(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 008 850 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
08.06.2022 Bulletin 2022/23

(21) Application number: **20212186.9**

(22) Date of filing: **07.12.2020**

(51) International Patent Classification (IPC):
E04F 11/18 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E04F 11/1817; E04F 11/1834; E04F 11/1853;
E04F 2011/1823

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(54) **DEVICE, SYSTEM AND INSTALLATION METHOD FOR MOUNTING A PANEL**

(57) There is described a positioning and clamping device (1) for a panel (2), for example a panel for forming a balustrade on a balcony, wherein the device is configured to be placed in the U-shaped cavity of a profile beam (3). The device is provided with a positioning plate (15) inserted in an opening (16) in the base and wider than the base so that the positioning plate may be installed in a stationary position between the sidewalls of the U-shaped cavity of the profile beam. The lateral displacement of the positioning plate enables setting the angular position of the panel (2) while the latter is adequately supported along its side surfaces, but before clamping the panel into a fixed position relative to the beam profile (3).

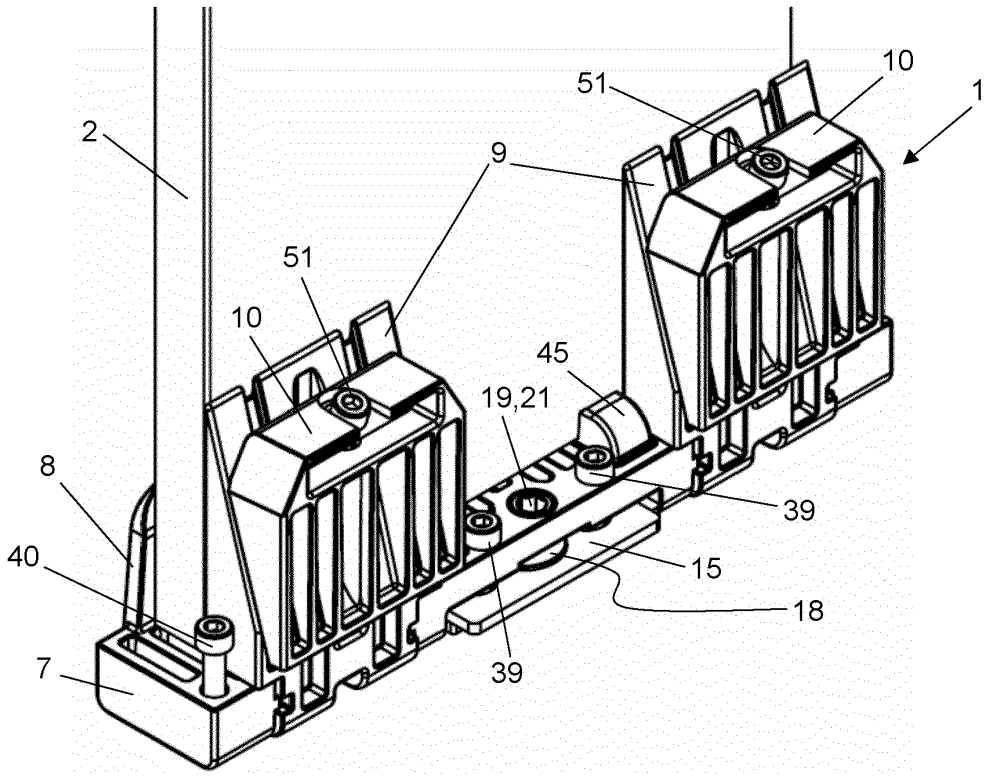

FIG. 3

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Description

Field of the invention

[0001] The present invention is related to the installation of mainly vertically oriented panels in a building, for example for enclosing a balcony space.

Background to the invention

[0002] It is well-known to close off balconies or other spaces in a building by a balustrade formed of vertically mounted rectangular panels, often glass panels, placed side by side and without interposed supports or posts between adjacent panels, so that the panels are fixated only along their base. Various systems are known for clamping the panels at the base, such as the systems disclosed in patent publication documents US2019/0177973 or WO2015/047109. As is the case in these exemplary documents, the panels are often placed in the cavity of a U-shaped profile beam mounted on a horizontal surface, for example the floor of a balcony. Inside this cavity and thereby obscured from sight by the upstanding walls of the profile, the panels are secured by suitably shaped support and clamping elements.

[0003] These elements are often provided with means for adjusting the position of the panels before securing the panels in a required position. Mainly the angular position relative to a horizontal plane needs to be correctly set before the panel can be secured. For this purpose, and as illustrated for example by the above-cited prior art documents, many of the existing systems are provided with curved or truncated elements which are capable of sliding relative to one another before being secured by a fixing bolt or the like. These elements are often quite bulky and difficult to arrange in the limited space available inside the U-shaped cavity. Some of these elements have complex shapes which increases the cost of the systems in question.

[0004] Additionally, prior art systems lack the ability to precisely control the adjustment of the position and/or angle of the panels, which are typically glass panels. In a lot of the prior art system types of wedges are used that are forced into a locking position by for example hammering, which leads to the risk of unreliable locking as the clamping force cannot be controlled and over time the wedges could release again from their initial position. Further the shocks from hammering the wedges into place and the related stress concentrations could lead to damage to the glass panels.

[0005] Further in prior art systems for mounting such panels on balconies or similar locations, there is a need for first equalizing any irregularities and/or slopes in the ground surface, for example by means of providing a suitable filler and/or levelling material or structure. There typically is a need, depending on the length over which such a balcony needs to be installed to level out height differences and/or irregularities in the order of 2 cm to 3 cm, for example by means of a suitable mortar to create a level and flat filling below the mounting element for the panels. It is clear that this filling and/or levelling operation, and often the time required for the materials used in these operation to set and/or harden, impact the efficiency of the method for mounting such systems. The need for filler materials also leads to degradation of aesthetic and structural properties of the building as mounting of the system.

Summary of the invention

[0006] The present invention addresses at least some of the above-mentioned problems of the prior art. This is achieved by a device, a system and a barrier, such as a balustrade or an enclosure, as well as an installation method thereof, in accordance with the appended claims.

[0007] The invention is thus related to a positioning and clamping device for a panel, wherein the device is configured to be placed upright in the U-shaped cavity of a profile beam. The device comprises a cradle for receiving the panel therein, wherein the cradle comprises a base and lateral support elements. The device is provided with a positioning plate inserted in an opening in the base and wider than the base so that the positioning plate may be installed in a stationary position between the sidewalls of the U-shaped cavity. The positioning plate interacts with a circular setting plate that is rotatably inserted in a circular opening in the positioning plate, and that comprises an eccentrically placed pivot axle. The pivot axle is rotatably mounted in the base, so that rotation of the pivot axle about its central axis generates a lateral displacement of the base relative to the stationary positioning plate. This lateral displacement enables setting the angular position of the panel while the latter is adequately supported along its side surfaces, but before clamping the panel into a fixed position relative to the beam profile.

[0008] The positioning plate and the setting plate are pieces with low technical complexity, which also take up little space as they are situated in a limited area at the base of the positioning device.

[0009] According to a first aspect of the invention, there is provided a device for positioning and clamping a planar panel in a U-shaped profile beam when the profile beam is mounted with the open end of the U shape oriented upwards, wherein the panel, when placed in a vertical position, comprises a straight underside and two planar side surfaces, the device comprising a cradle suitable for being placed inside the U-shaped cavity of the profile beam, the cradle comprising :

- a base for receiving the underside of the panel,
- lateral support elements on either side of the base for supporting the two planar side surfaces of the panel,
- one or more securing elements for clamping the panel between the lateral support elements,

characterised in that the device further comprises:

- a planar positioning plate inserted in an opening through the base, the positioning plate comprising a circular opening,
- a planar setting plate having a circular shape that fits within the circular opening of the positioning plate, configured such that the only possible movement of the setting plate relative to the opening is a rotation about its central axis, wherein the setting plate is provided with an eccentrically placed pivot axle, that is rotatable about its central axis with respect to the base of the cradle,

wherein the positioning plate is wider than the width of the base, so that the rotation of the pivot axle about its central axis actuates a relative movement of the base with respect to the positioning plate when the latter is held in a stationary position, thereby enabling to set the angular position of a panel held by the device.

[0010] The positioning plate allows for the ability to precisely control the adjustment of the angle of a panel, which are typically glass panels.

[0011] According to an embodiment there is provided a device, wherein the lateral support elements comprise a back portion that is fixed to or uniform with the base of the cradle and one or more support elements which are movable so as to adapt the space between the back portion and the movable elements to the width of a panel, wherein the movable elements have a triangular cross section, and wherein the one or more securing elements include one or more wedge-shaped elements configured to be inserted between the movable elements and a sidewall of the U-shaped cavity and secured to the movable elements, to thereby clamp the panel between the back portion and the movable elements.

[0012] In this way, by means of the movable elements, there is a decreased risk of unreliable locking as the clamping force can be established in a more controlled manner and the risk that over time the wedges could release again from their initial position is decreased.

[0013] Further, as during mounting, the clamping force is gradually increased the risk for unallowable stress concentrations which could lead to damage to the glass panels is reduced.

[0014] According to an embodiment there is provided a device, wherein the cradle comprises two of said movable elements and two respective wedge-shaped securing elements, and wherein the positioning plate is located in between said two movable elements.

[0015] According to an embodiment there is provided a device, wherein the base is provided with one or more recesses, one recess for each of said movable support elements, and wherein the movable support elements are slidably inserted in said recesses so that their position can be adapted to the width of the panel.

[0016] According to an embodiment there is provided a device, further comprising fixing elements for releasably securing the positioning plate to the base of the cradle.

[0017] According to an embodiment there is provided a device, wherein the fixing elements include a fixing plate located underneath the positioning plate, the fixing plate being essentially immobile relative to the base when the cradle is placed in the U-shaped cavity, the fixing plate comprising :

- a central opening into which said pivot axle is rotatably inserted,
- at least one threaded hole, adjacent to the central opening,

wherein the positioning plate comprises at least one hole above and overlapping the respective at least one threaded hole and larger in diameter than the latter, the larger hole allowing the passage of a securing bolt for fixing the positioning plate to the fixing plate by screwing the securing bolt into the threaded hole.

[0018] According to an embodiment there is provided a device, wherein the device is further provided with one or more positioning bolts for adjusting the height of the cradle inside the U-shaped cavity.

[0019] In this way adjustment of the height, to compensate for slopes or irregularities of the ground surface is achieved in such a way that no levelling or filler material is needed, which leads to more efficient mounting method. Additionally the panel is levelled by means which are positioned inside the U-shaped cavity, which are not visible and thus provide for an increased aesthetic effect, as well as an improved structural property as in this way the elements for adjusting the height are protected and shielded from the elements, and further remain accessible for readjustment after mounting, if that would be necessary. Further it is clear that in this way the U-shaped profile beam can be mounted directly to the ground surface, without the need for intermediate elements such as filling or levelling materials, which provides for a more secure and rigid mounting.

[0020] According to an embodiment there is provided a device,, wherein the device further comprises one or more preliminary holding elements which are inserted in grooves provided in the upper surface of the base, and whose position inside said grooves is adapted to the width of the panel.

[0021] According to a second aspect there is provided a system for positioning and clamping a plurality of planar panels for forming a barrier, the system comprising one or more U-shaped profile beams and a plurality of devices in accordance with the first aspect.

[0022] According to a third aspect, there is provided a method for positioning and clamping a plurality of planar panels for forming a barrier, the method comprising the steps of :

- mounting one or more U-shaped profile beams on a support surface, to thereby form a single elongate U-shaped cavity,

- placing a plurality of devices according to any one of claims 1 to 7 in the U-shaped cavity formed by the one or more profile beams, wherein the positioning plates of said devices are held stationary between the upstanding walls of the U-shaped cavity,
- placing a panel in the U-shaped cavity, wherein the panel is supported by the cradles of at least two of said devices, while the lateral support elements are not securing the panel, and wherein the panel is supported laterally by a lateral panel support placed along an upper region of at least one of the inner walls of the U-shaped cavity,
- adjusting the angle of the panel by rotating the pivot axles off the setting plates of the respective devices,
- when the angle of the panel is set, securing the positioning plates to the base of the respective devices,
- securing the movable support elements to thereby clamp the panel in the U-shaped cavity.

[0023] In this way an efficient, simple and user-friendly mounting and adjustment of the planar panels is possible.
[0024] According to an embodiment, there is provided a method, wherein the devices further comprise at least one positioning bolt for adjusting the height of the cradle inside the U-shaped cavity, and wherein the height of the cradles of the devices is set by turning these bolts, after setting the angle of the panel and before securing the positioning plates to the base of the devices.
[0025] According to a fourth aspect, there is provided a barrier comprising :

- one or more U-shaped profile beams mounted on a surface and forming an elongate U-shaped cavity,
- a plurality of panels mounted side by side in said cavity,

wherein each panel is supported by at least two devices according to the first aspect, mounted in the cavity.
[0026] According to an embodiment, there is provided a barrier, wherein said barrier is a balustrade of a balcony.
[0027] According to a further embodiment, there is provided a barrier, wherein the panels are glass panels.

Brief description of the figures

[0028]

Figure 1a illustrates two panels of a balustrade in accordance with an embodiment of the invention. Figure 1b shows a detail of the profile beam into which the panels are mounted.

Figure 2 illustrates the balustrade of Figure 1a with the profile beam removed from the drawing, showing the position of two positioning and clamping devices in accordance with the invention.

Figure 3 is a detailed 3D view of the positioning and clamping device according to an embodiment of the invention.

Figure 4 illustrates the main components of the positioning and clamping device of Figure 3.

Figure 5 is a side view of the device, installed in the profile beam and holding a panel.

Figure 6 shows the underside of the positioning and clamping device, illustrating the location of the positioning plate.

Figure 7 illustrates the positioning plate in detail, along with a fixing plate for securing the positioning plate to the base of the device.

Figures 8a and 8b illustrate the way in which the angular position of the panel is set using a device according to the invention.

Figure 9 illustrates the setting of the height of the panel using a device according to an embodiment of the invention.

Figures 10a and 10b illustrates the steps of the method for positioning and clamping a panel using positioning and clamping devices in accordance with the embodiment shown in the previous drawings.

Figures 11 and 12 illustrate cross sections of different embodiments similar to the ones illustrated in the other drawings, comprising panels with different widths.

Detailed description of embodiments of the invention

[0029] Before the present invention is described, it is to be understood that this invention is not limited to particular systems and methods or combinations described, since such systems and methods and combinations may, of course, vary. It is also to be understood that the terminology used herein is not intended to be limiting, since the scope of the present invention will be limited only by the appended claims.
[0030] As used herein, the singular forms "a", "an", and "the" include both singular and plural referents unless the context clearly dictates otherwise.
[0031] The terms "comprising", "comprises" and "comprised of" as used herein are synonymous with "including", "includes" or "containing", "contains", and are inclusive or open-ended and do not exclude additional, non-recited members, elements or method steps.
[0032] The term "about" ,"approximately" or "essentially", as used herein when referring to a measurable value such as a parameter, an amount, a temporal duration, and the like, is meant to encompass variations of

+/-10% or less, preferably +/-5% or less, more preferably +/-1% or less, and still more preferably +/-0.1% or less of and from the specified value, insofar such variations are appropriate to perform in the disclosed invention. It is to be understood that the value to which the modifier "about", "approximately" or "essentially" refers is itself also specifically, and preferably, disclosed.

[0033] Whereas the terms "one or more" or "at least one", such as one or more or at least one member(s) of a group of members, is clear *per se,* by means of further exemplification, the term encompasses *inter alia* a reference to any one of said members, or to any two or more of said members, such as, e.g., any ≥3, ≥4, ≥5, ≥6 or ≥7 etc. of said members, and up to all said members.

[0034] All references cited in the present specification are hereby incorporated by reference in their entirety. In particular, the teachings of all references herein specifically referred to are incorporated by reference.

[0035] Unless otherwise defined, all terms used in disclosing the invention, including technical and scientific terms, have the meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. By means of further guidance, term definitions are included to better appreciate the teaching of the present invention.

[0036] In the following passages, different aspects of the invention are defined in more detail. Each aspect so defined may be combined with any other aspect or aspects unless clearly indicated to the contrary. In particular, any feature indicated as being preferred or advantageous may be combined with any other feature or features indicated as being preferred or advantageous.

[0037] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment, but may do so. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner, as would be apparent to a person skilled in the art from this disclosure, in one or more embodiments. Furthermore, while some embodiments described herein include some but not other features included in other embodiments, combinations of features of different embodiments are meant to be within the scope of the invention, and form different embodiments, as would be understood by those in the art. For example, in the appended claims, any of the claimed embodiments can be used in any combination.

[0038] In the present description of the invention, reference is made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration only, images of specific embodiments in which the invention may be practiced. Parenthesized reference numerals cited in the claims with reference to respective elements merely exemplify the elements by way of example, with which it is not intended to limit the respective elements.

[0039] It is to be understood that other embodiments may be utilised and structural or logical changes may be made without departing from the scope of the present invention. The following detailed description, therefore, is not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

[0040] Figure 1a illustrates a portion of an embodiment of a barrier 50, in the form of for example a balustrade 50 in accordance with an embodiment of the present invention. The balustrade comprises glass panels 2 placed side by side in the U-shaped cavity of a profile beam 3, for example formed of aluminium, mounted on a planar surface, for example the floor of a balcony. The detail in Figure 1b shows the profile beam 3, with plastic closing strips 30 attached to the rim of the upstanding walls of the profile. It is clear that alternative embodiments are possible in any other suitable material, such as for example a suitable metal, such as for example aluminium, steel, etc. or any suitable combination or hybrid of a plastic and a metal. At the outer end of one of the closing strips 30, a sealing strip 31 is attached, preferably formed of rubber or an equivalent material such as for example a suitable plastic, and lying against one sidewall of the panel 2. On the other side, the opposite sidewall of the panel 2 is supported by a retention band 32 attached to the inner wall of the profile 3 near the top of said inner wall. The retention band 32 is also preferably formed of a sealing material, but has sufficient solidity to hold the panel 2 in place when the panel is inserted between the back portion 8 and the holding elements 45, which will be described in further detail below with reference to Figure 4, and pressed against the band 32. The retention band 32 further comprises a thin extension 33 lying against the sidewall of the panel 2 and serving as a sealing strip with the same function as the sealing strip 31 on the other side.

[0041] Figure 2 shows the balustrade 50 with the U-profile removed, thereby visualising a number of positioning and clamping devices 1 according to an embodiment of the invention. According to the embodiment shown, two devices 1 are installed for each of the panels 2.

[0042] Figures 3 to 5 illustrate one of the positioning and clamping devices 1 in more detail. Figure 3 shows a 3D view of the assembled device 1 holding a glass panel 2, while Figure 4 illustrates the main components of the device 1. Figure 5 is a side view of the assembled device holding a glass panel 2 and installed in a U-shaped profile beam 3. The device 1 comprises a cradle that includes a base 7, a back portion 8 and two movable support elements 9. The base 7 is an elongate piece, preferably formed of a synthetic material. According to a particular embodiment, the synthetic material could for example be formed in a suitable glass fibre reinforced

polyamide, such as for example nylon, however it is clear that alternative embodiments are possible in which any other suitable material is provided, such as for example any other suitable plastic, any suitable metal, and/or any suitable combination thereof or hybrid material. The base 7 is configured to be placed lengthwise on the bottom of the U-shaped cavity of the profile beam 3, extending in the longitudinal direction of the cavity. The width 7W of the base 7 is smaller than the width 3W of the U-shaped cavity to such a degree that a significant shift of the base 7 relative to the sidewalls of the cavity is enabled. The widths 7W and 3W are shown in further detail in for example Fig. 5, and thus refer to the distance along a substantially horizontal direction in the state shown in Figure 5, transverse to the longitudinal direction of the profile beam 3, or in other words transvers, or substantially transverse to the longitudinal plane of the panel 2, and/or the upright legs of the U-shaped cavity of the profile beam 3.

[0043] The back portion 8 is an upright wall element extending along the majority of the length of the base 7. In the embodiment shown, but without forming a limitation to the scope of the invention, the base 7 and the back portion 8 are formed as a single uniform piece. The base 7 comprises two recesses 34 into which the movable support elements 9 can be slidably inserted so that the panel 2 may be supported by the base 7 along its underside 4, see for example Fig. 5, and by the back portion 8 and the movable elements 9 along the respective side surfaces 5 and 6 of the panel 2. In this way, the base 7, the back portion 8 and the movable elements 9 effectively form a cradle into which the panel 2 can be placed.

[0044] In the embodiment shown, the movable support elements 9 have a triangular cross-section and are configured to co-operate with wedge-shaped securing elements 10 which are inserted into the triangular space between the movable elements 9 and the side wall of the U-profile beam 3. Securing bolts 51 oriented in a slanted direction enable the securing of the wedge elements 10 to the movable elements 9, to thereby immobilize said movable elements 9, and clamp the panel 2 between the back portion 8 and the movable elements 9, at the same time clamping the device 1 as a whole into the U-shaped cavity of the profile beam 3.

[0045] However, before the panel 2 is clamped in this way, the device 1 according to the embodiment shown allows positioning of the panel 2 correctly in terms of its angular position and in terms of its height. The means for adjusting the angular position are characteristic for the present invention. As seen in Figures 3 to 5 and in more detail in Figures 6 and 7, the base 7 comprises a central opening 16 into which a positioning plate 15 is inserted. The positioning plate 15 may be a metal plate, such as for example a suitable steel plate, such as for example stainless steel, however any other suitable material, such as for example a suitable metal, for example aluminium, or a suitable plastic, which have a suitable strength and robustness are possible. The positioning plate 15 is essentially parallel to the bottom surface of the base, although a slight deviation from this parallel orientation is possible, as long as such a deviation does not hinder the functionality of the plate 15 (described hereafter) in an important way.

[0046] As is best visible in the side view in Figure 5, the positioning plate 15 is wider than the base 7, extending outward from the base on either side thereof. It is seen also in Figure 5 that the positioning plate 15 is held stationary between the sidewalls of the U-shaped cavity of the profile beam 3, because the width 15W of the plate 15 corresponds to the width 3W of the U-shaped cavity of the profile beam. If the width 15W of the plate 15 is smaller than the width 3W of the cavity, the plate 15 could be held stationary within the cavity by auxiliary holding means such as blocking elements inserted between the plate 15 and the profile. The fact that the positioning plate 15 is held stationary is important for enabling the angular positioning as will be explained hereafter. It is further clear that the width 7W of the base 7 is smaller than the width 15W of the positioning plate 15 to such a degree that a suitable shift of the base 7 relative to the sidewalls of the cavity of the profile beam 3 is enabled.

[0047] Figures 6 and 7 show that the positioning plate 15 comprises a circular opening 17 through the complete thickness of the plate. Into this opening 17, a circular setting plate 18, preferably also formed of metal is rotatably inserted so as to be substantially coplanar with the positioning plate 15. It is clear that according to alternative embodiments the circular setting plate 18 may be formed from any suitable material, such as for example steel, such as for example stainless steel, however any other suitable material, such as for example a suitable metal, for example aluminium, or a suitable plastic, which have a suitable strength and robustness. The diameters of the opening 17 and the setting plate 18 correspond so that the only possible movement of the setting plate 18 relative to the opening 17 is a rotation about its central axis (not taking into account the required lateral play to enable the free rotation of the plate 18 inside the opening 17). The setting plate 18 is further provided with an eccentrically placed pivot axle 19, i.e. the pivot axle 19 is placed out of centre on the circular face of the setting plate 18 and oriented essentially perpendicularly with respect to said circular face. The pivot axle 19 is rotatable with respect to the base 7 of the cradle, i.e. the pivot axle 19 can rotate about its central rotation axis that is essentially fixed with respect to the base 7. To this aim, the pivot axle 19 is rotatably inserted in a vertically oriented opening 20 provided in the base 7.

[0048] The pivot axle 19 is provided at the top with a nut section 21 compatible with an Allen wrench for actuating the rotation of the pivot axle 19 about its central axis. To this aim, the nut section 21 is accessible from the top when a panel is installed in the device (see Fig. 3), and when the closing strip 30 and the sealing strip 31 are removed (or before mounting these strips). Rotating the pivot axle 19 in this way actuates the rotation of the

setting plate 18 along with the pivot axle 19 about the latter's rotation axis, located eccentrically with respect to the setting plate itself 18. Because of this eccentric position, the rotation of the setting plate 18 exerts a force on the positioning plate 15, the force acting to move the positioning plate 15 relative to the base 7 if the latter would be stationary.

[0049] However, because the positioning plate 15 is held stationary between the walls of the U-shaped cavity, the force generates a movement of the base 7 relative to the plate 15, causing the base 7 to be shifted back and forth between the sidewalls of the cavity, and transversely with respect to these sidewalls. Because of the eccentric position of the pivot axle 19, the base 7 undergoes also a slight movement in the longitudinal direction of the U-shaped cavity. The length of the opening 16 is overdimensioned with respect to the positioning plate 15 so as to allow this longitudinal component of the shift of the base 7.

[0050] The lateral shift of the base 7 enables the setting of the angular position of a panel 2 held by the cradle of the device, as illustrated in Figures 8a and 8b. These images show the position of the base 7 corresponding to a +2° or -2° shift from the perpendicular or 0° panel position, which for example means perpendicular to the substantially horizontal plane of the base 7 or the bottom plane of the U-shaped cavity of the profile beam. In other words, the embodiment of the positioning and clamping device 1 according to such an embodiment is configured to allow an adjustment of the angular position of a panel 2 held by the cradle of the device in a range of +/- 2° with respect to a predetermined central reference position. It is clear that alternative embodiments with other suitable ranges, such as for example equal to or smaller than +/- 10°, or equal to or smaller than +/- 5° are possible. Typically, the range is adapted to enable compensation of irregularities and/or slopes in the ground surface of about 1° or 2° per meter.

[0051] In the embodiment shown, the angular positioning is further enabled by the retention band 32 to one side and the lateral support elements 9 combined with their respective wedge elements 10 on the other side. As the base 7 is shifted, the panel 2 maintains contact with the retention band 32 so that it is the position of this retention band 32 that determines the relation between the angular position of the panel 2 and the lateral position of the base 7. The lateral support elements 9 and the wedge elements 10 (not yet secured by the bolts 51) support the panel on the other side, thereby assisting the panel to get in contact with the retention band 32 as the base 7 is shifted. Preferably, in order to provide for a more precise adjustment of the angle, there can be applied a small manual force on the side of the panel facing away from the back portion 8, in the direction of the back portion 8, to ensure that during the mounting operation of the panel, before the panel is fixed by the wedge elements 10, the panel is held in contact with the retention band 32. This is a simple and user friendly action, which can be performed by an operator from the location where the screws for making the adjustments to the device during the mounting operation are located.. During positioning, the wedge elements 10 are not secured to the support elements 9, this means the bolts 51 are not screwed tight), so that the position of the wedge elements 10 can adapt to the changing gap between the panel 2 and the profile's sidewall, as a consequence of the lateral shift of the base 7. As explained further, the wedge elements 10 will be secured after the desired angular position has been set.

[0052] Generally, it is required that the panel 2 is retained at least on at one side of the panel at a position above the base 7, in order for the lateral shift of the base 7 to result in a controllable angular shift of the panel. In the embodiment shown, this is realized by the presence of the retention band 32. However, the way in which this retention is done may differ from the above-described embodiment.

[0053] In the embodiment shown, and best visible in Figure 7, the pivot axle 19 is inserted at its lower end in a fixing plate 35 which may be a metal plate mounted underneath and in contact with the setting plate 15 and provided with a central opening 36 into which the pivot axle 19 is rotatably inserted.. It is clear that according to alternative embodiments the fixing plate 35 may be formed from any suitable material, such as for example steel, such as for example stainless steel, however any other suitable material, such as for example a suitable metal, for example aluminium, or a suitable plastic, which have a suitable strength and robustness. The fixing plate 35 comprises lateral extensions 52 which fit into corresponding recesses in the bottom of the base 7, so that the fixing plate 35 is essentially immobile relative to the base 7 when the latter is placed on the bottom of the U-shaped cavity. The fixing plate 35 further comprises two threaded holes 37, one on either side of the central opening 36. The positioning plate 15 comprises openings or holes 38 located above and overlapping these threaded holes 37 and having a larger diameter than the threaded holes 37. Securing bolts 39 pass through openings 22 in the base 7, through the larger openings or holes 38 and are screwed into the threaded holes 37. When the bolts 39 are not screwed tight, relative movement between the positioning plate 15 and the fixing plate 35 is allowed within the boundaries defined by the diameter of the larger openings or holes 38. This diameter is therefore configured to allow sufficient freedom of movement in order to enable setting of the panel's angular position within a practically applicable range. When the desired angle is set, the securing bolts 39 are screwed tight, securing the positioning plate 15 to the fixing plate 35 and thereby to the base 7, thereby immobilizing the positioning plate 15 and the base 7 with respect to each other.

[0054] The fixing plate 35 and the bolts 39 represent just one example of how the positioning plate 15 can be secured relative to the base 7. The fixing plate 35 could for example form an integral part of the base 7, or it could

be omitted. In the latter case, the positioning plate 15 and the base 7 could be secured together by bolts passing through larger openings in the base 7 and screwed into smaller threaded holes in the positioning plate.

[0055] In the embodiment shown, the clamping and positioning device 1 further comprises two positioning bolts 40 for adjusting the height of the base 7 and thereby of the panel 2 with respect to the bottom of the U-shaped cavity. As illustrated in Figure 9, the height H is adjusted by rotating the bolts 40 which rest on the bottom of the cavity, so that turning the bolts 40 in one or the other direction lifts up or brings down the base 7 relative to the bottom. The invention however also includes a device with other types of height regulation means or without any height regulation means.

[0056] As seen in Figures 3 and 4, the device according to the embodiment of the drawings comprises a pair of holding elements 45 inserted into grooves 46, so that when mounted inside these grooves they are fixed to the base 7. The holding elements 45 represent preliminary holding means for the panel 2 and are pushed against the side of the panel, while the opposing side of the panel rests against the back portion 8. With this, the elements 45 help to keep the panel 2 in place relative to the base 7 while the angular position of the panel is set. It is clear that when the holding elements 45 are positioned inside said grooves that they are adapted to the width 2W of the panel 2, or in other words, that, according to this embodiment, the distance between the holding elements 45 and the back portion 8 is equal, or substantially equal to the width 2W of the panel 2. This is further shown in detail in Figures 11 and 12, which shows a cross-section showing these holding elements 45 and the grooves 46 in more detail of two alternative embodiments. In the embodiment of Figure 11 the width 2W of the panel 2 is larger than the width 2W of the panel 2 in the embodiment of Figure 12. As further shown the embodiment of the holding elements 45 in Figure 11 is different from that in Figure 12, in such a way that the distance between the holding element 45 in Figure 11 and the back portion 8 is larger in Figure 11 than in Figure 12. In this way a maximum of elements of the system can be used independent of the width 2W of the panel 2, and only the holding elements 45 need to be adapted to the width 2W of the panel. The presence of such preliminary holding means is however not a limitation of the scope of the present invention.

[0057] The invention is related also to a system for mounting, positioning and clamping a plurality of panels forming a barrier. The system comprises one or more U-shaped profile beams 3 and a plurality of positioning and clamping devices 1 according to any embodiment of the invention. The system may further comprise additional means for holding the panel in place during the angular positioning of the panel, such as the retention band 32, or for closing off the cavity of the profile beams, such as the closing strips 30 and the sealing strip 31. The system may further comprise any tools necessary for installing the barrier.

[0058] The invention is also related to a barrier obtainable by using a system according to the invention. This may be a balustrade of a balcony formed by a plurality of glass panels mounted side by side and without interposed supports or posts, wherein each panel is mounted in a U-shaped profile beam 3 and supported in the cavity thereof by at least two positioning and clamping devices 1 in accordance with the invention.

[0059] The invention is also related to a method for positioning and clamping one or more panels 2 in a U-shaped profile beam 3. When the positioning and clamping device 1 of the drawings is used, the steps of the method are illustrated in Figures 10a and 10b. The panel is placed in the U-shaped cavity of the profile beam 3, comprising at least two positioning devices 1 installed on the bottom of the cavity. The panel 2 is placed so that its underside 4 rests on the base 7 of the devices. In each of the devices, the holding elements 45 are shifted against the one side surface of the panel, while the other side surface rests against the back portion 8. Then the lateral support elements 9 are pushed against the side surface of the panel and the wedge elements 10 are pushed downward as far as possible, so that the panel is supported on the one hand by the retention beam 32, and on the other by the holding elements 9. The wedge elements 10 are however not secured by the bolts 51 to the support elements 9 at this moment, i.e. the devices 1 are not laterally blocked within the cavity. The positioning and clamping method is then performed. The steps A to D of the method are symbolized by four Allen wrenches depicted in Figures 10a and 10b. In step A, the angular position of the panel is set, by rotating the pivot axle 19 of the setting plate 18. Then (step B) the height is set by rotating the positioning bolts 40. Then (step C) the angular position is fixed by securing the fixing bolts 39. Finally, in step D, the panel is laterally secured by screwing tight the bolts 51, thereby securing the wedge elements 10 and clamping the panel between the sidewalls of the cavity. After this, the closing strips 30 and the sealing strip 31 can be mounted.

[0060] As stated above, the invention is not limited by the combination of features defined by the embodiment shown in the drawings. Although it is preferred to have two lateral support elements 9 with the positioning plate 15 located between the two, a device according to the invention may have just one lateral support element 9 and one positioning plate 15. Also, the device could comprise more than two positioning plates 15 located at different positions along the base 7 of the device. Instead of the triangular-shaped support elements 9 and the wedges 10, the lateral support and clamping of the panel may be realized using other shapes of support and clamping elements. The back portion 8 could be movable and securable relative to the base 7 instead of being fixed. According to still further alternative embodiments of the lateral support elements are possible, for example instead of and/or in addition to the back portion 8, the holding elements 45 could for example comprise a U

shaped cross section, in to which the underside 4 of the panel 2 can be held, or in other words of which the width 3W of the U-shaped cavity of the profile beam 3 corresponds to the width 2W, which could also be referred to as the thickness, of the panel 2. Similar according to the embodiments shown in the drawings, it is however advantageous when there is attached an element to the base 7, which similar as the back portion 8 is configured to assist with guiding the positioning and clamping device 1 inside the U-shaped profile during a potential up- and/or down movement during the height adjustment operation, and/or which ensures that the positioning and clamping device 1 doesn't tilt and/or pivot along the longitudinal axis of the U-shaped profile during adjustment of the height and/or the angle of the panel 2.

Claims

1. A device (1) for positioning and clamping a planar panel (2) in a U-shaped profile beam (3) when the profile beam is mounted with the open end of the U shape oriented upwards, wherein the panel, when placed in a vertical position, comprises a straight underside (4) and two planar side surfaces (5,6), the device comprising a cradle suitable for being placed inside the U-shaped cavity of the profile beam, the cradle comprising :

    - a base (7) for receiving the underside (4) of the panel (2),
    - lateral support elements (8,9) on either side of the base for supporting the two planar side surfaces (5,6) of the panel,
    - one or more securing elements (10) for clamping the panel between the lateral support elements,

    characterised in that the device further comprises :

    - a planar positioning plate (15) inserted in an opening (16) through the base (7), the positioning plate (15) comprising a circular opening (17),
    - a planar setting plate (18) having a circular shape that fits within the circular opening (17) of the positioning plate (15), configured such that the only possible movement of the setting plate (18) relative to the opening (17) is a rotation about its central axis, wherein the setting plate is provided with an eccentrically placed pivot axle (19) that is rotatable about its central axis with respect to the base (7) of the cradle,

    wherein the positioning plate (15) is wider than the width of the base (7), so that the rotation of the pivot axle (19) about its central axis actuates a relative movement of the base (7) with respect to the positioning plate (15) when the latter is held in a stationary position, thereby enabling to set the angular position of a panel (2) held by the device.

2. The device according to claim 1, wherein the lateral support elements comprise a back portion (8) that is fixed to or uniform with the base (7) of the cradle and one or more support elements (9) which are movable so as to adapt the space between the back portion (8) and the movable elements (9) to the width of a panel (2), wherein the movable elements (9) have a triangular cross section, and wherein the one or more securing elements include one or more wedge-shaped elements (10) configured to be inserted between the movable elements (9) and a side-wall of the U-shaped cavity and secured to the movable elements (9), to thereby clamp the panel (2) between the back portion (8) and the movable elements (9).

3. The device according to claim 2, wherein the cradle comprises two of said movable elements (9) and two respective wedge-shaped securing elements (10), and wherein the positioning plate (15) is located in between said two movable elements (9).

4. The device according to claim 2 or 3, wherein the base (7) is provided with one or more recesses (34), one recess for each of said movable support elements (9), and wherein the movable support elements (9) are slidably inserted in said recesses so that their position can be adapted to the width of the panel (2).

5. The device according to any one of the preceding claims, further comprising fixing elements (35,39) for releasably securing the positioning plate (15) to the base (7) of the cradle.

6. The device according to claim 5, wherein the fixing elements include a fixing plate (35) located underneath the positioning plate (15), the fixing plate being essentially immobile relative to the base (7) when the cradle is placed in the U-shaped cavity, the fixing plate (35) comprising :

    - a central opening (36) into which said pivot axle (19) is rotatably inserted,
    - at least one threaded hole (37), adjacent to the central opening (36),

    wherein the positioning plate (15) comprises at least one hole (38) above and overlapping the respective at least one threaded hole (37) and larger in diameter than the latter, the larger hole (38) allowing the passage of a securing bolt (39) for fixing the positioning plate (15) to the fixing plate (35) by screwing the securing bolt (39) into the threaded hole (37).

7. The device according to any one of the preceding

claims, wherein the device is further provided with one ore more positioning bolts (40) for adjusting the height of the cradle inside the U-shaped cavity.

8. The device according to any one of the preceding claims, wherein the device further comprises one or more preliminary holding elements (45) which are inserted in grooves (46) provided in the upper surface of the base (7), and whose position inside said grooves is adapted to the width of the panel (2).

9. A system for positioning and clamping a plurality of planar panels for forming a barrier, the system comprising one or more U-shaped profile beams (3) and a plurality of devices (1) in accordance with any one of claims 1 to 8.

10. A method for positioning and clamping a plurality of planar panels (2) for forming a barrier, the method comprising the steps of:

- mounting one or more U-shaped profile beams (3) on a support surface, to thereby form a single elongate U-shaped cavity,
- placing a plurality of devices (1) according to any one of claims 1 to 7 in the U-shaped cavity formed by the one or more profile beams, wherein the positioning plates (15) of said devices are held stationary between the upstanding walls of the U-shaped cavity,
- placing a panel (2) in the U-shaped cavity, wherein the panel is supported by the cradles of at least two of said devices (1), while the lateral support elements (8,9) are not securing the panel, and wherein the panel is supported laterally by a lateral panel support (32) placed along an upper region of at least one of the inner walls of the U-shaped cavity,
- adjusting the angle of the panel (2) by rotating the pivot axles (19) off the setting plates (18) of the respective devices (1),
- when the angle of the panel is set, securing the positioning plates (15) to the base (7) of the respective devices (1),
- securing the movable support elements (9) to thereby clamp the panel (2) in the U-shaped cavity.

11. The method according to claim 10, wherein the devices further comprise at least one positioning bolt (40) for adjusting the height of the cradle inside the U-shaped cavity, and wherein the height of the cradles of the devices is set by turning these bolts (40), after setting the angle of the panel (2) and before securing the positioning plates (15) to the base (7) of the devices (1).

12. A barrier (50) comprising :

- one or more U-shaped profile beams (3) mounted on a surface and forming an elongate U-shaped cavity,
- a plurality of panels (2) mounted side by side in said cavity,

wherein each panel is supported by at least two devices (1) according to any one of claims 1 to 8, mounted in the cavity.

13. The barrier according to claim 12, wherein said barrier is a balustrade of a balcony.

14. The barrier according to claim 12 or 13, wherein the panels (2) are glass panels.

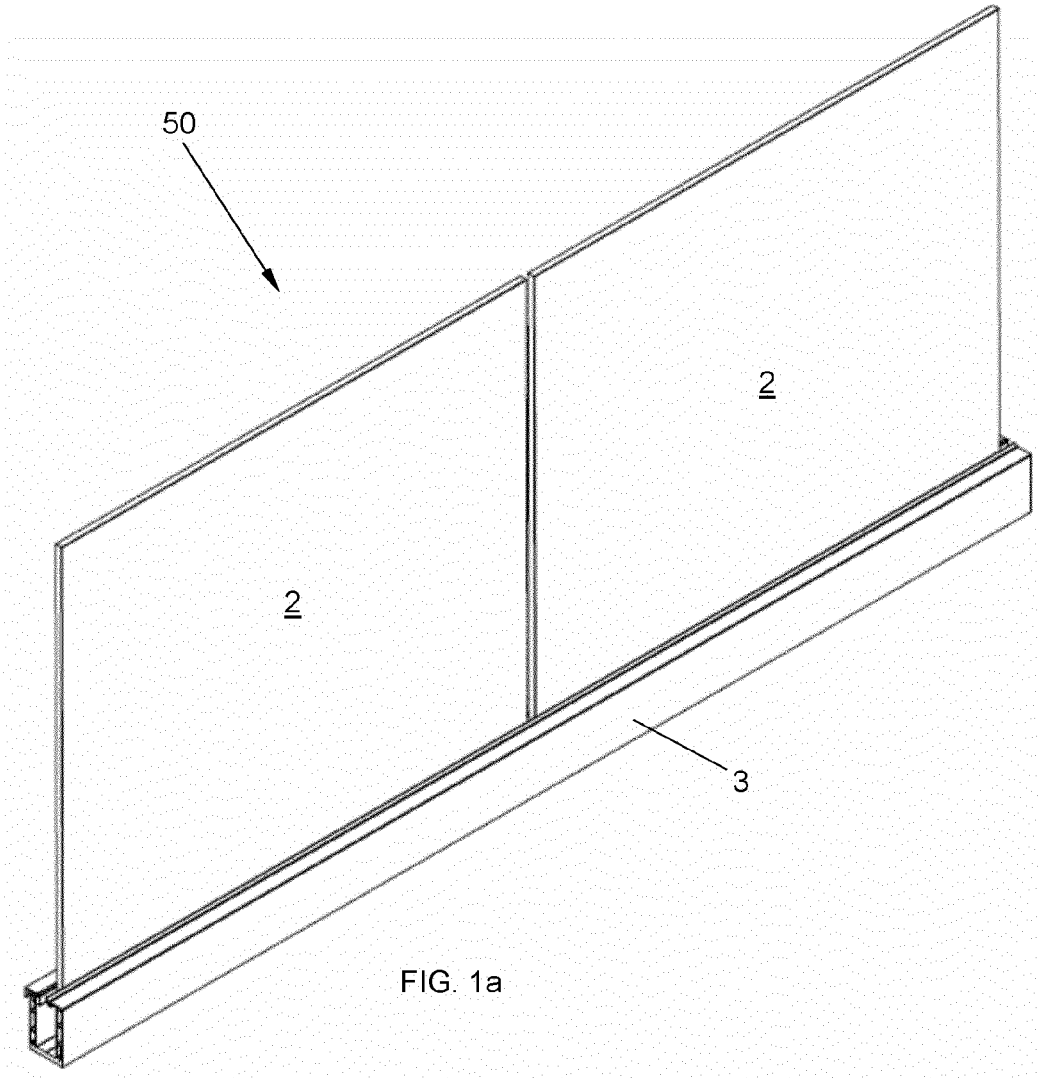


FIG. 1a

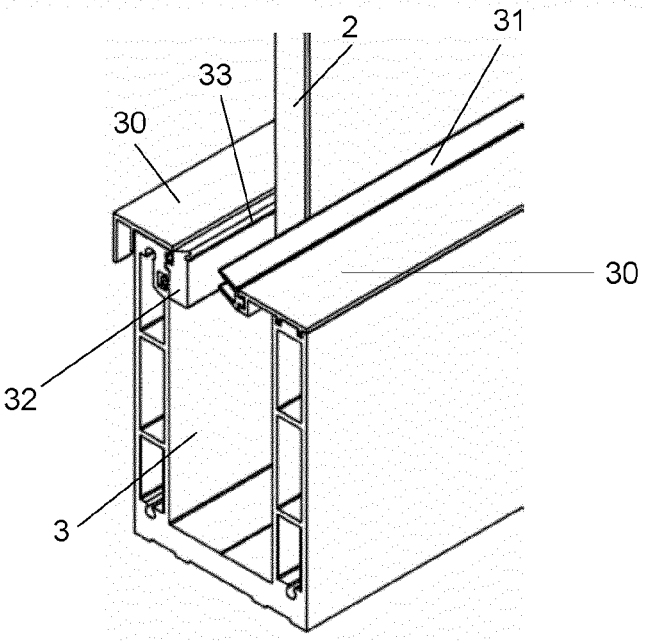


FIG. 1b

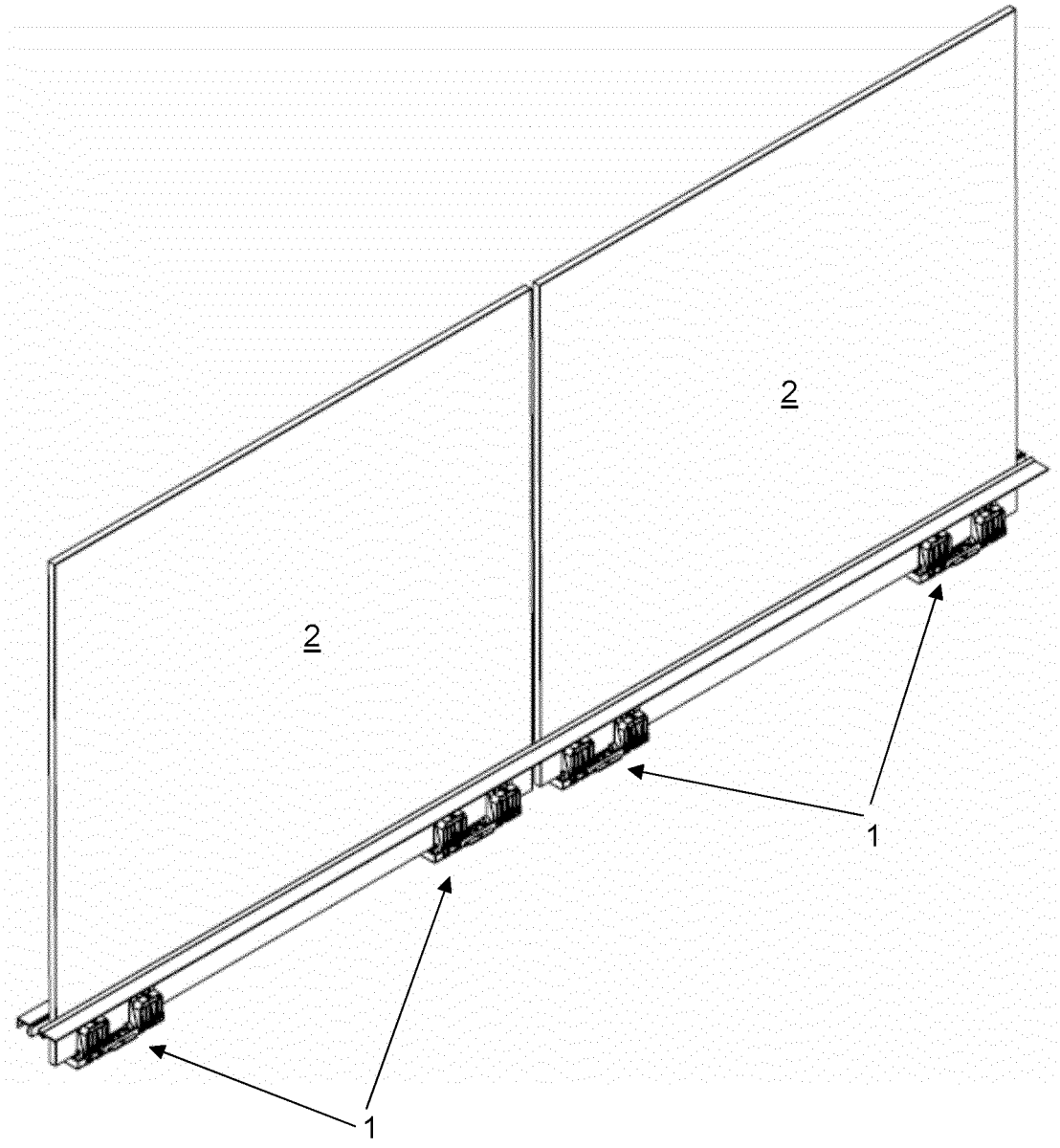
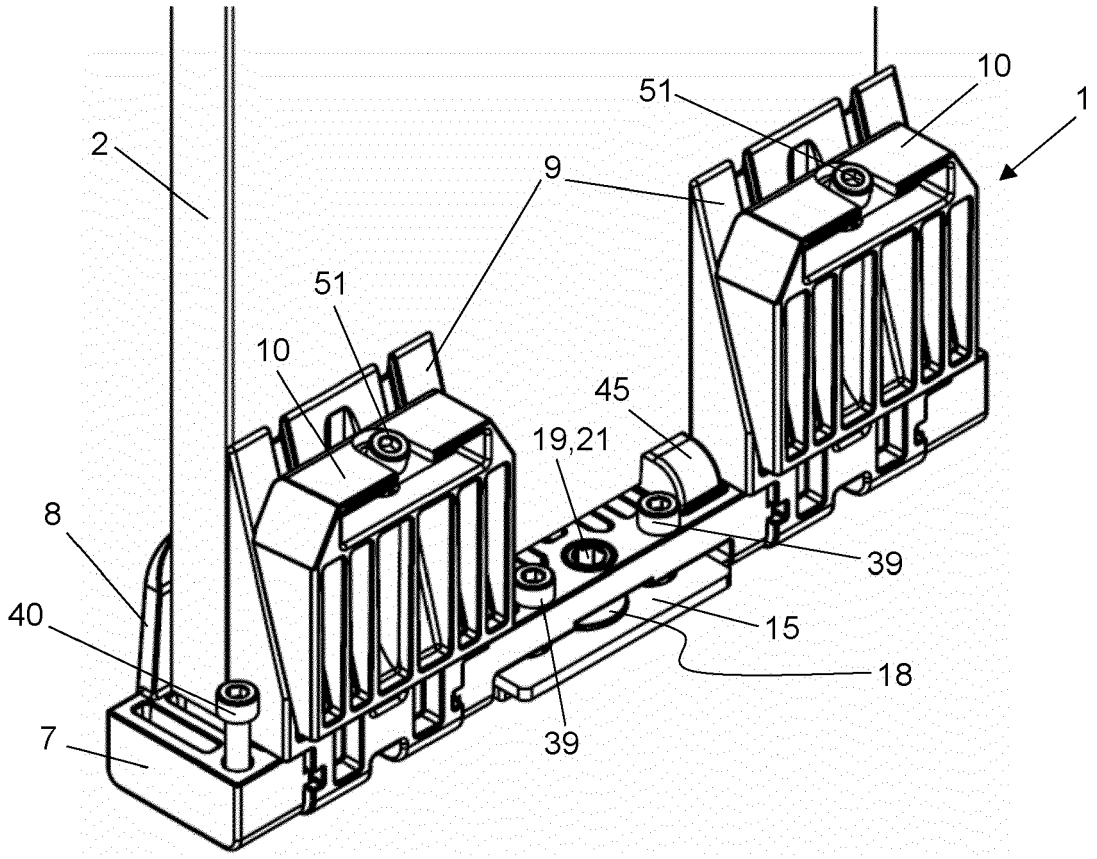


FIG. 2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19,21
8
39
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18
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FIG. 3

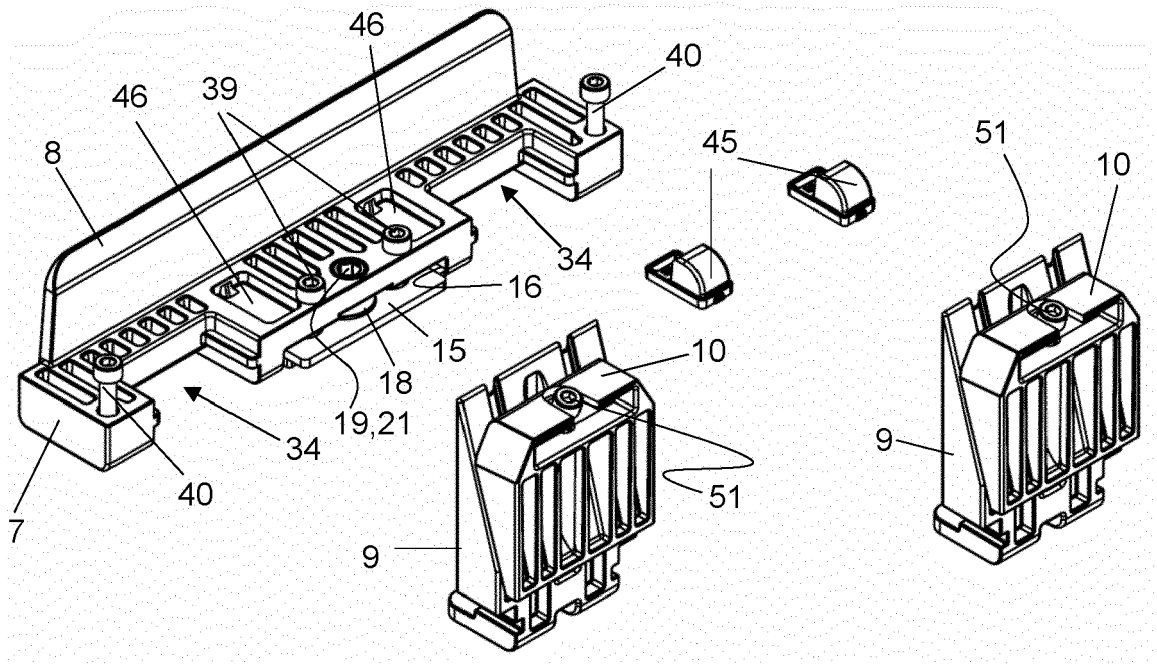
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FIG. 4

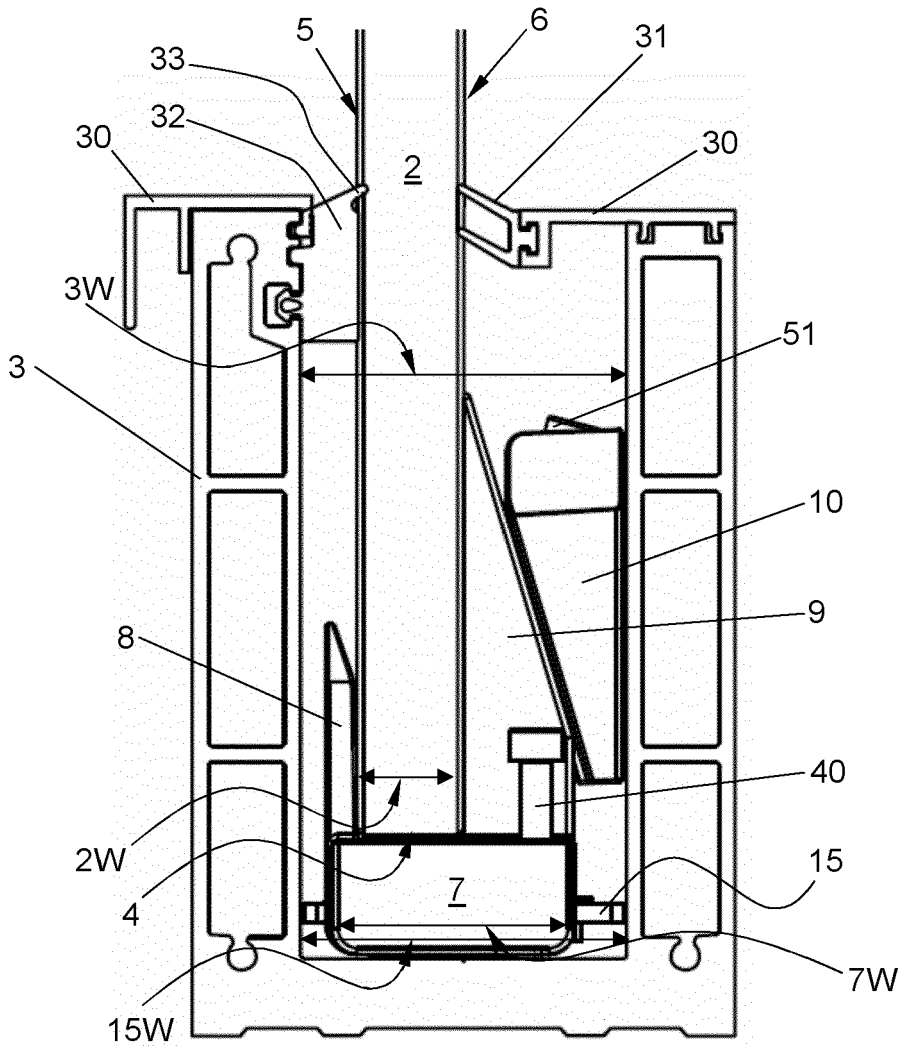

FIG. 5

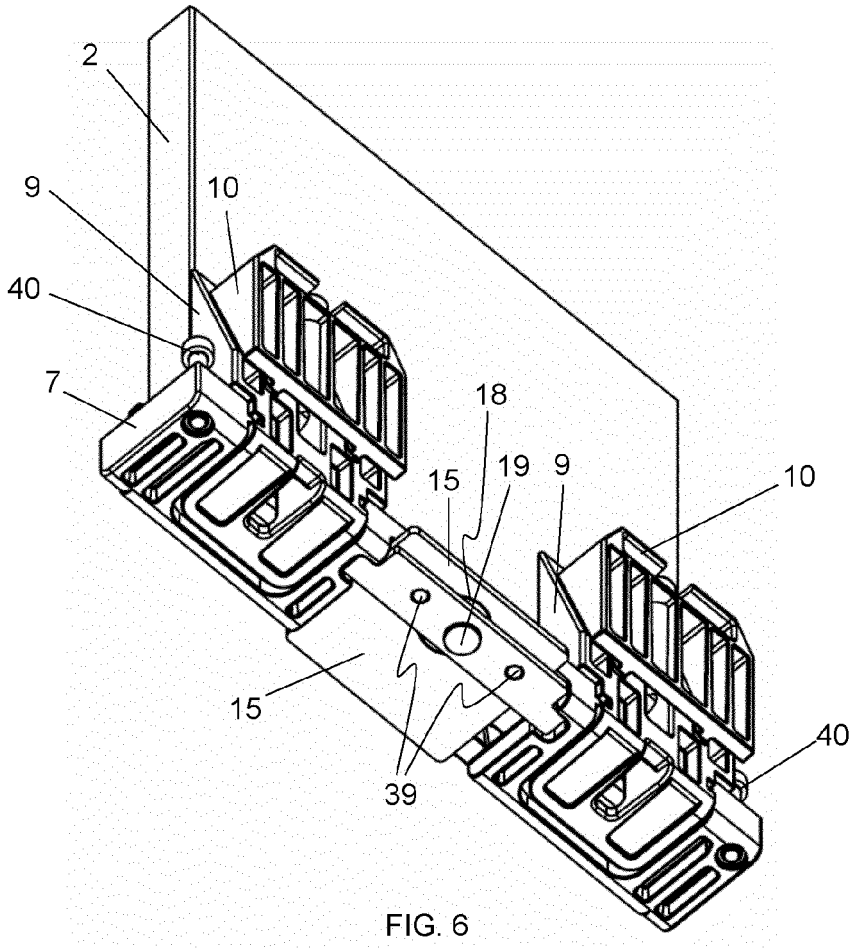
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FIG. 6

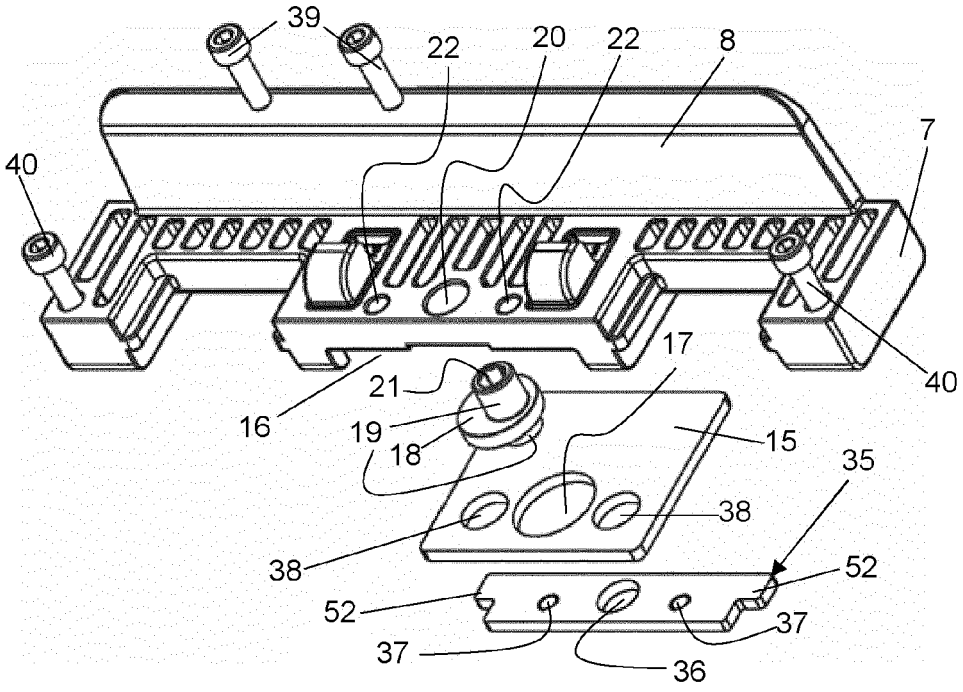
39
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FIG. 7

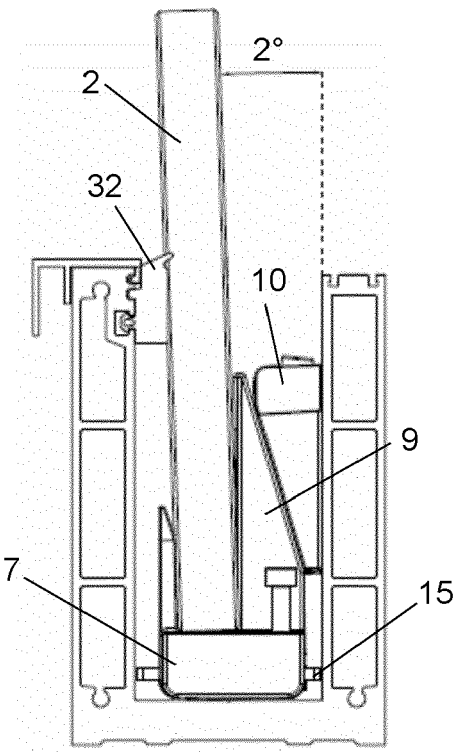

FIG. 8a

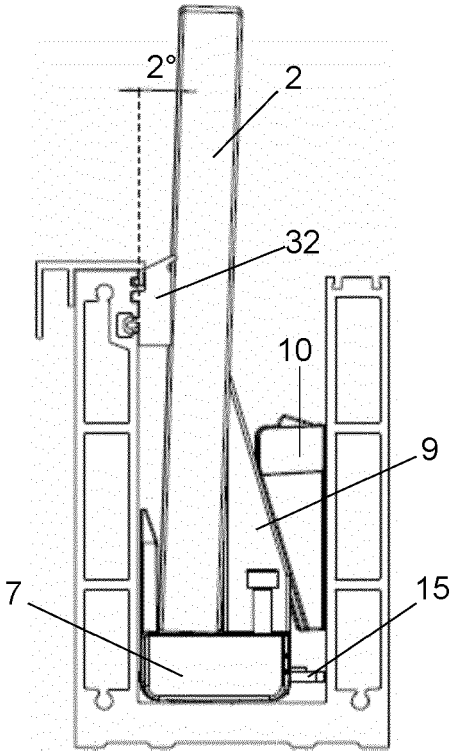

FIG. 8b

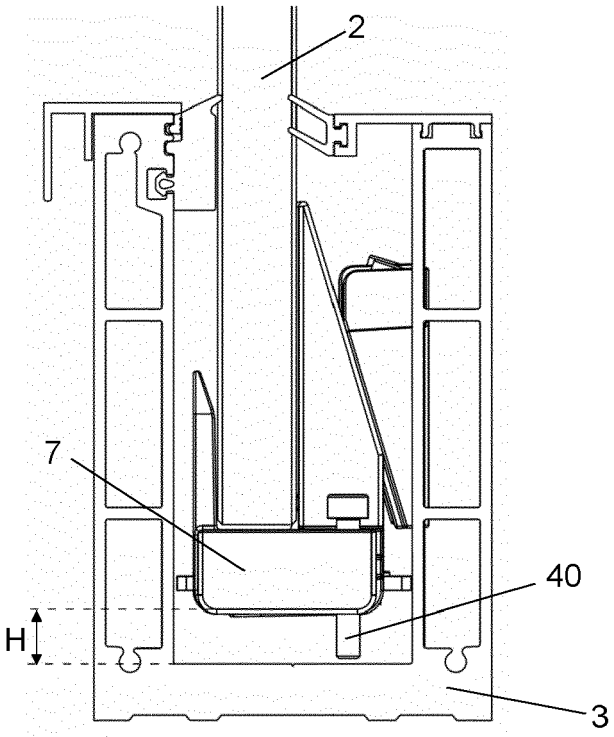

FIG. 9

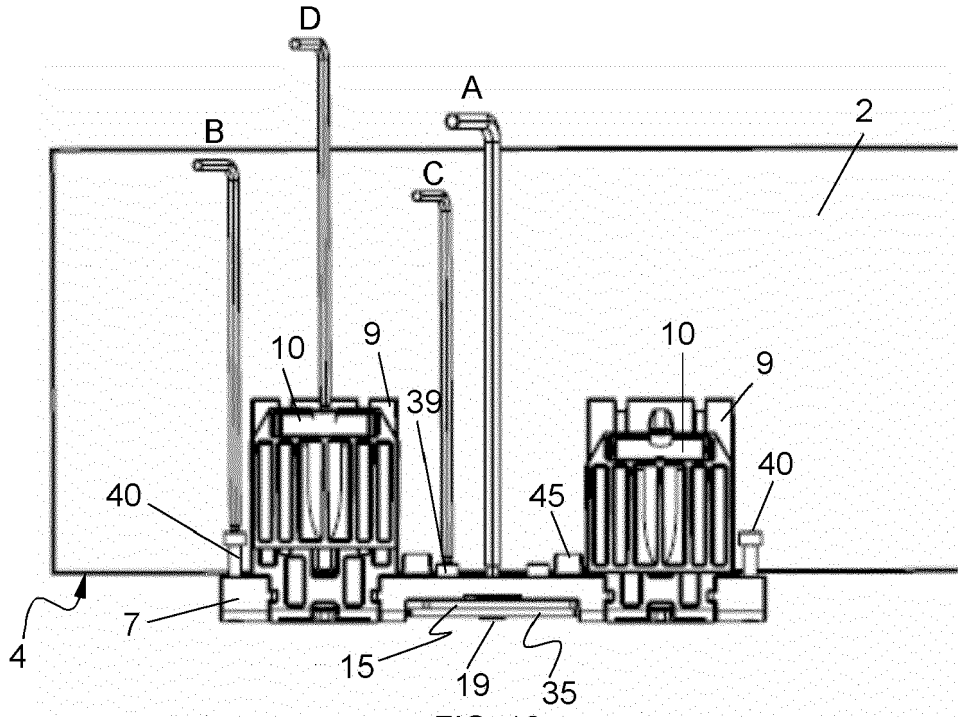

FIG. 10a

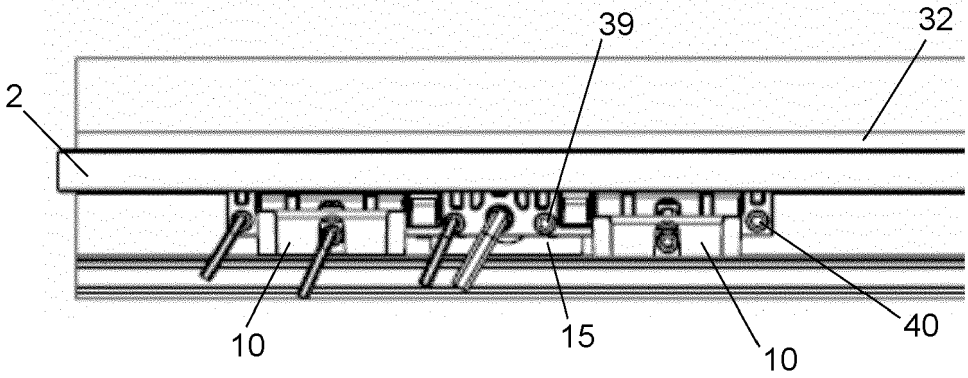

FIG. 10b

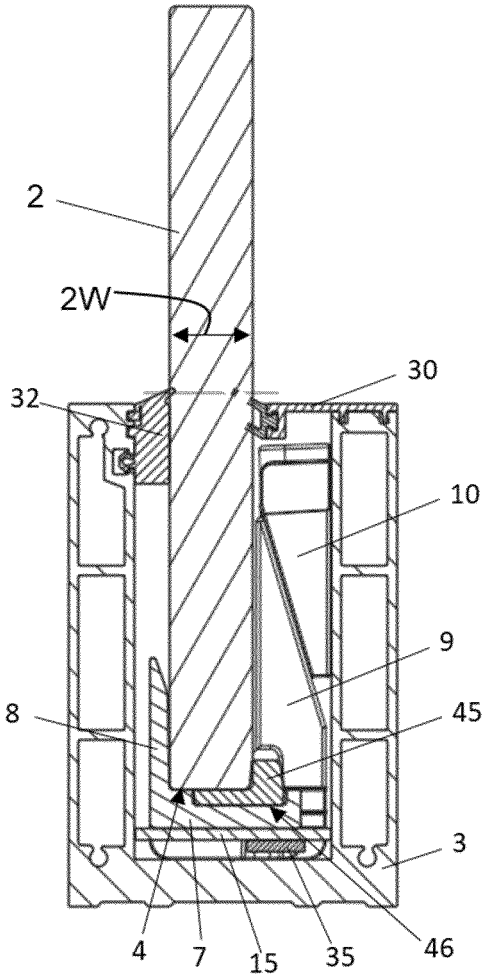

FIG. 11

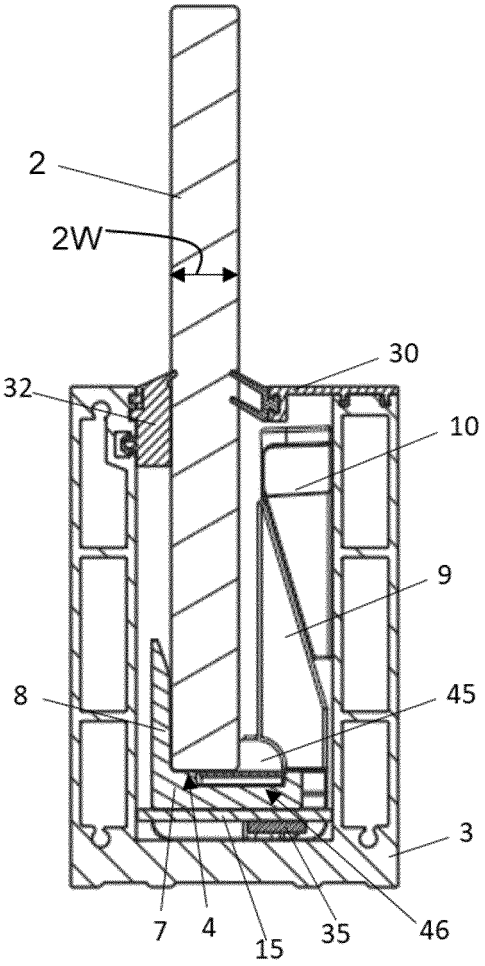

FIG. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 20 21 2186

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A	EP 2 479 357 A1 (MAENE NV [BE]) 25 July 2012 (2012-07-25) * figure 2 *	1-14	
A,D	WO 2015/047109 A1 (HARDWARE AND GLASS GROUP PTY LTD [NZ]; SPENCE JOHN SCOTT [NZ] ET AL.) 2 April 2015 (2015-04-02) * the whole document *	1-14	
A,D	US 2019/177973 A1 (MITROVIC MILAN [CA]) 13 June 2019 (2019-06-13) * the whole document *	1-14	TECHNICAL FIELDS SEARCHED (IPC) E04F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 April 2021	Arsac England, Sally

CATEGORY OF CITED DOCUMENTS

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26-04-2021

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