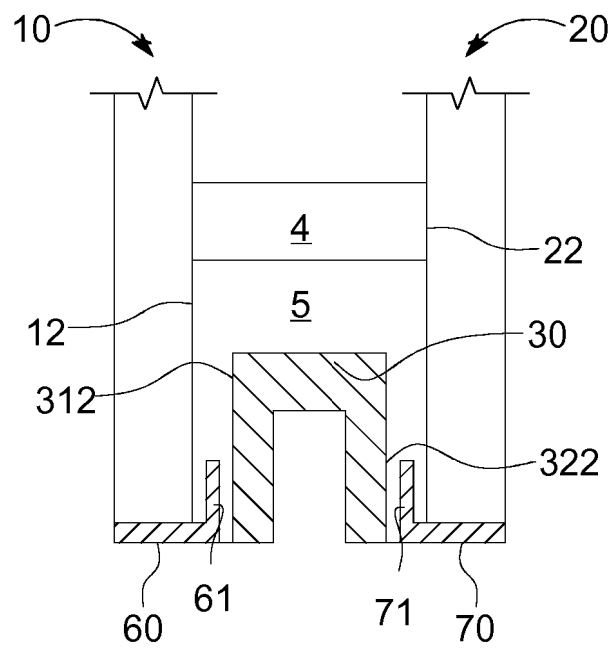


Figure 3B

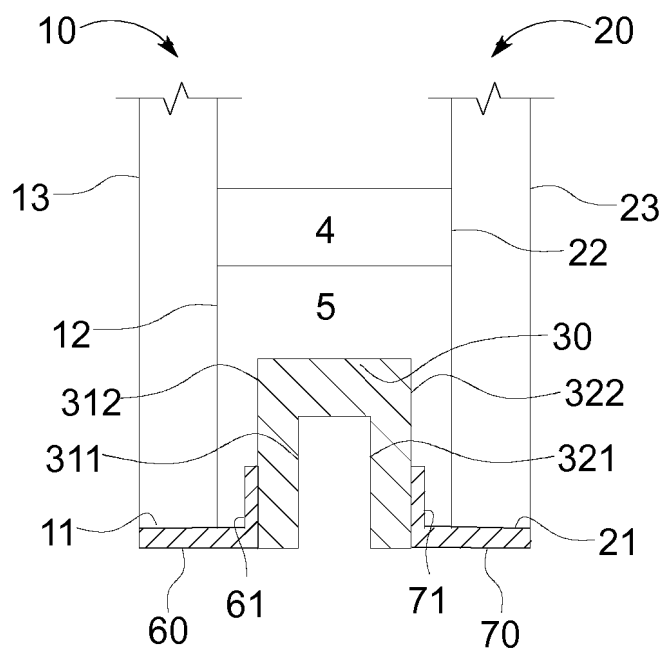


Figure 3C

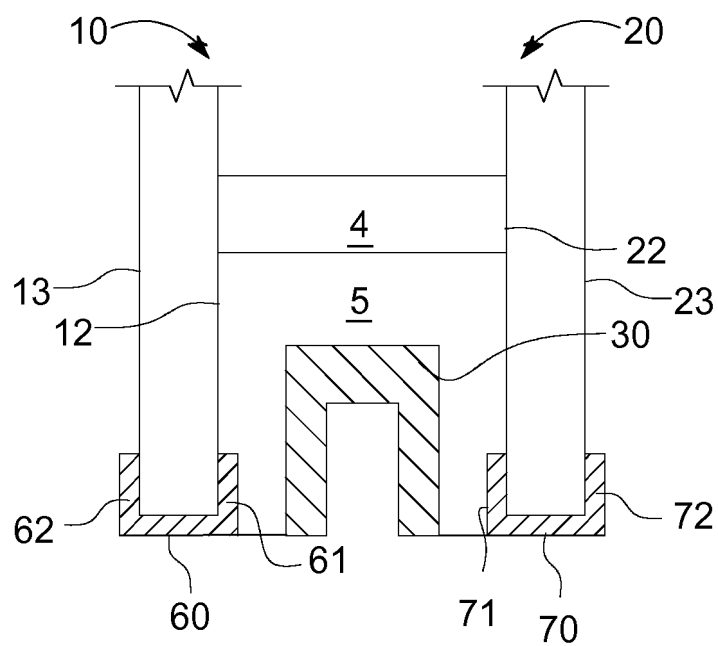


Figure 4

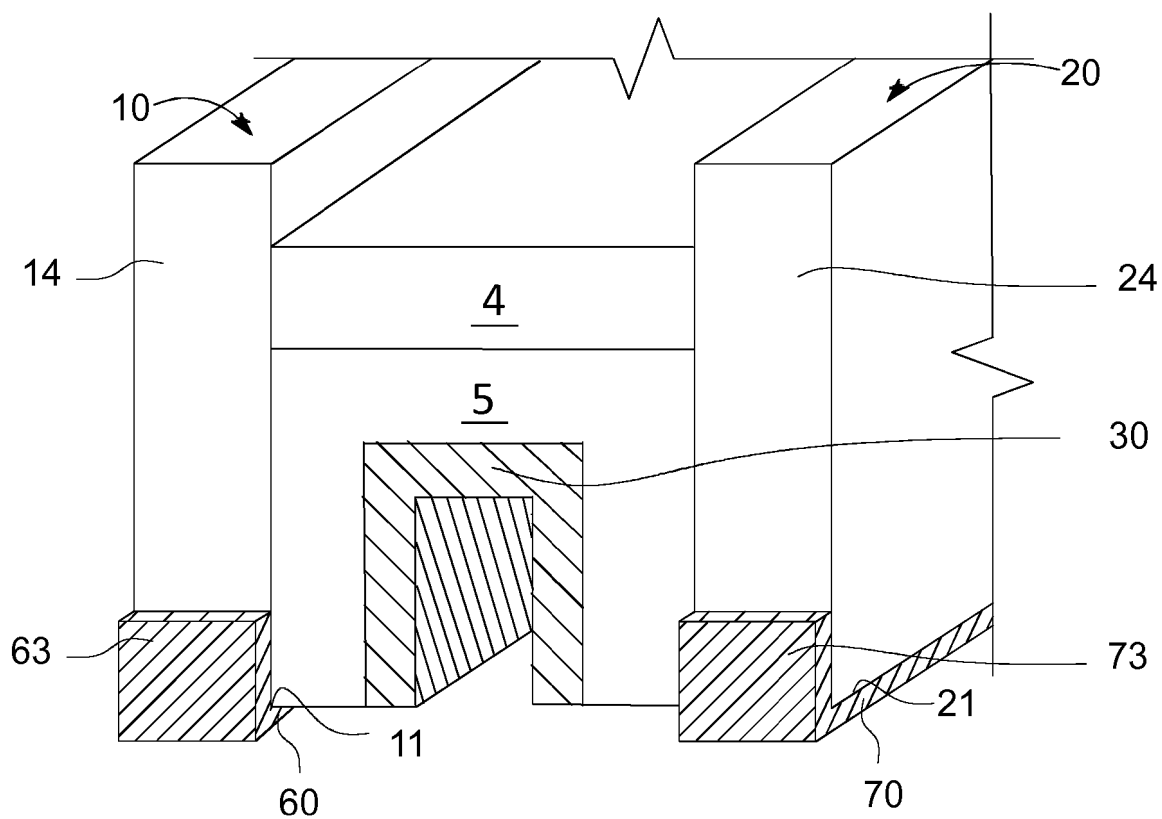


Figure 5

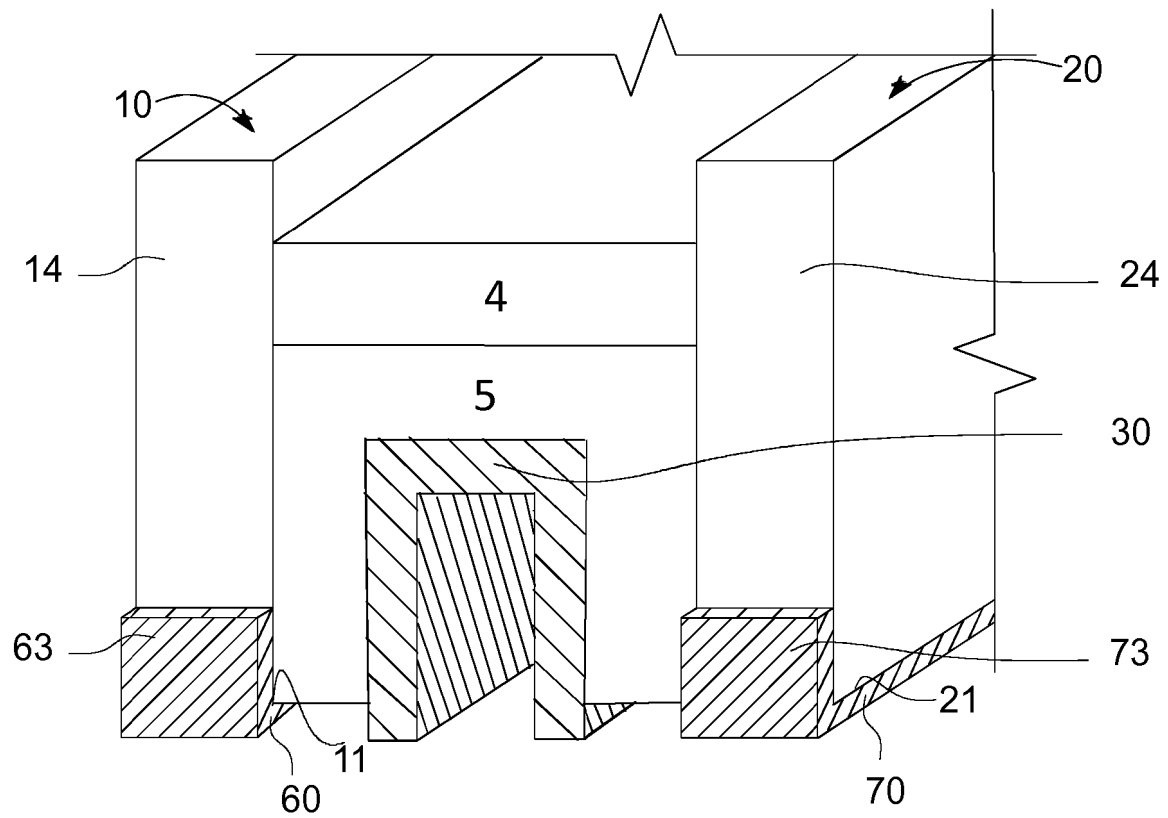


Figure 5A

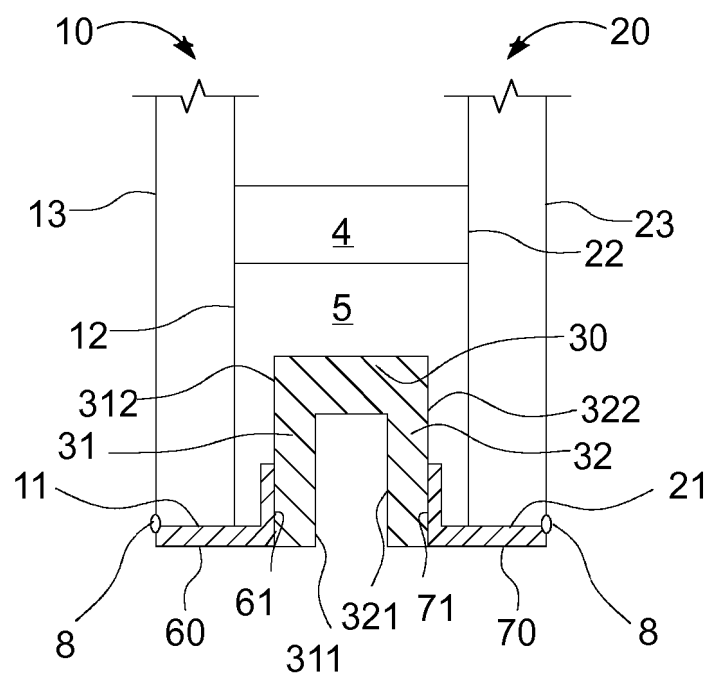


Figure 6

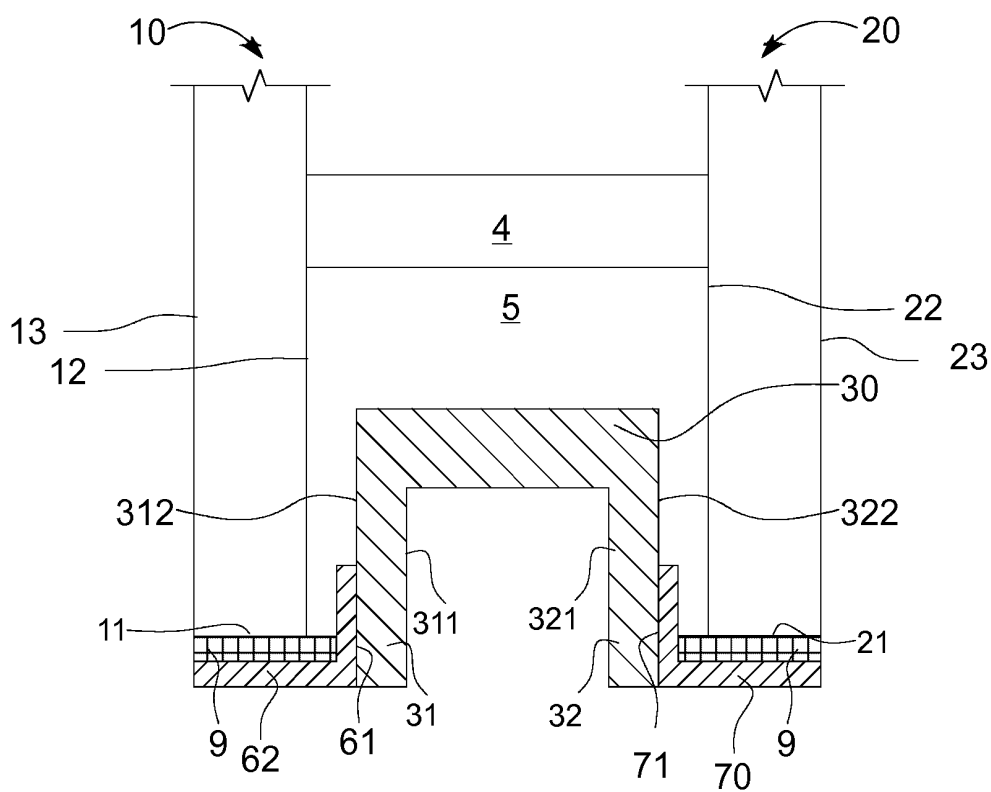


Figure 7

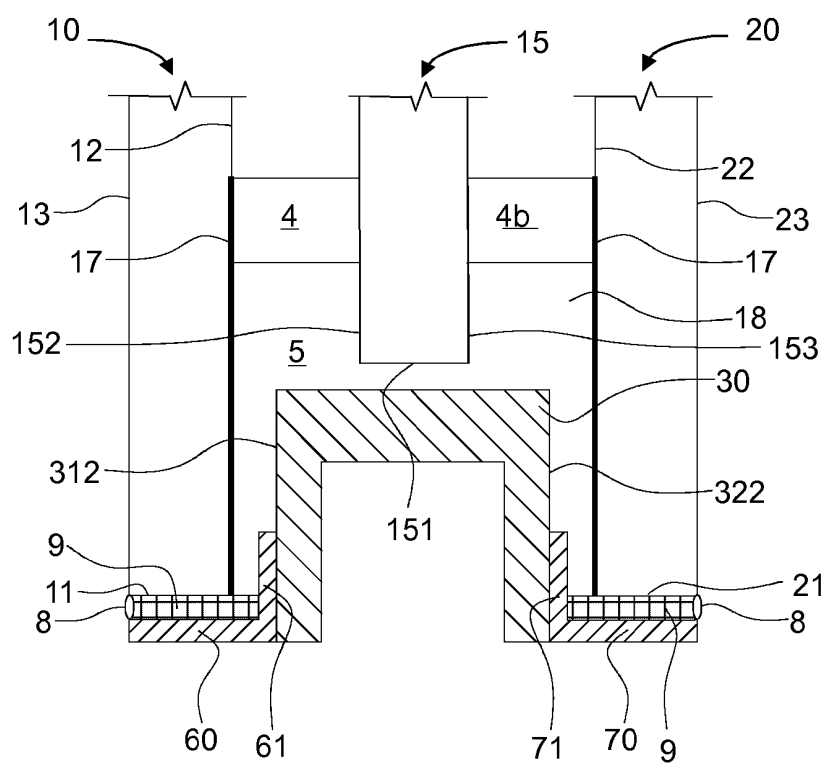


Figure 8

REFERENCES CITED IN THE DESCRIPTION

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