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

(11) **EP 3 683 375 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.07.2020 Bulletin 2020/30

(51) Int Cl.:
E04D 13/03 *(2006.01)*

(21) Application number: **20151205.0**

(22) Date of filing: **10.01.2020**

(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

(30) Priority: **15.01.2019 DK PA201970028**

(71) Applicant: **VKR Holding A/S**
2970 Hørsholm (DK)

(72) Inventors:
- **ERDMANN, Lars**
  2970 Hørsholm (DK)
- **HENRIKSEN, Jens-Ulrik Holst**
  2970 Hørsholm (DK)

(74) Representative: **AWA Denmark A/S**
Strandgade 56
1401 Copenhagen K (DK)

(54) **INSULATION FRAME COMPRISING A TRANSIENT DEFORMATION ZONE**

(57) The invention relates to an insulation frame for a roof window to be mounted in an inclined roof structure of a building and a related method and kit. The insulation frame comprising a top, a bottom and two side frame members each including an insulation member, said insulation frame defining an inner opening configured to surround a frame of the roof window, wherein at least one of the insulation members is made of a resilient material and at least one of the insulation members comprises at least one groove provided on the inner side or the outer side and/or the interior side of the at least one insulation member, and that said at least one groove constitutes a deformation zone allowing a transient deformation during mounting of the roof window or the insulating frame.

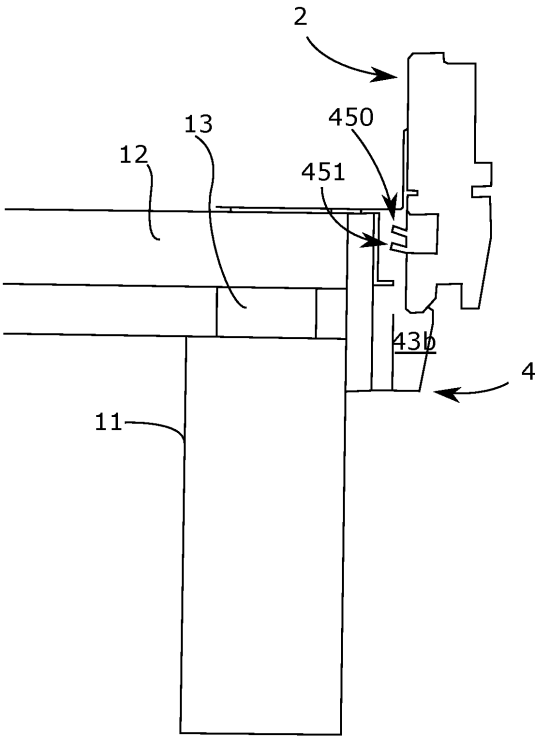

Fig. 3

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Description

[0001] The present invention relates to an insulation frame for a roof window to be mounted in an inclined roof structure of a building, the insulation frame comprising a top, a bottom and two side frame members each including an insulation member, said insulation frame defining an inner opening adapted to surround a frame of the roof window, and said insulation frame and said insulation member having an interior side intended to face an interior of the building and an exterior side intended to face an exterior, an inner side facing the inner opening, and an outer side facing away from the inner opening, and each insulation member has: a height extending perpendicular to a plane defined by the insulation frame, a length extending in a direction parallel to said plane defining the longest dimension of the insulation member, and a width extending in parallel to said plane between the inner side and the outer side, wherein at least one of the insulation members is made of a resilient material.

[0002] The invention also relates to a kit comprising the insulation frame and a method for mounting a roof window in a pitched roof structure.

[0003] Insulation frames are known for example from EP1061199A1 and EP2677092A1.

[0004] However, as it is well known to the skilled person, the work associated with mounting insulation frames and windows in an inclined roof structure is challenging, for example in cases where the distance between the battens and/or counter battens of the roof structure is slightly shorter than the corresponding outer dimensions of the insulation frame; and/or where the angle between the battens and counter battens, constituting the corner of the opening in the roof for mounting the insulation frame, is not sufficiently perpendicular. In such cases the mounting of the window and the insulation frame is difficult or even impossible without damaging the insulation frame, or without a necessary modification of, or even reinstallation of, the relevant battens and/or counter battens.

[0005] In EP 2915 932 an insulation member for a roof window is disclosed. A problem with insertion of the insulation frame has in this application been solved by making the insulation frame compressible and tapered in order to ease installation.

[0006] It is therefore the object of the invention to provide an insulation frame, which eases the mounting of a roof window or an insulation frame in an inclined roof structure.

[0007] This object is achieved by at least one of the insulation members comprising at least one groove having a depth, a width and a length, that said at least one groove is provided on the inner side or the outer side and/or the interior side of the at least one insulation member wherein the length extends in a longitudinal direction parallel to the length of the insulation member; and that said at least one groove constitutes a deformation zone allowing a transient deformation during mounting of the roof window or the insulating frame. This object could also be achieved by other means disclosed in this application.

[0008] When the groove(s) is/are provided on the inner or outer side of the insulation member, the impact of the frame of the window on the insulation frame will during mounting of the roof window in the insulation frame, cause the part of the insulation member immediately above a groove in direction of the exterior side to bend and thereby create sufficient space for the window frame to fit into the inner opening. As at least the part of the frame members comprising the groove is made of a resilient material, the part of the insulation member immediately above said groove in direction of the exterior will re-expand and at least substantially regain its position from before the mounting. Thereby the groove facilitates the mounting of the roof window in the insulation frame, and damage to the insulation frame is avoided. The insulation frame may be mounted after the window frame, but the effect is the same.

[0009] When the groove(s) is/are provided on the interior side of the insulation member, it makes it easier to mount the cladding positioned on the exterior side of the insulation member as the insulation member is easier to press down towards the interior side.

[0010] A groove differs from a slit in that it has a width, and some material has been removed. It is not merely a single cut creating a slit. The groove(s) allow(s) the insulation member to be compressed over the entire section where the groove(s) is/are provided more easily. The compression happens when the insulation frame is positioned between the roof structure and the window frame, so instead of the insulation curls up or shrivels when either the insulation frame or window frame is positioned in place, the insulation frame is slightly compressed and thereby fills up the space between the roof structure and the window frame and provides a tight fit for the window in the roof structure.

The groove(s) provide(s) a more intuitive a safe installation, that reduces or eliminates the need for making changes to the insulation member on site during installation. As a further advantage, the grooves are not visible when the window frame and the insulation member is in the mounted state.

[0011] In an embodiment any one of the at least one insulation members may include at least two grooves, such as at least three grooves. The presence of two, or even three grooves, further facilitate the mounting of a roof window, as the mechanism underlying the effect of said transient deformation zone is enhanced compared to situations where an insulation member comprises only one groove.

[0012] EP2466032B1 describes alternative frame members, in particular useful for insulation along the sides of the window. To increase the ability of the side frame member(s) to adapt to the roof structure and solve the problems associated with using a simple strip of insulation material, the side frame member is made from

a slit material. The slits are arranged so that they extend in the height direction from the lower side and preferably in a plane, which is substantially perpendicular to a length axis of the side frame member. Such slits allow different sections of the insulating material to be displaced in relation to each other and allow one section to be fully compressed above a batten, while the neighbouring section is fully expanded and follow the sides of the batten all the way down. The present invention may be combined with a frame member as described in EP2466032B1, such that the side frame members corresponds to those described in EP2466032B1, and the top and bottom frame members correspond to the present invention.

[0013] Using insulation elements where the side frame members are made from a slit material is particularly advantageous when replacing a window in an existing roof structure. Here it is not possible to insert the insulation frame from the interior side due to the pre-existing roof structure, lining or other elements. Additionally, it is advantageous that insulation elements can adapt to the pre-existing structures, such that a tight fit is provided between the window frame and the roof structure.

[0014] In a further embodiment a length and a width of the inner opening may substantially correspond to outer dimensions of the window frame or is slightly smaller than the dimensions of the window frame, in order to provide a tight fit between the insulation member and the window frame in a mounted state.

[0015] The at least one groove may extend in a longitudinal direction over the entire length of the insulation member. The at least one groove may also extend from at least one corner defined by two adjacent insulation members over only a part of the lengths of each the two adjacent insulation members, for example over 10% to 40% of each of said lengths. The at least one groove may also extend over only a part of the length. The grooves may be positioned anywhere and extend over any length on the inner side of the frame member, not only in the corners but also along the length of the frame member interrupted by areas, where no grooves are provided. The at least one groove may be provided only on (one of) the side frame members or only on the top and/or bottom frame members.

[0016] It may be advantageous that the grooves extend over the entire length of the frame member. This is of particularly relevance where the dimensions of the inner opening are too narrow to correspond to the outer dimensions of the window frame, as a result of too short distance between the battens and/or counter battens adjacent to the insulation frame.

[0017] Providing a groove near or in the corners of the insulation frame, preferably on the inner side or the outer side, is particularly relevant where the angles of the corners at the inner side of the insulation frame are not sufficiently perpendicular, as a result of the corresponding angles between the battens and counter battens adjacent to the insulation frame is not sufficiently perpendicular, so mounting of the window frame in the inner opening is difficult or even impossible without damaging the insulation frame.

[0018] In another embodiment the depth of the at least one groove provided on the inner side or the outer side of the at least one insulation member may be extending in an angle α in relation to the plane defined by the insulation frame, and preferably said angle is between 0° and 60°, more preferably between 15° and 60°, most preferably between 30° and 45°. An angle α between 15° and 60°, and especially between 30° and 45°, enhances the ability for the part of the insulation member immediately above each grove in direction of the exterior side to at least substantially regain its position from before the mounting of the window.

[0019] In a further embodiment the angles α for each of the grooves of an insulation member may be substantial identical.

[0020] The depth of the at least one groove may be in the range of 3-12 mm, preferably 5-10 mm. The depth of the respective grooves provided in the same insulation member may be different, such that for example the depth of the grooves may decrease for each groove in direction towards the interior side of the insulation frame when provided on the inner or outer side of the insulation member. For example, if two grooves are present, the groove towards the exterior side may be 10 mm deep and the groove towards the interior side may be 5 mm deep. There may be more need for flexibility at the insulation member closest to the exterior side.

[0021] The width of the least one groove may be constant over the entire depth, for example 2-4 mm, such as about 3.5 mm, or may taper in direction of its depth.

[0022] In yet another embodiment the width of each of the at least one groove, at its mouth may be 5% to 20% of the height of the insulation member, for example 2-4 mm, preferably 3-4 mm.

[0023] A distance between the grooves may be 10% to 20% of the height of the insulation member.

[0024] The resilient material for the insulation member may be selected from the group consisting of: extruded polyethylene, other polymer foams, mineral wool, composites and combinations thereof. The resilient material is preferably made of foam. The material used for the insulation member may be different from wood as the insulation frame should be more insulating than the window frame itself, which is often made of wood. The insulation member may comprise more than one material, for example a resilient material used along the part of the height of the insulation member adapted to receive the window frame, and another for the remaining part of the insulation member. The two materials may be attached to each other by means of an adhesive. The other material has preferably also insulating properties that surpass the insulating properties of wood.

[0025] The insulation frame may further comprise a connector bracket attached to, preferably embedded in, the insulation member, for attaching the insulation frame to the roof structure. The connector bracket preferably

extends along most of the length (around 90%) of the insulation member.

[0026] In embodiments of the insulation frame where the top and/or bottom member are according to any of the claims 1 to 12, the side frame members of the insulation frame may comprise:

> a first insulating element, preferably made from a dimensionally stable insulating material, a second insulating element made from a compressible insulating material, and where the first and second insulating elements are interconnected so that, in use, the orientation of the insulating elements is such that the first insulating element is on top of the second insulating element, the side of the first insulating element facing away from the second insulating element defining an upper side of the side frame member and the side of the second insulating element facing away from the first insulating element defining a lower side of the side frame member, wherein a height direction is defined as a direction extending from said lower side to said upper side, and
> wherein the second insulating element is made from a material with slits extending in said height direction from said lower side.

[0027] Fastening means or a connector bracket may be attached to the first and or the second insulation element.

[0028] In a second aspect the invention relates to a kit, comprising at least a first insulation frame and a second insulation frame, wherein the first and/or the second insulation frame is according to the invention, and wherein the first and second insulating frames are adapted to be positioned adjacent to each other such that the interior side of first insulating frame is facing the exterior side of the second insulation frame. That way more insulation frames may be provided together, which eases installation.

[0029] In a third aspect the invention relates to a method of mounting a roof window in an inclined roof structure of a building, the method comprises the steps of:

> a) providing an insulation frame for the roof window,
> b) making an opening in the roof structure adapted to a length and a width of the insulation frame;
> c) mounting the roof window with the window frame in the opening of the roof structure;
> d) fastening the window frame to the roof structure;
> e) mounting the insulation frame such that it surrounds the window frame;

whereby the resilient material of the at least one insulating member containing the at least one groove is transiently deformed during the mounting of the insulation frame, the roof window or the window frame.

[0030] The steps need not necessarily be performed in the listed order, but step e may be performed before step c. I.e. the insulation frame may be attached to the roof structure prior to mounting of the window frame. If the insulation frame is mounted first, the insulation frame is preferably provided with a connector bracket, allowing it to rest/become more easily attached to the roof structure.

[0031] Another option is that an insulation frame may be mounted in the opening of the roof structure, the window frame is mounted and then a further insulation frame is mounted adjacent to the already mounted insulation frame.

[0032] The first insulation frame is preferably provided with at least one groove on the interior side of the insulation member and the second insulation frame is preferably provided with at least one groove on the inner side or the outer side of the insulation member.

[0033] All the different embodiments of the different groove shapes, number, position, length etc. may be combined in any way suitable.

All embodiments may be provided with a connector bracket, or the connector bracket may be dispensed with likewise in all embodiments.

[0034] The grooves in the frame members may be dispensed with and the object may be achieved in different ways, where other features disclosed in this application achieve the same object.

[0035] The presence of two insulation members comprised by the two side frame members, preferably a top and a bottom member, and each comprising at least one groove is of particular advantage in situations where the dimensions of the inner opening are too narrow to correspond to the outer dimensions of the window frame, as a result of too short distance between the two counter battens adjacent to the two side members of the insulation frame, as there will be at least one deformation zone at each of the top and bottom insulation frame members which further facilitates the mounting of the roof window compared to a situation where only one of the insulation members comprised by the top or bottom frame members comprising at least one groove.

[0036] The presence of four insulation members comprised by the top, bottom and the two side frame members and one or more of the frame members comprising at least one groove is of particular advantage in situations where the dimensions of the inner opening are too narrow to correspond to the outer dimensions of the window frame, as a result of too short distance between the battens and/or counter battens adjacent to the insulation frame, and/or where the angles of the corners at the inner side of the insulation frame are not sufficiently perpendicular, as a result of the corresponding angles between the battens and counter battens adjacent to the insulation frame is not sufficiently perpendicular; as there will be at least one deformation zone at each of the four insulation frame members which further facilitates the mounting of the roof window compared to situations where only one, two or three of the insulation members comprised by the top or bottom frame members comprises at least one

groove.

[0037] By the expression "not sufficiently perpendicular" throughout this description is meant that the angle between a batten and a counter batten both adjacent to at least one of the corners of the insulation frame deviate from 90° to such a degree that mounting of the roof window in the inner opening is difficult or even impossible without damaging the insulation frame. The deviation may for example be +/-0.1° to +/-2°, typical +/-0.2° to +/-1°.

[0038] By the expression "resilient" is meant that the material is compressible with one's fingers and no tools are required for the compression.

[0039] The insulation member has preferably a thermal conductivity of or below 0,040 W/mK, more preferably a thermal conductivity below 0,037 W/mK.

[0040] The groove(s) may be cut or milled into the insulation member. The width of a groove may be greater than 0 mm, preferably greater than 1 mm.

[0041] The insulation frame may be formed in one piece or in two or three or more pieces. Several insulation frames having different characteristics may be placed adjacent each other, preferably such that one insulation frame faces the interior of the building and the other insulation frame faces the exterior.

The term "roof window" refers to any part of a roof window including a frame, cladding, brackets and flashing and other elements forming part of a roof window.

Brief description of the drawings:

[0042] In the following, embodiments of the invention will be explained in more detail with reference to the schematic drawings, in which:

Fig. 1 is a perspective and partially cut-away view of a roof structure with a frame for a roof window mounted in a conventional manner,

Fig. 2 is a perspective view of a roof structure with an insulation frame for a roof window prior to mounting according to an embodiment of the invention,

Fig. 3 is a cross-sectional view of an embodiment of a side frame member,

Fig. 4 is a cross-sectional view of an embodiment of a bottom frame member,

Fig. 5 is a perspective view of an embodiment of an insulation frame,

Fig. 6 is an enlarged view of the detail marked VII in Fig. 5;

Fig 7 is an enlarged view of the detail marked VIII in Fig. 5;

Fig. 8, 9, 10a and 10b are each cross sectional views of embodiments of the insulation member,

Fig. 11 is a cross-sectional view of an embodiment of the insulation frame,

Figs. 12a and 12b are each perspective views of embodiments of an insulation frame with a connector bracket,

Figs, 12c and 12d are each perspective views of embodiments of an insulation frame without a connector bracket,

Fig 13 is a perspective view of an embodiment of an insulation frame in the mounted position,

Fig. 14 is a cross-sectional view of an embodiment of two insulation frames in the mounted state,

Figs. 15-20 are cross sectional views of embodiments of insulation frames,

Fig. 21a is a perspective view of an embodiment of a top frame member,

Fig. 21b is a view of a different embodiment compared to fig. 21a, of a top frame member as shown from the inner side,

Fig. 22a is a perspective view of an embodiment of a bottom frame member,

Fig. 22b is a view of the bottom frame member from the inner side as shown in fig. 22a,

Fig. 23 is a cross-sectional view of the insulation frame member where the slit is provided as seen in fig. 22,

Figs. 24-25 show an embodiment of the side frame members.

[0043] An example of a roof structure 1 with rafters 11, 11' and battens 12, which are perpendicular to the rafters and intended to support a roofing material (not shown), such as tiles or slates, is shown in Fig. 1. Counter-battens 13 extending in parallel with the rafters 11, 11' provides a distance between the battens and the rafters.

[0044] Below the batten structure 12, 13, a waterproof membrane 14 serves as the exterior side of an underroof. The waterproof membrane may consist of roofing felt, reinforced plastic sheeting or aluminium film and may be either diffusion-tight, in which case suitable ventilation devices for airing the underroof may be mounted in the membrane, or open for diffusion of vapour. The waterproof membrane 14 is here supported by a layer 15 of boards or veneer sheets, but it is possible to use only a membrane.

[0045] Between the rafters 11 is an insulation layer 16, which may be soft or hard, typically consisting of mineral wool, glass wool, plastic foam or the like and on the interior side the roof is finished by a vapour seal 17, such as a plastic or aluminium foil laminate, and an interior covering 18, which may consist of boards, gypsum boards or the like.

[0046] A window frame 2 for a roof window has been mounted in an opening, cut out in the underroof, removing part of one of the rafter 11 as well as sections of battens and counter-battens. The window frame 2 is fastened to the roof structure 1 in a conventional manner, here by being attached to two counter battens 13 and auxiliary battens 19 (only one visible) by means of traditional angle fittings 21.

[0047] Fig. 2 shows an insulation frame 4 about to be mounted in an inclined roof structure 1 as seen in fig. 1. A hole has been cut in an underroof 14 and the underroof

14 is attached to the battens 12. The insulation frame 4 comprises a top 570, a bottom 580 and two side frame members 590, 591, each including an insulation member 43b.

[0048] The insulation member 43b, which constitutes the major part of the frame member 4, is made of a material of a dimensionally stable nature having good insulating properties, preferably a polymer foam, such as extruded polyethylene (PE). The insulation member preferably has a density of approximately 30 kg/m^3 and/or a thermal conductivity of 0,040 W/mK. Mineral wool and other insulating materials such as foams of polypropylene (PP), polyurethane (PU), polyvinylchloride (PVC), expanded polystyrene (EPS) or extruded polystyrene (XPS) may, however, also be used. The material chosen should preferably be resistant to fire and moisture and choosing a material with some elasticity will ease installation. The insulation frame members may be made by moulding, extrusion or cutting and possibly assembled from two or more pieces by means of adhesives, gluing or welding or by mechanical means. These two pieces need not be the same material.

[0049] The insulation frame 4 further comprises connector brackets 410. The connector brackets 410 have flanges extending over their entire length and projecting away from an inner opening 3 defined by the insulation frame 4. This means that it not necessary to have the connector brackets and battens in exact positions in relation to each other to achieve a proper support for the insulation frame. It is noted, that the insulation frame 4 need not be attached to the battens or other parts of the roof structure but may simply rest on top of these connector brackets 410 as the subsequent fastening of the roof window will also secure the insulation frame 4. However, to keep the insulation frame 4 in place before and during the installation of the window frame (not shown) therein, it may be advantageous to attach at least some of the connector brackets 410 to the roof structure 1.

[0050] Figs. 3 and 4 show the insulation frame 4 mounted in a roof structure, where fig. 3 is a cross section of a side frame member installation and fig. 4 is a cross section of a bottom frame member installation.

[0051] The insulation member 43b is provided with two grooves 450, 451 extending from an inner side IS in a direction towards an outer side OS. The grooves allow the insulation member 43b to become more resilient and it will therefore be transiently deformed during mounting of the window frame 2.

[0052] Figs. 5-7 shows an embodiment of an insulation frame 4, an interior side $I_{nt}S$ intended to face the interior of the building and an exterior side $E_{xt}S$ intended to face the exterior. In the details marked VII the part h of the insulation frame adapted to come into contact with the window frame, is marked. Further details are shown in fig. 7 marked as VIII in fig. 6. The part h forms part of the inner opening 3, when the insulation frame members 570, 580, 590, 591 are interconnected. The height H defines the complete height of the insulation member 43b. The width W is the width of the part h of the insulation member 43b adapted to come into contact with the window frame. This part is made of a resilient material and is provided with two grooves 450, 451, where the groove 450 towards the exterior side $E_{xt}S$ has a greater depth d than the groove 451 positioned towards the interior side $I_{nt}S$. The width W_g of the grooves 450, 451 is identical in this embodiment, but they could might as well have been different from each other. More grooves could have been provided as well, for example three or four grooves. The grooves 450, 451 are inclined in relation to the width W and the height of the part h and extend from an inner side IS towards an outer side OS and from the interior side $I_{nt}S$ towards the exterior side $E_{xt}S$.

[0053] In figs. 8 and 9 a distance (d_i) between the grooves 450, 451 is shown. The distance di is the same for the two embodiments but the distance may differ if more than two grooves 450, 451 are present. The same applies to the width of the grooves W_g. The grooves 450, 451 in fig. 8 have a rectangular shape, while the grooves 4501, 4511 in fig. 9 are tapered. Tapered and rectangular shaped grooves may be combined such that both shapes are present in the same insulation frame 43b. As can be seen in both embodiments the grooves 450, 4501 towards the exterior side $E_{xt}S$ are deeper than the grooves towards the interior side $I_{nt}S$ in order to be able to better receive the window frame when it is being mounted.

[0054] Figs. 10a and 10b show the same embodiments as in figs. 9a and 9b, respectively, however other details are described. It can be seen that the grooves 450, 451, 4501, 4511 are formed in an angle α in relation to the plane defined by the insulation frame 4. The angle is preferably between 0° and 60°, more preferably between 15° and 60°, most preferably between 30° and 45°.

[0055] In the embodiment in fig. 11 a length L_{in} and/or width Win of the inner opening varies over the height H of the insulation members 43b, so that at the exterior side $E_{xt}S$ the length L_{in} and width Win of the inner opening 3 corresponds substantially to the corresponding outer dimensions of the roof window. At the interior side $I_{nt}S$ the length L_{in} and/or width Win of the inner opening 3 is/are smaller than the corresponding outer dimensions of the roof window, so that the insulation members 43b at the exterior side $E_{xt}S$ are adapted for coming into contact with the frame 2 of the roof window in parallel to least a part h of the height H of the insulation members. The window frame 2 is thereby able to rest on a ledge 44 of the insulation member 43b formed in the inner opening 3.

[0056] Figs. 12a and 12b show an insulation frame 4 where the grooves 450, 451 extend in a longitudinal direction from at least one corner defined by two adjacent insulation members 43 over only a part l of the lengths L of each said two adjacent insulation members 43, for example over 10% to 40% of each of said lengths L. The grooves 450, 451 may also extend in a longitudinal direction over the entire length L of the insulation member 43 or where the at least one groove. Even though only one and two grooves are present respectively, a further

groove may be provided. The groove may either be rectangular shaped or tapered or a combination of both may be present. A connector bracket 410 is mounted on or embedded in the insulation frame 4. This embodiment is preferably mounted before the window frame is mounted, preferably from the exterior side. The connector bracket on the insulation frame then rests on the rafters or battens in the roof structure and is preferably attachable to the roof structure.

[0057] In fig. 12c and 12d the insulation frame 4 is not provided with connector brackets and is thus suitable for mounting after the window frame has been mounted in the roof structure. The Insulation frame may then be pressed between the window frame and the roof structure and thereby the grooves 450, 451 allow for easier mounting as the insulation frame is easier to compress due to the grooves. The insulation frame 4 without the connector bracket is preferably mounted from the interior side.

[0058] Fig. 13 show a perspective view of insulation members 43a and 43b in the mounted state. In this embodiment the insulation frame comprising insulation member 43a has been mounted first due to the presence of the connector bracket 410 and the window frame 2 has been mounted subsequently. The insulation member 43a is mounted from the exterior side. The insulation member 43a may also be mounted after the window has been put into place. After the window frame has been mounted an insulation frame comprising insulation member 43b is mounted adjacent to the insulation frame 43b and window frame 2. In fig. 14 a cross-sectional view corresponding to the embodiment in fig. 13 can be seen. Here the position of the grooves 450,451 and 452 can be seen as well.

[0059] The grooves 450 and 451 may instead be positioned on the outer side. This option is most advantageous when the insulation frame 4 is mounted after the window frame 2 and no connector brackets are embedded in the insulation member 43b.

[0060] All the different features described above in relation to insulation member 43b, also applies to insulation member 43b.

[0061] Figs. 15-20 are different embodiments of cross sections of insulation members 43a and 43b forming part of each of their insulation frame. The different embodiments in figs. 15-20 may be seen as kits according to the invention. The different combinations of insulation frames as shown in figs. 15-20 are merely example of combinations. Each insulation frame may be used independently of the other insulation frames it has been combined with. All embodiments may be provided with connector brackets preferably somewhere between insulation member 43a and 43b. The slits 450 and 451 in insulation element 43b is provided on the inner side, but they may also be provided on the opposite side, i.e. on the outer side.

[0062] Fig. 21a shows an embodiment of a top frame member 570 comprising three insulation elements 43c, 53 and 43b. The insulation element 43b is positioned between the rafter 12 and the frame 2 of the window. The frame member 570 is positioned after the window frame 2 has been mounted in the roof. The insulation element 43b slides below the window mounting bracket 411, while insulation elements 53 and 43b rest above the window mounting bracket 411. The frame member 570 is mounted from the exterior side. The insulation members 43c, 53 and 43b are all connected to each other along 80-90% of the length of the frame member, e.g. By an adhesive or merely made in one piece. At the ends the frame member 570 is provided with slits 50, such that the mounting brackets 411 of the window can fit in these slits 50. The grooves 450, 451 allows for easier compression of the insulation element 43b. It can be seen that the insulation element 43b has been slightly deformed in order to provide a tight fit between the rafter 12 and the frame 2. The top frame member 570 may be comprising two insulation elements instead, where insulation element 43c and 53 form one insulation element and insulation element 43b forms the other insulation element. Preferably this top frame member is also provided with slits.

[0063] Fig. 22a shows an embodiment of a bottom frame member 580 comprising two insulation elements 53 and 43b. The insulation element 43b is positioned between the batten 12 and the frame 2 of the window. The frame member is positioned after the window frame has been mounted in the roof. The insulation element 43b slides below the window mounting bracket 411, while insulation element 53 rest above the window mounting bracket 411. The frame member 580 is mounted from the exterior side. The insulation members 53 and 43b are all connected to each other along 80-90% of the length of the frame member, e.g. By an adhesive or merely made in one piece. At the ends the frame member 580 is provided with slits 50, such that the mounting brackets 411 of the window can fit in these slits. The grooves 450, 451 allows for easier compression of the insulation element 43b. It can be seen that the insulation element 43b has been slightly deformed in order to provide a tight fit between the batten 12 and the frame 2. The cross-sectional shape of insulation element 53 has been adapted by cutting a corner facing the exterior and the outer side, off.

[0064] Figs. 21b and 22b shows two embodiments of a frame member 570 and 580 respectively seen from the inner side. Here the slits 50 extend along the length of the frame members about 5-15% of the length from each side of the frame member.

[0065] Fig. 23 is a cross sectional view of the bottom frame member 580 as seen in fig. 22.

[0066] In some embodiments the insulation frame 4 further comprises one or two insulation elements 53 and 43d, both shaped as an insulation frame as well. Insulation element 43d is made of a resilient material and largely corresponds to insulation member 43b, however without the grooves. Insulation element 53 is made of a non-compressible material, but still having insulating properties. The insulation member 43a is adapted to face the

exterior side, while the insulation member 43b is adapted to face the interior side. The insulation members 43a and 43b are made of a resilient material. The insulation members 43a, 43b and the insulation elements 53 and 43d may have different shapes than depicted in the figure. The insulation element 53 may be made of a compressible material or foam as well. In figure some of the figures insulation member 43a is provided with grooves 452 on the interior side. The grooves may be provided on the exterior side of insulation member 43a. One, two or more grooves may be present instead of three grooves. Insulation element 43c corresponds to insulation member 43a, however without the grooves. The grooves 452 absorbs the irregularities around the window mounting brackets, and thus provides a better fit.

[0067] Figs. 24 and 25 show simplified views in a cross-sectional perspective and from the side, respectively, where the window is represented only by the right-hand frame piece 2 and where roofing and flashing have been removed to lay open the roof structure 1 and the insulation.

[0068] In the embodiment shown the roof structure 1 is composed of a series of rafters 11, only one of which is shown, an underroof 14 clamped between the rafter and a counter batten 13 above each rafter, and finally a series of battens 12 arranged perpendicularly to the rafters and counter battens.

[0069] The window may be secured to the load-bearing rafters or the counter battens by means of traditional mounting brackets (not shown) provided at the side frame member or at the corners between adjoining frame pieces.

[0070] A frame member 10 comprising a first insulating element 101 and a second insulating element 102 is attached to the outer side of the window frame piece 2 by means of screws 103 and it is further attached to the battens 12 by means of a bracket 104. In this way the attachment of the frame member 10 will contribute to the attachment of the window itself and if the first insulating element 101 is sufficiently strong, traditional mounting brackets may be left out entirely. The more usual situation, however, will be that the frame member 10 is attached either to the window frame piece 2 or to the battens 12 instead of to both as depicted here.

[0071] The bracket 104 on the frame member 10 is depicted as an L-profile extending over the entire length of the insulating member. This substantially eliminates the risk of erroneous mounting, since the bracket 104 will not be misplaced in relation to the battens 12, and provides strength and stiffness, but it is also possible to use smaller brackets located at each or some of the battens. Alternatively, the frame member 10 and the opposite frame member (not shown) may be attached as disclosed in figure 2 by means of the connector bracket.

[0072] In general, the features of the embodiments shown and described may be combined freely and no feature should be seen as essential unless it obviously is.

Claims

1. An insulation frame (4) for a roof window to be mounted in an inclined roof structure (1) of a building, the insulation frame (4) comprising a top (570), a bottom (580) and two side frame members (590, 591) each including an insulation member (43), said insulation frame (4) defining an inner opening (3) configured to surround a frame (2) of the roof window, and said insulation frame (4) and said insulation member (43a, 43b) having an interior side ($I_{nt}S$) intended to face an interior of the building and an exterior side ($E_{xt}S$) intended to face an exterior, an inner side (IS) facing the inner opening (3), and an outer side (OS) facing away from the inner opening (3),
and each insulation member (43a, 43b) has:

   a height (H) extending perpendicular to a plane defined by the insulation frame (4),
   a length (L) extending in a direction parallel to said plane defining the longest dimension of the insulation member (43a, 43b), and
   a width (W) extending in parallel to said plane between the inner side (IS) and the outer side (OS),
   wherein at least one of the insulation members (43a, 43b) is made of a resilient material **characterized in that** at least one of the insulation members (43a, 43b) comprises at least one groove (450, 4501, 452) having a depth (d), a width (w_g) and a length (l), that said at least one groove (450, 4501,452) is provided on the inner side (IS) or the outer side (OS) and/or the interior side of the at least one insulation member (43a, 43b) wherein the length (l) extends in a longitudinal direction parallel to the length (L) of the insulation member (43a, 43b); and that said at least one groove (450, 4501, 452) constitutes a deformation zone allowing a transient deformation during mounting of the roof window or the insulating frame (4).

2. The insulation frame (4) according to any of the preceding claims wherein any one of the at least one insulation members (43a, 43b) includes at least two grooves (450, 451; 4501, 4511, 452), such as at least three grooves.

3. The insulation frame (4) according to claim 1 or 2, where a length (L_{in}) and a width (Win) of the inner opening (3) substantially corresponds to outer dimensions of the window frame (2) or is slightly smaller than the dimensions of the window frame (2) in order to provide a tight fit between the insulation member (43a, 43b) and the window frame (2) in a mounted state.

4. The insulation frame (4) according to any of the pre-

ceding claims, where the at least one groove (450, 4501, 452) extends in a longitudinal direction over the entire length (L) of the insulation member (43) or where the at least one groove (450, 4501, 452) extends from at least one corner defined by two adjacent insulation members (43) over only a part (l) of the lengths (L) of each said two adjacent insulation members, for example over 10% to 40% of each of said lengths (L).

5. The insulation frame (4) according to any one of the preceding claims, where the depth (d) of the at least one groove (450, 4501,452) provided on the inner side (IS) or the outer side (OS) of the at least one insulation member (43b) is extending in an angle α in relation to the plane defined by the insulation frame (4), and preferably said angle is between 0° and 60°, more preferably between 15° and 60°, most preferably between 30° and 45°.

6. The insulation frame (4) according to any one of the preceding claims, where the depth (d) of the at least one groove (450, 4501, 452) is in the range of 3-12 mm, preferably 5-10 mm.

7. The insulation frame (4) according to any one of the claims 2-6, where the depth (d) of the respective grooves (450, 451; 4501, 4511) provided in the same insulation member (43a, 43b) is different.

8. The insulation frame (4) according to any of the preceding claims, where the width (w_g) of the least one groove (450, 4501, 452) is constant over its/their entire depth (d), for example 2-4 mm, such as about 3.5 mm, or tapers (4501, 4511, 452) in direction of its depth (d).

9. The insulation frame (4) according to any one of the preceding claims, where the width (w_g) of each of the at least one groove (450, 4501, 452) at its mouth is 5% to 20% of the height (H) of the insulation member (43a, 43b), for example 2-4 mm, preferably 3-4 mm.

10. The insulation frame (4) according to any one of claims 2-9, where a distance (d_i) between the grooves (450, 451; 4501, 4511, 452) is 10% to 20% of the of the height (H) of the insulation member (43).

11. The insulation frame (4) according to any one of the preceding claims, where the resilient material is selected from a group consisting of: extruded polyethylene, other polymer foams, mineral wool, composites and combinations thereof.

12. The insulation frame (4) according to any one of the preceding claims, wherein the insulation frame (4) further comprises a connector bracket (410) attached to, preferably embedded in, the insulation member (43a, 43b), for attaching the insulation frame (4) to the roof structure (1).

13. The insulation frame (4) according to any one of the preceding claims,
wherein the top (570) and/or the bottom member (580) are according to any one of claims 1 to 12 and wherein the side frame members (10) comprises:

a first insulating element (101) made from a dimensionally stable insulating material,
a second insulating element (102) made from a compressible insulating material, and
fastening means (103,104) for fastening the insulating member to the window or the loadbearing structure,
where the first and second insulating elements (101,102) are interconnected so that, in use, the orientation of the insulating elements (101,102) is such that the first insulating element (101) is on top of the second insulating element (102), the side of the first insulating element (101) facing away from the second insulating element (102) defining an upper side of the side frame member (10) and the side of the second insulating element (102) facing away from the first insulating element (101) defining a lower side of the side frame member (10), wherein a height direction is defined as a direction extending from said lower side to said upper side, and
where said fastening means (103,104) is attached to the first insulating element,
wherein the second insulating element (102) is made from a material with slits (105) extending in said height direction from said lower side.

14. A kit comprising at least a first insulation frame (4) and a second insulation frame, wherein the first and/or the second insulation frame is according to claim 1, and wherein the first and second insulating frames are adapted to be positioned adjacent to each other such that the interior side of first insulating frame (4) is facing the exterior side of the second insulation frame (4).

15. The kit according to claim 14, wherein the first insulation frame (4) is provided with at least one, preferably more, groove(s) (452) on the interior side ($I_{nt}S$) of at least one insulation member (43a) and/or the second insulation frame (4) is provided with at least one, preferably more, groove(s) (450, 451) on the inner side (IS) or the outer side (OS) of at least one insulation member (43b).

16. A method of mounting a roof window in an inclined roof structure (1) of a building, said method comprises the steps of:

a) providing an insulation frame (4) for a roof window according to any of the claims 1-13,
b) making an opening in the roof structure (1) adapted to a length and a width of the insulation frame (4);
c) mounting the roof window with the window frame (2) in the opening of the roof structure (1);
d) fastening the window frame (2) to the roof structure (1);
e) mounting the insulation frame (4) such that it surrounds the window frame;

whereby the resilient material of the at least one insulating member containing the at least one groove (450, 4501, 452) is transiently deformed during the mounting of the insulation frame (4), the roof window or the window frame (2).

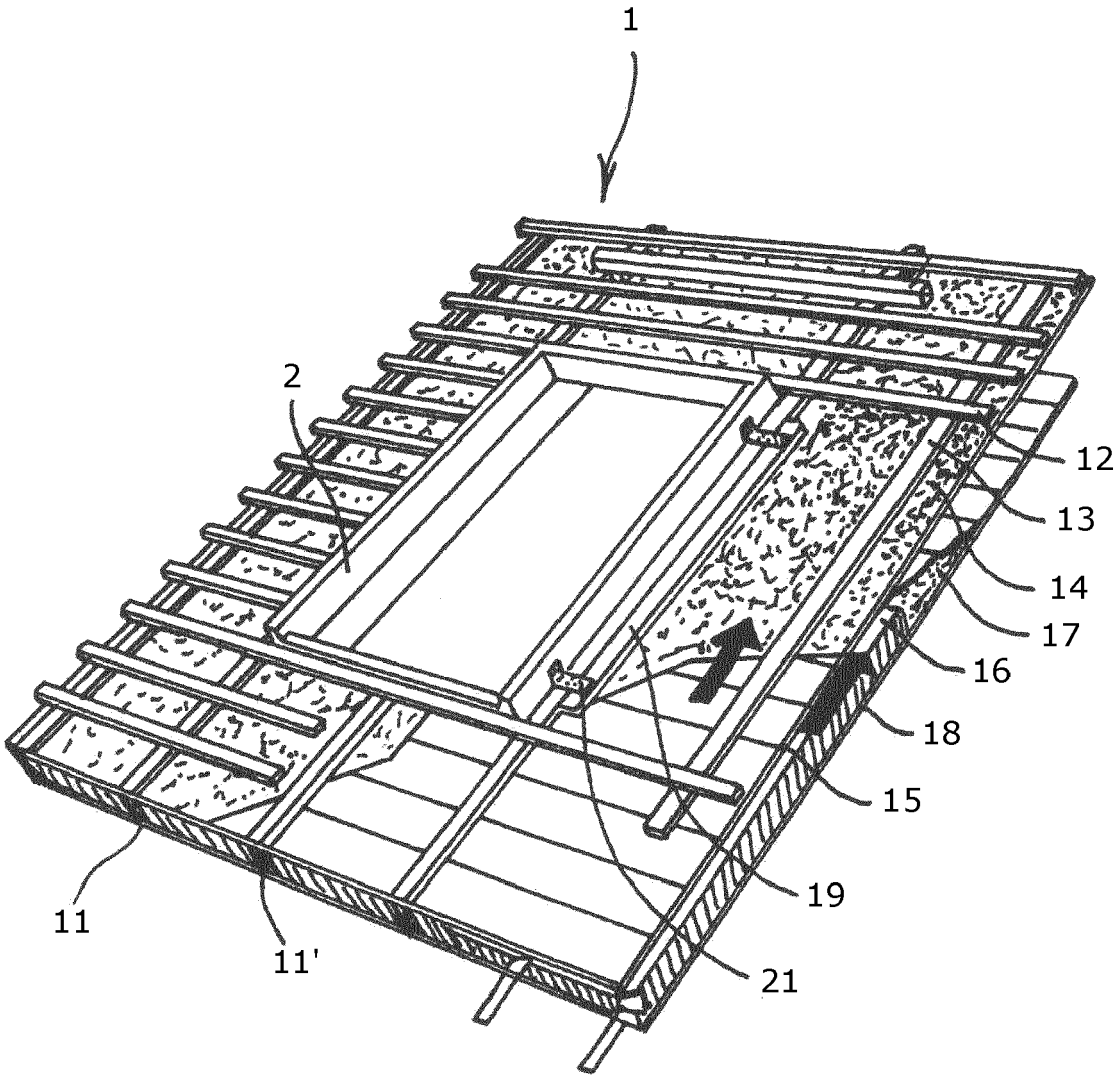

Fig.1

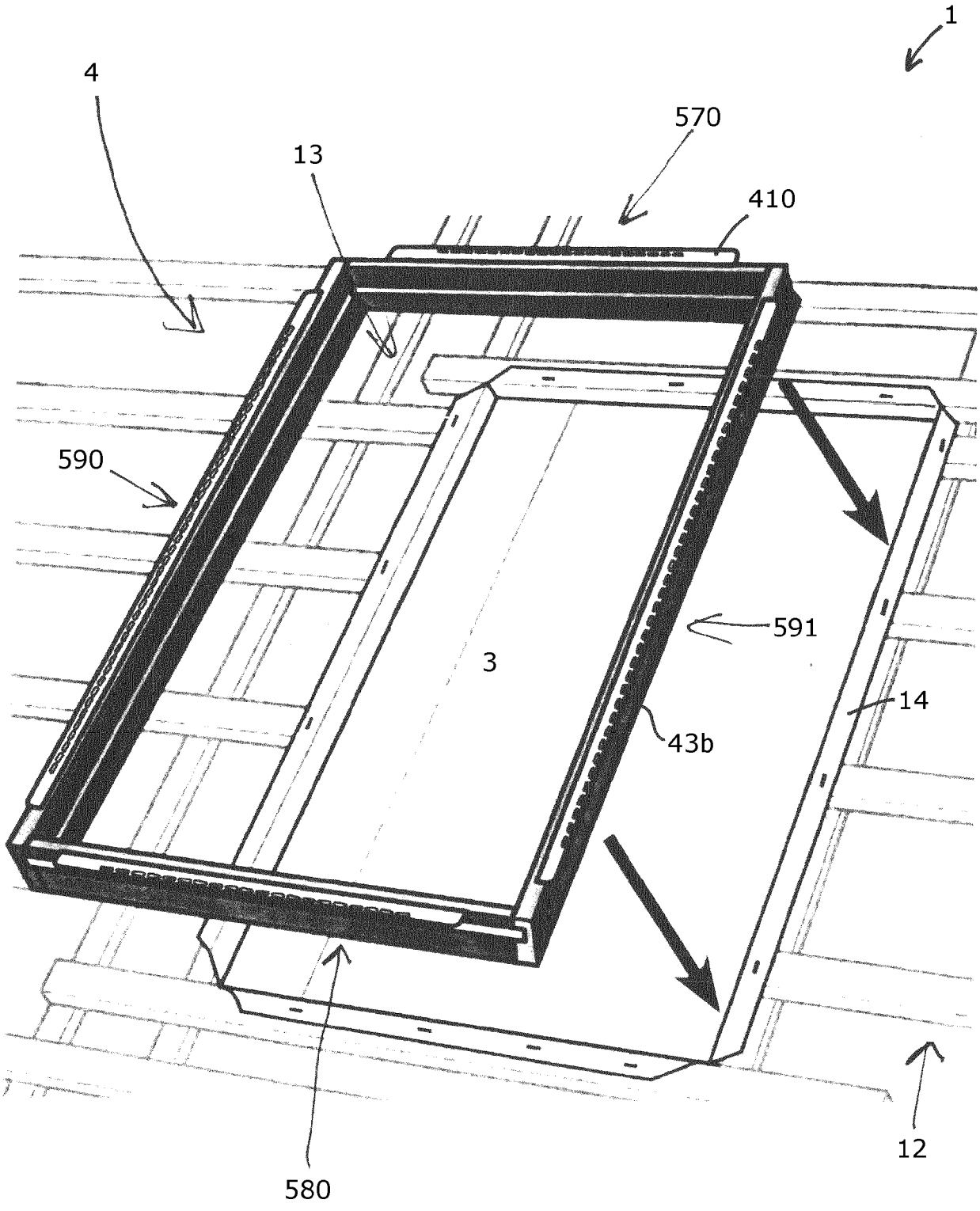

Fig. 2

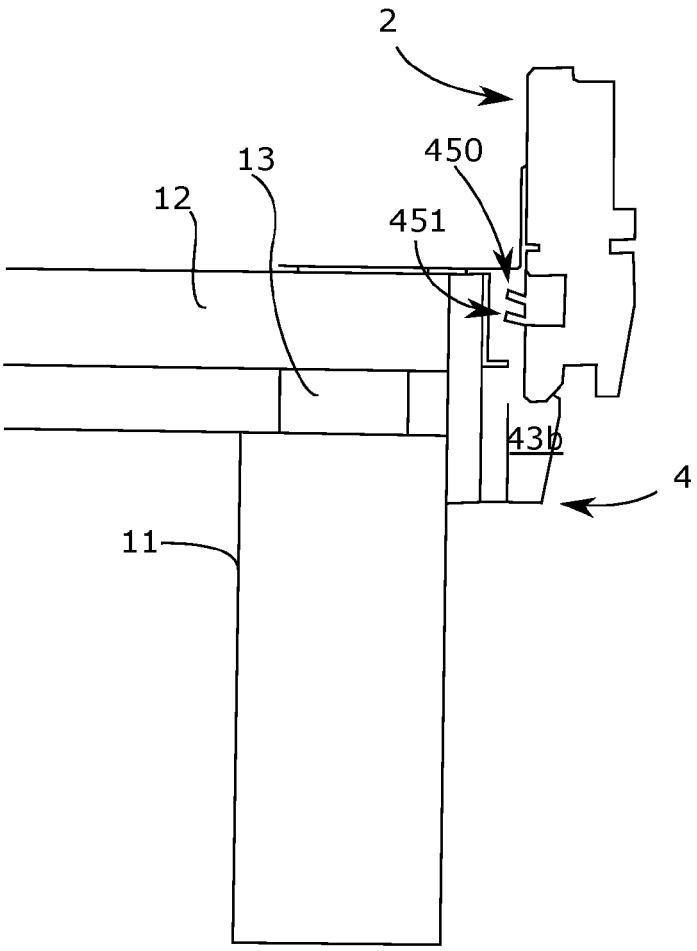

Fig. 3

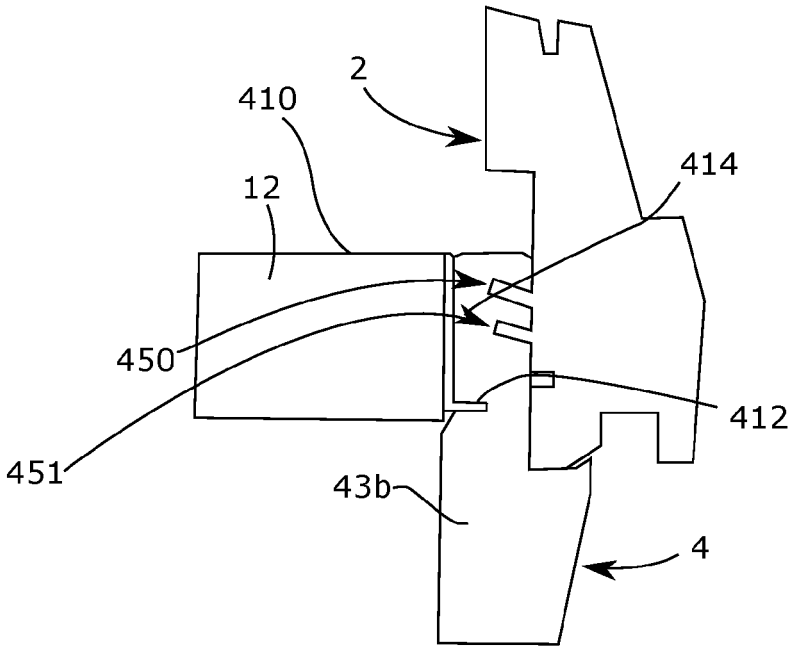

Fig. 4

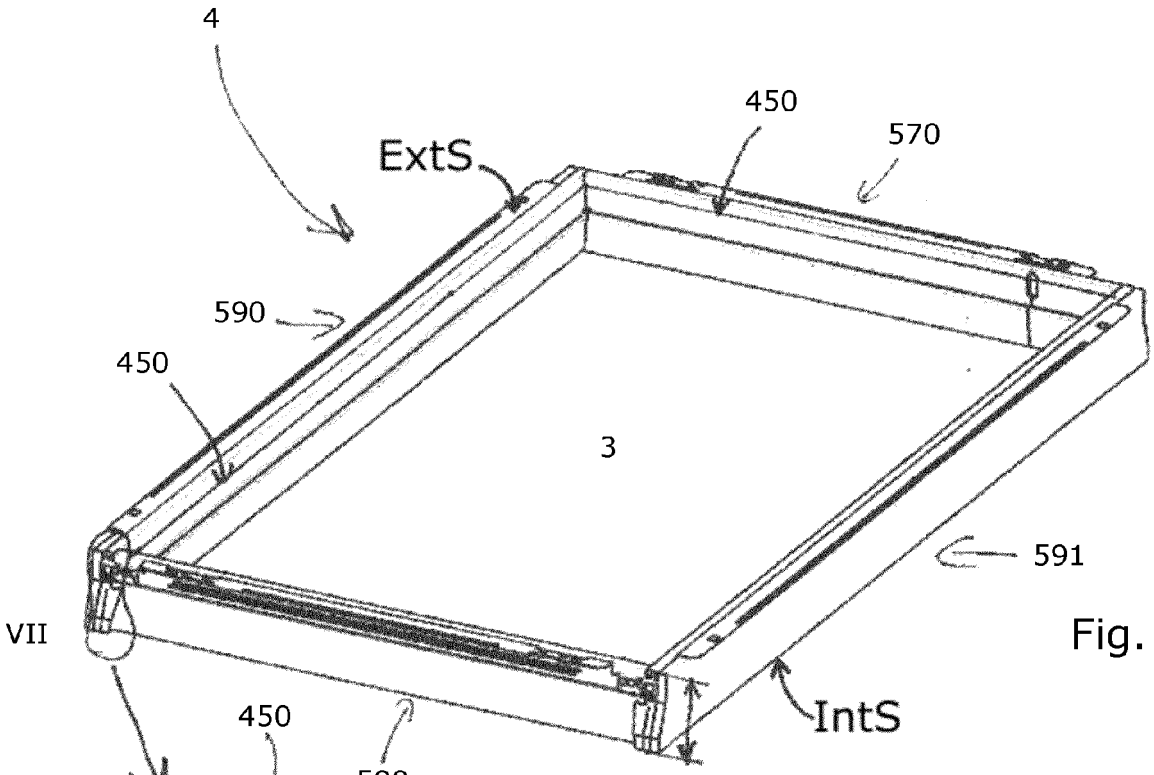

Fig. 5

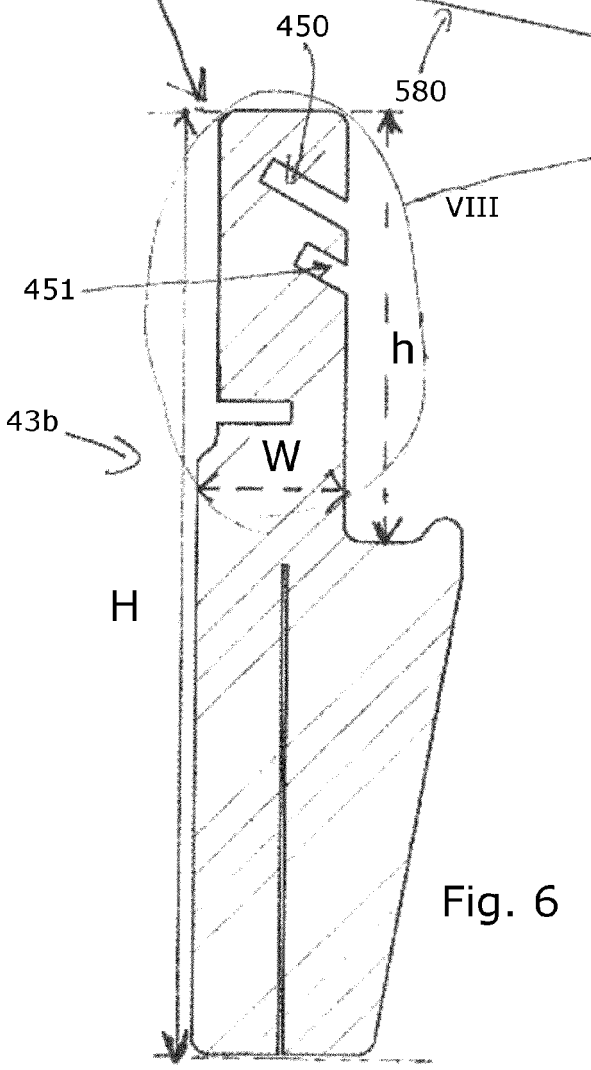

Fig. 6

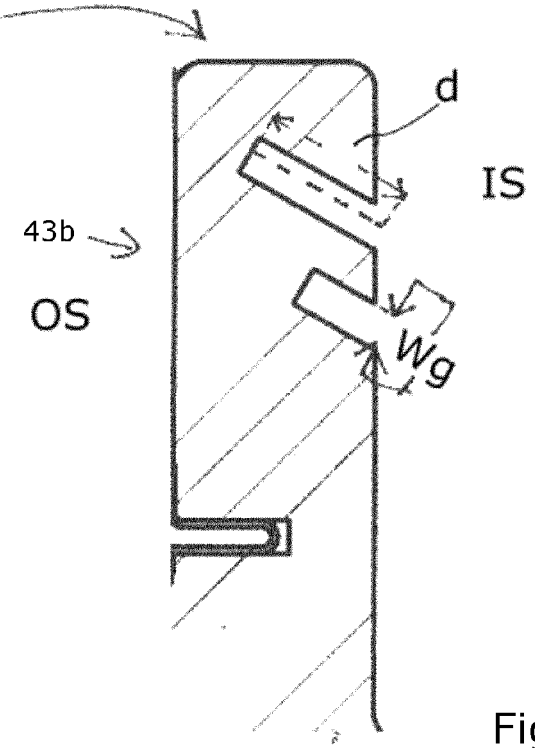

Fig. 7

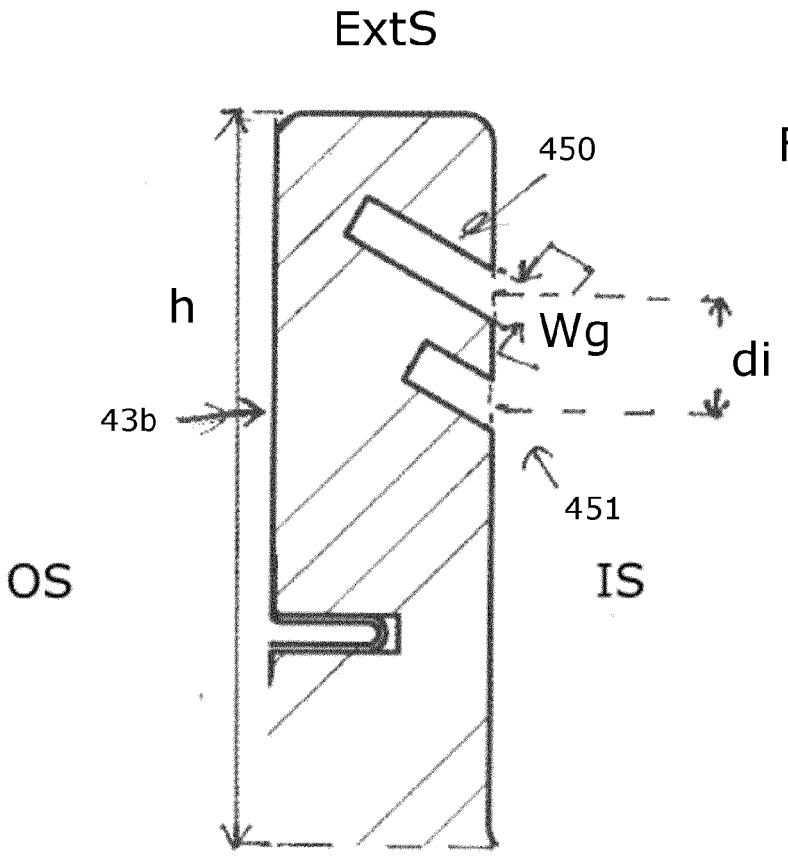

Fig. 8

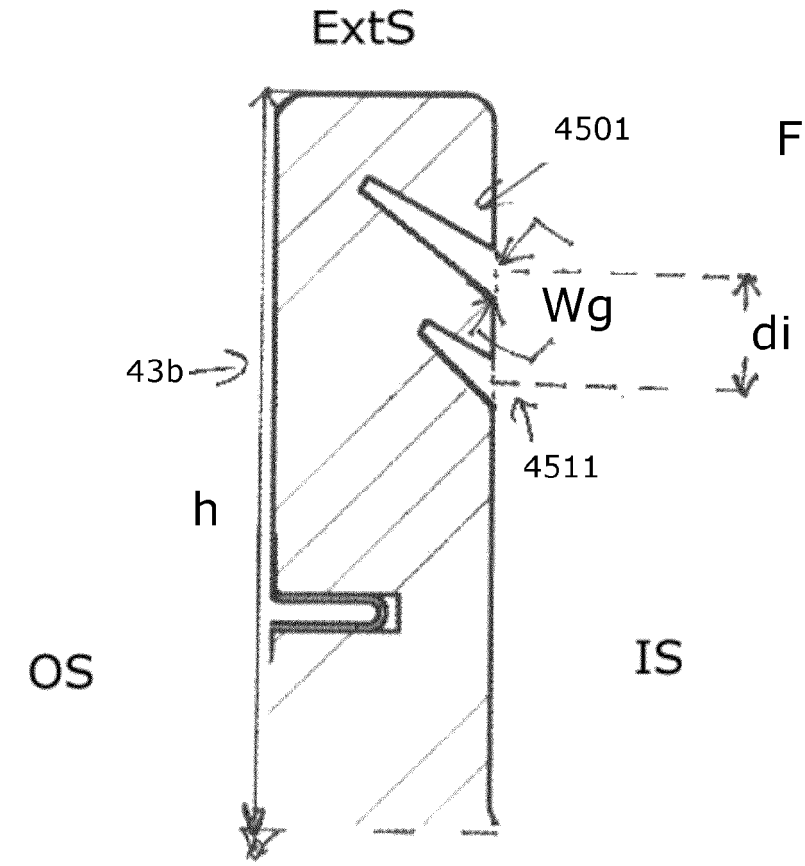

Fig. 9

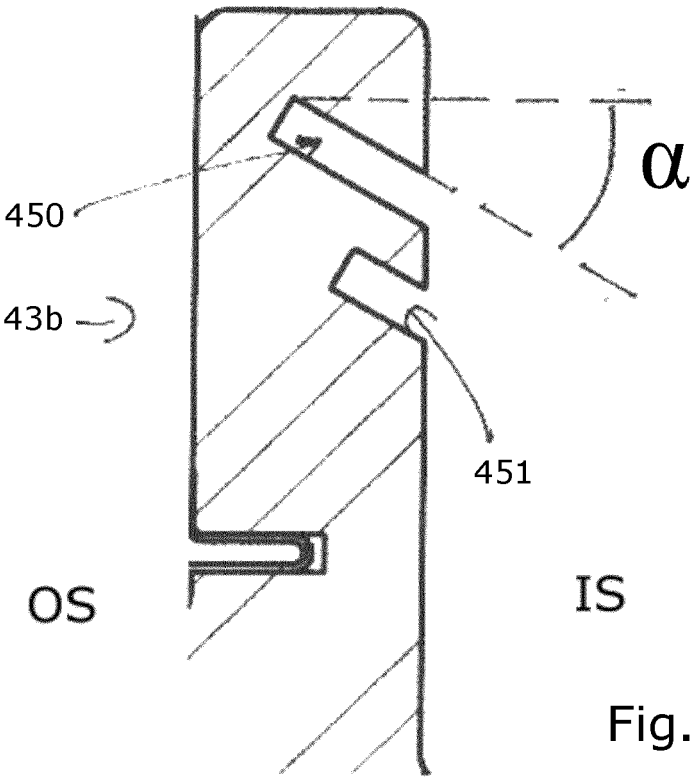

Fig. 10a

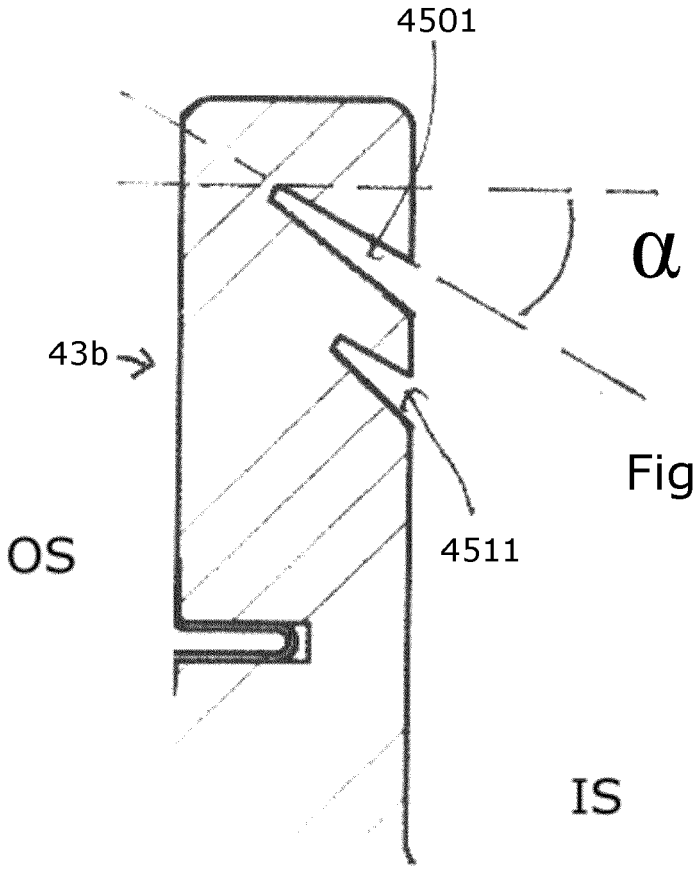

Fig. 10b

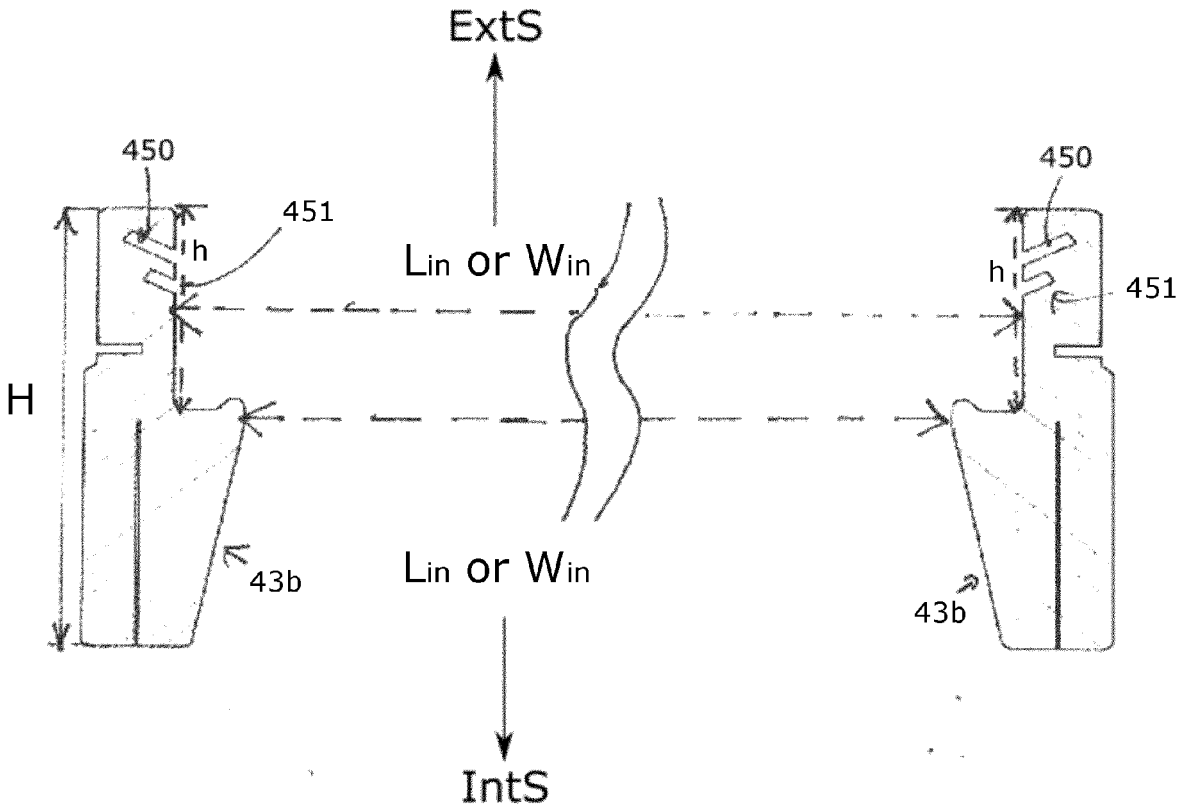

Fig. 11

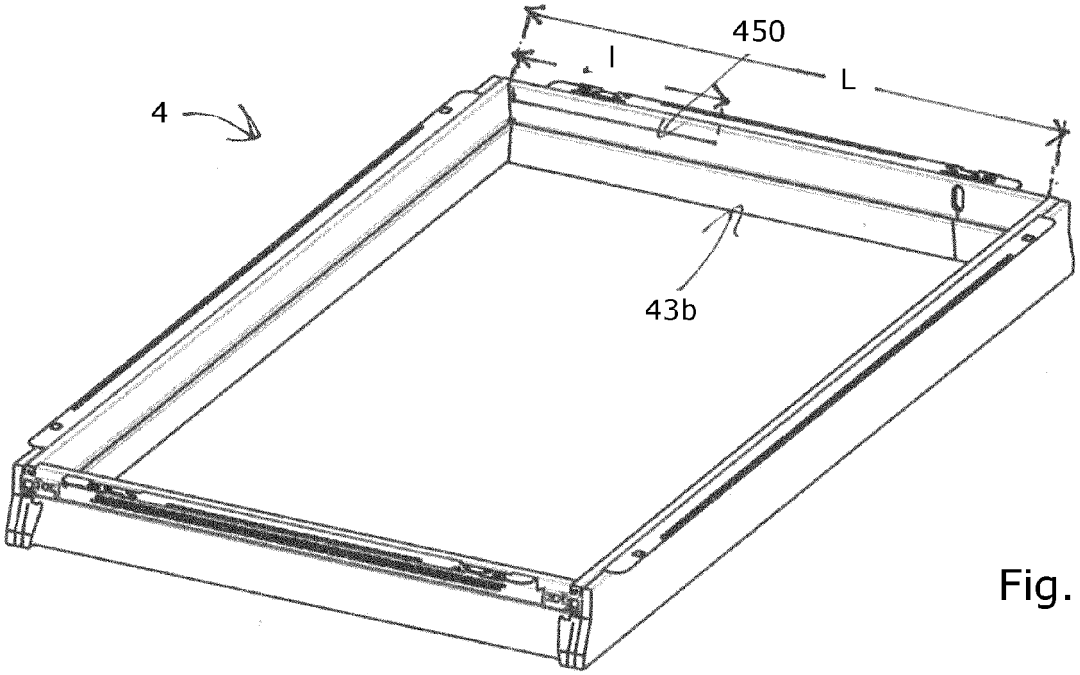

Fig. 12a

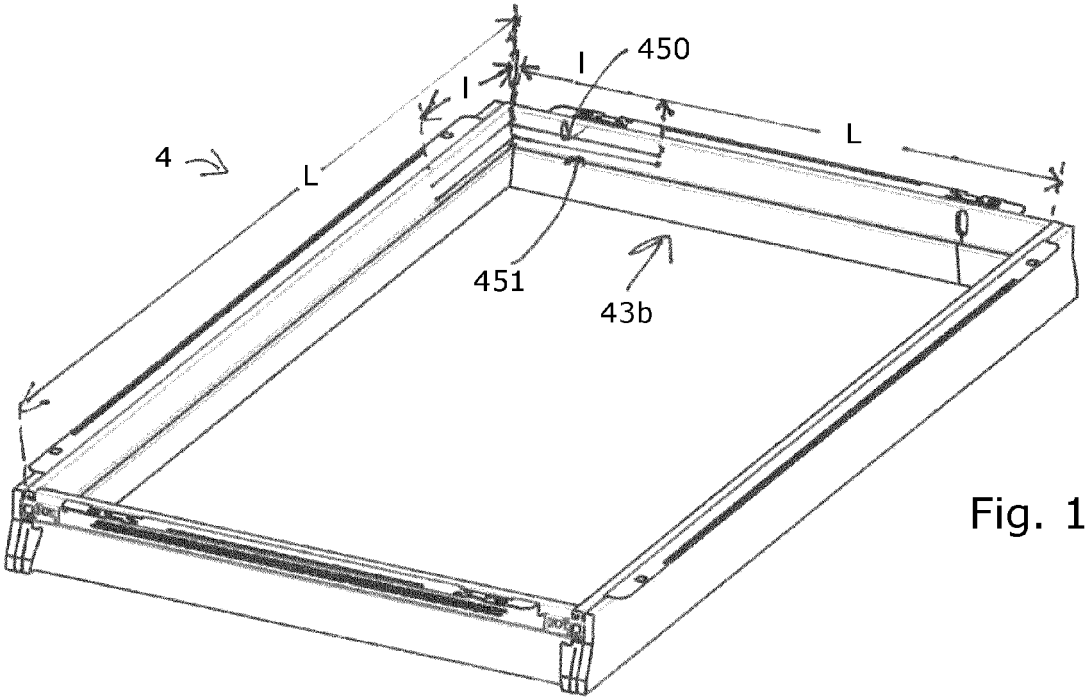

Fig. 12b

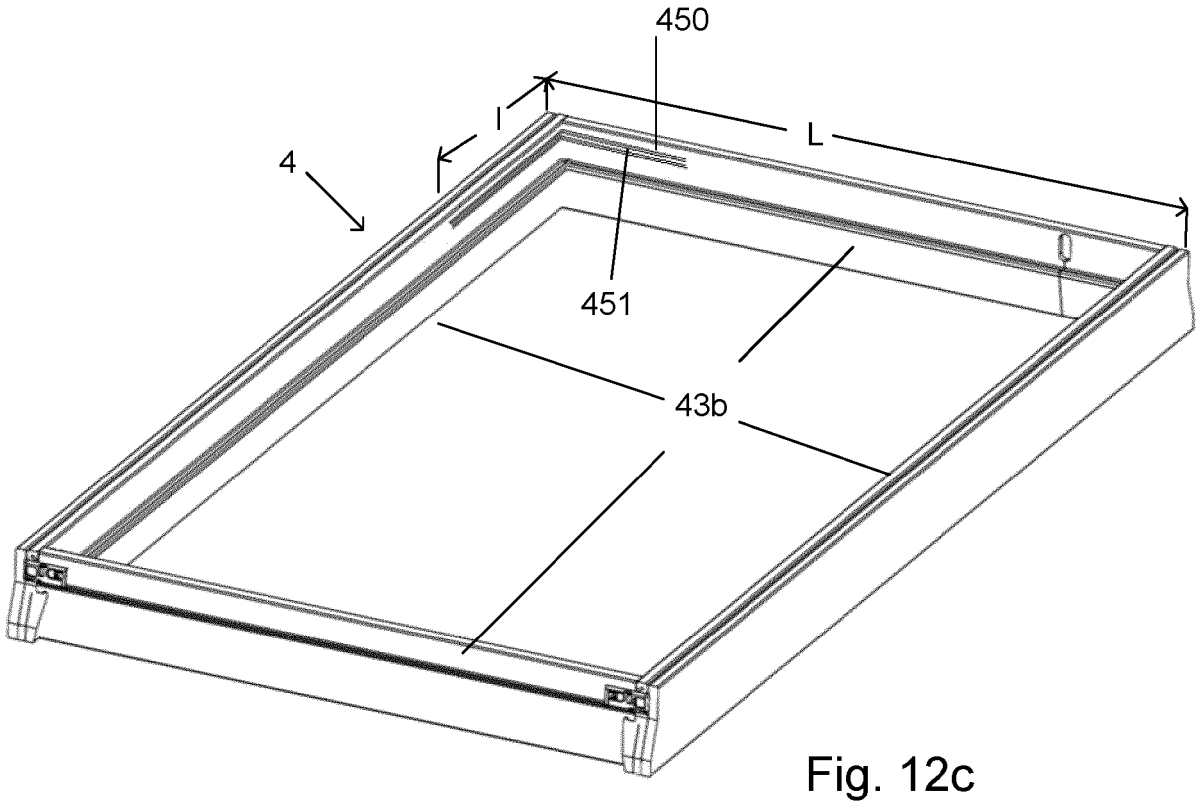

Fig. 12c

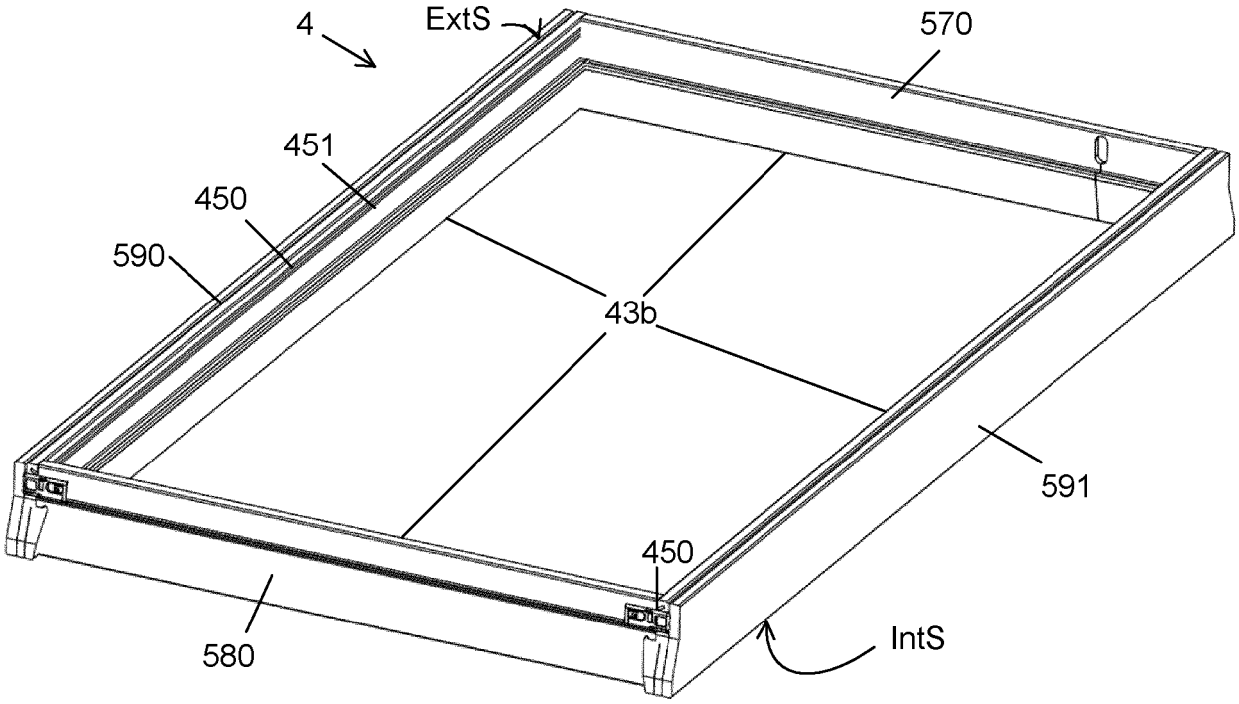

Fig. 12d

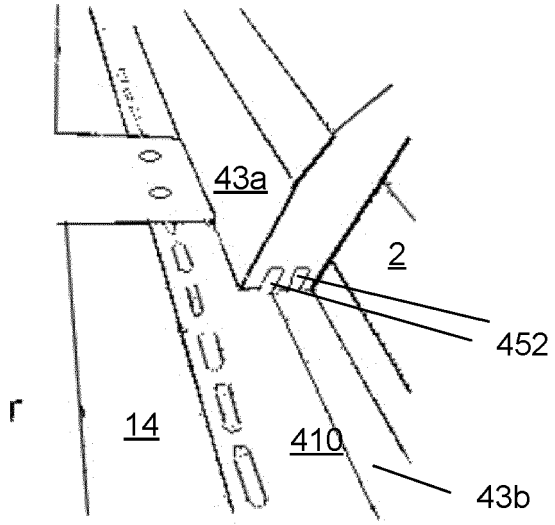

Fig. 13

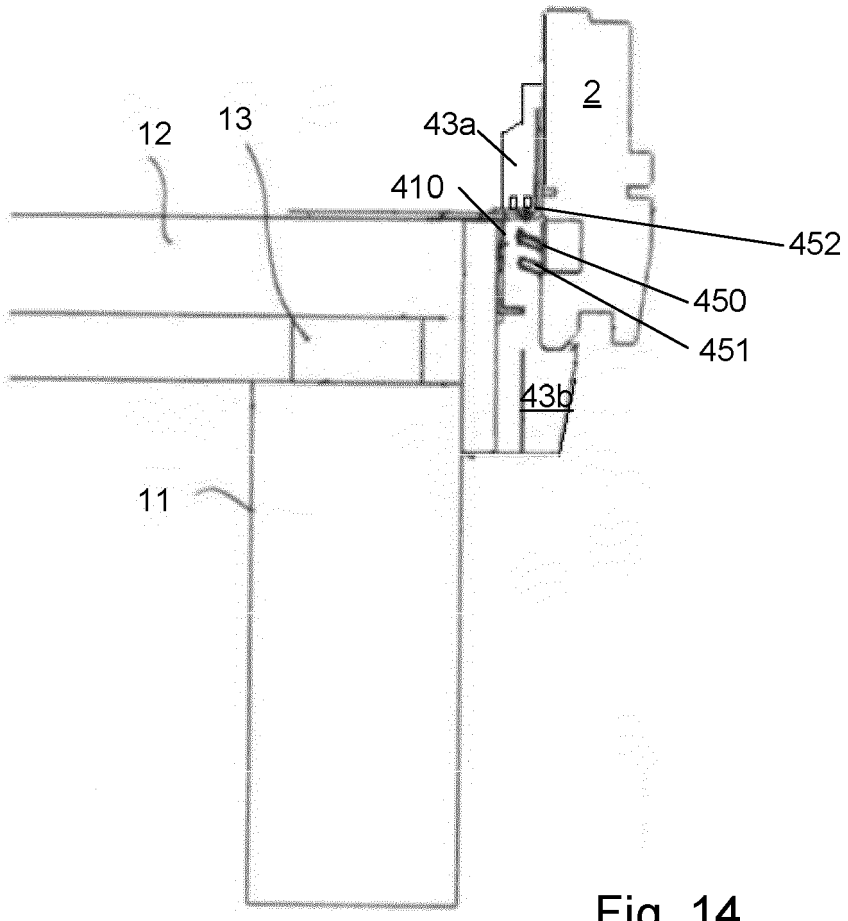

Fig. 14

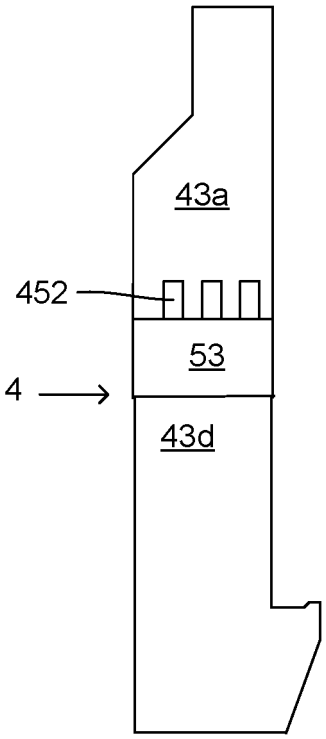

Fig. 15

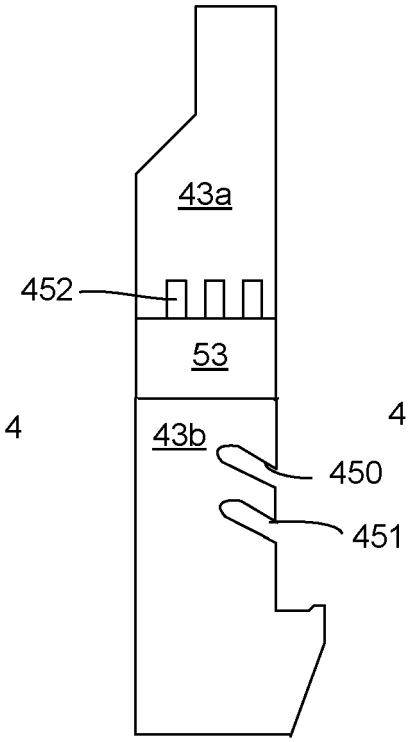

Fig. 16

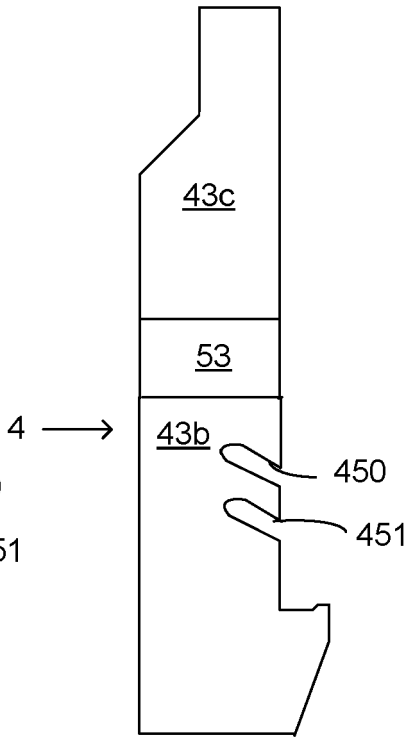

Fig. 17

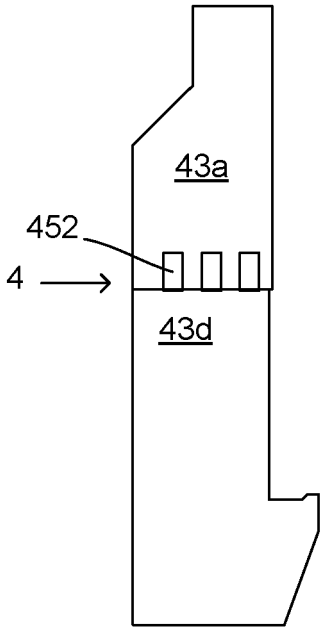

Fig. 18

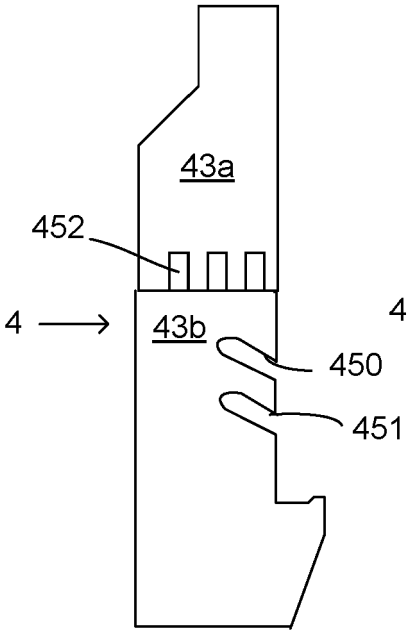

Fig. 19

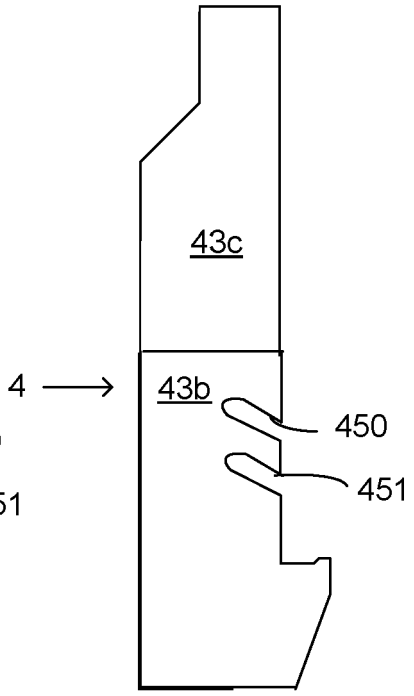

Fig. 20

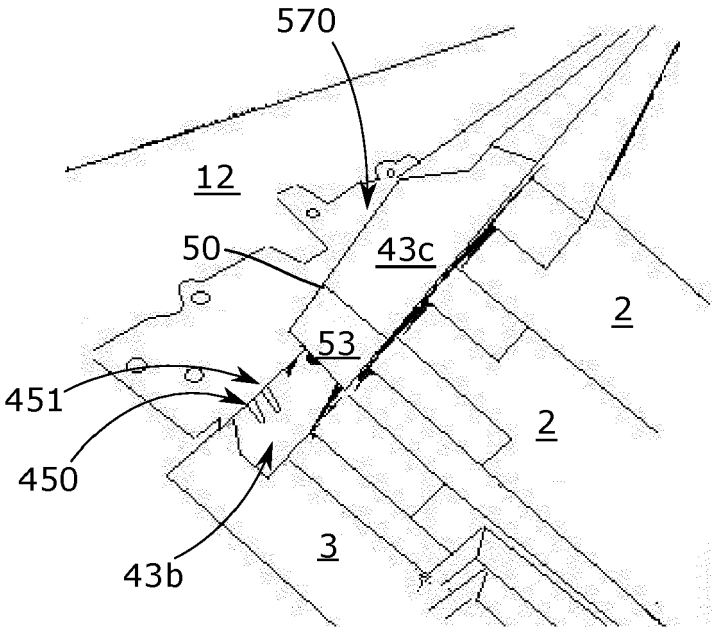

Fig. 21a

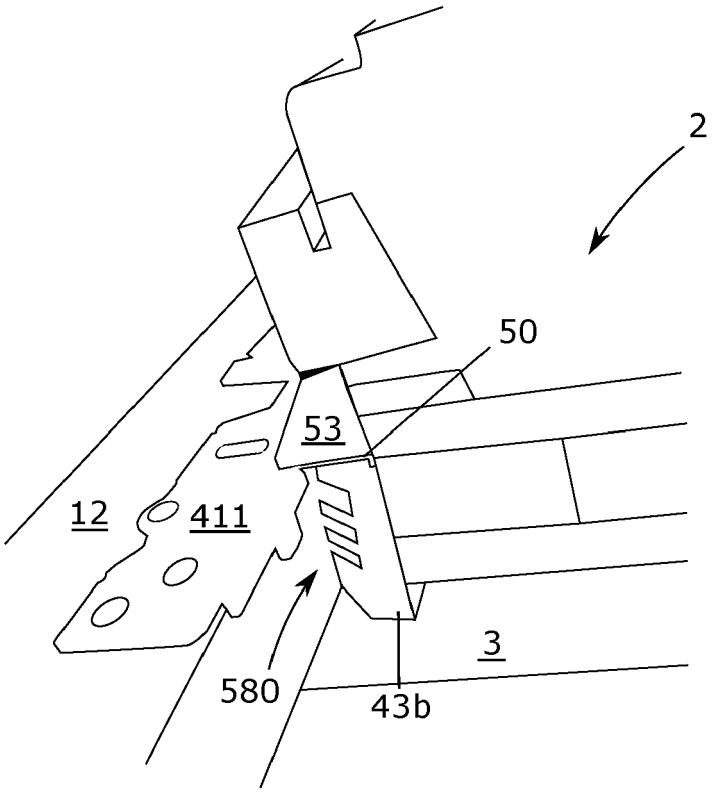

Fig. 22a

Fig. 21b

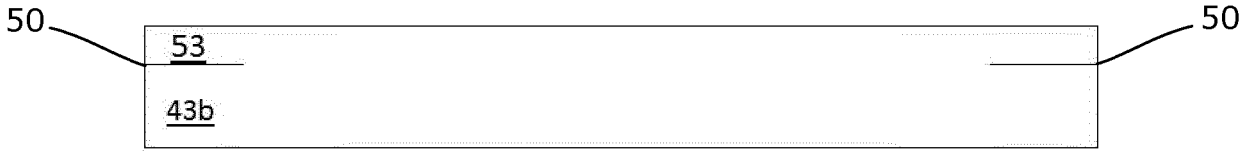

Fig. 22b

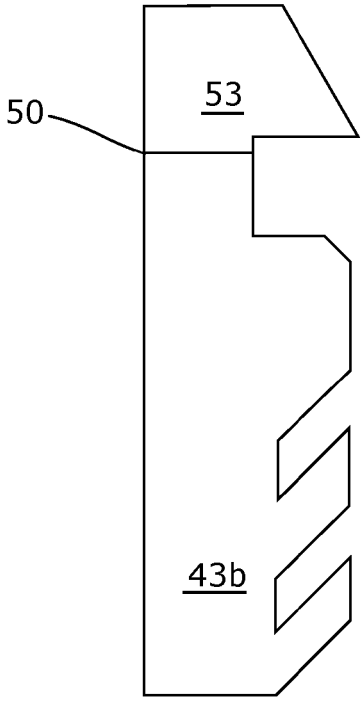

Fig. 23

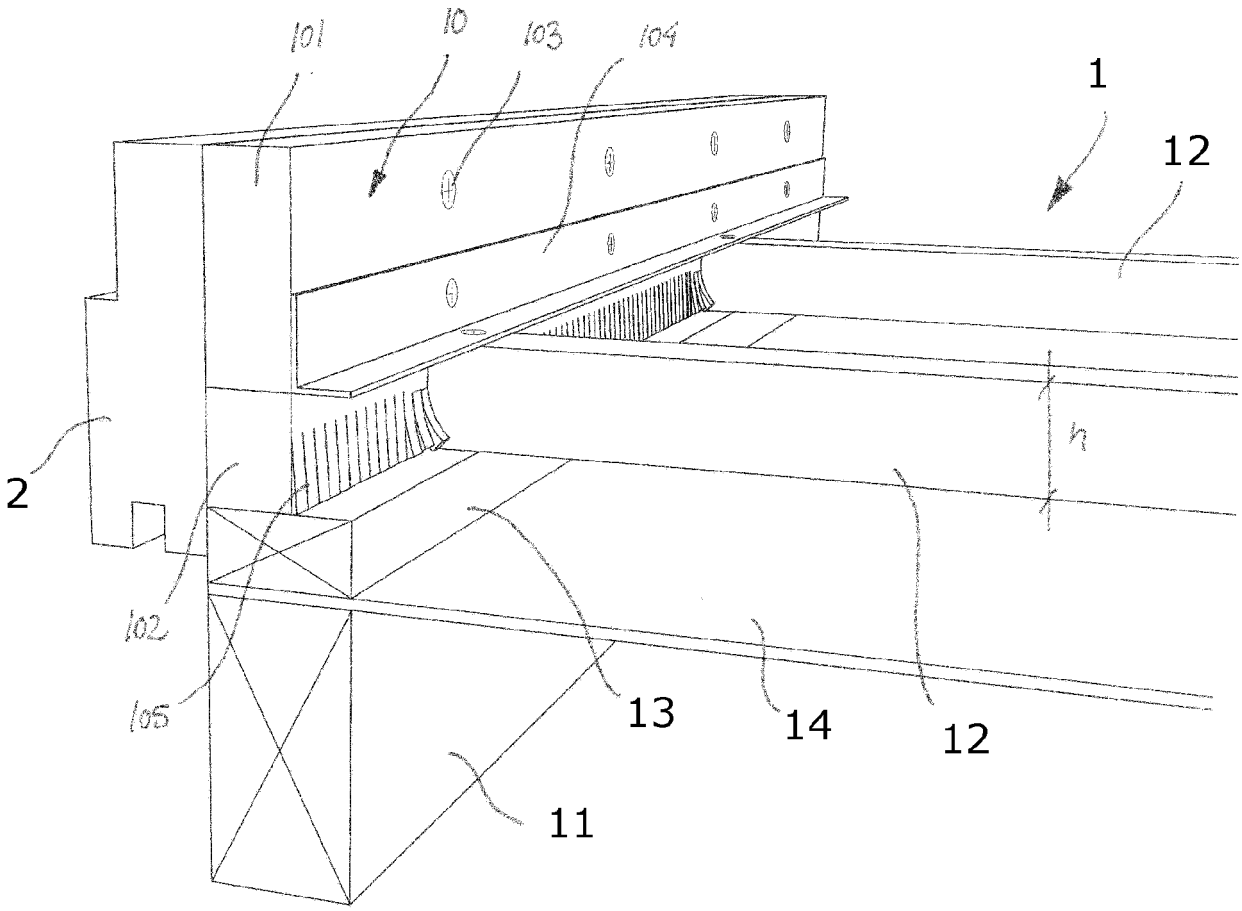

Fig. 24

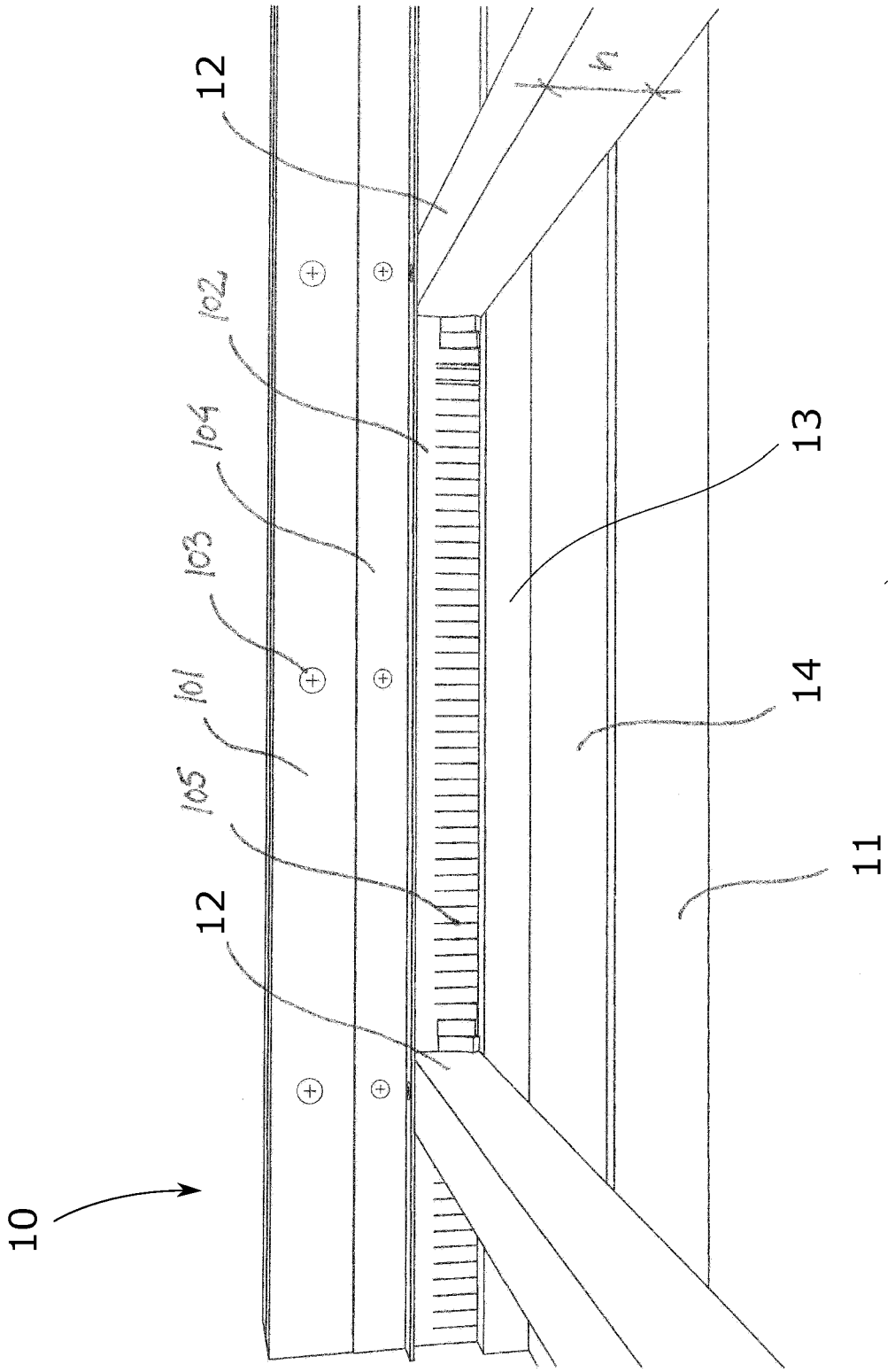

Fig. 25

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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 1205

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E04D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 April 2020	Tran, Kim Lien

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