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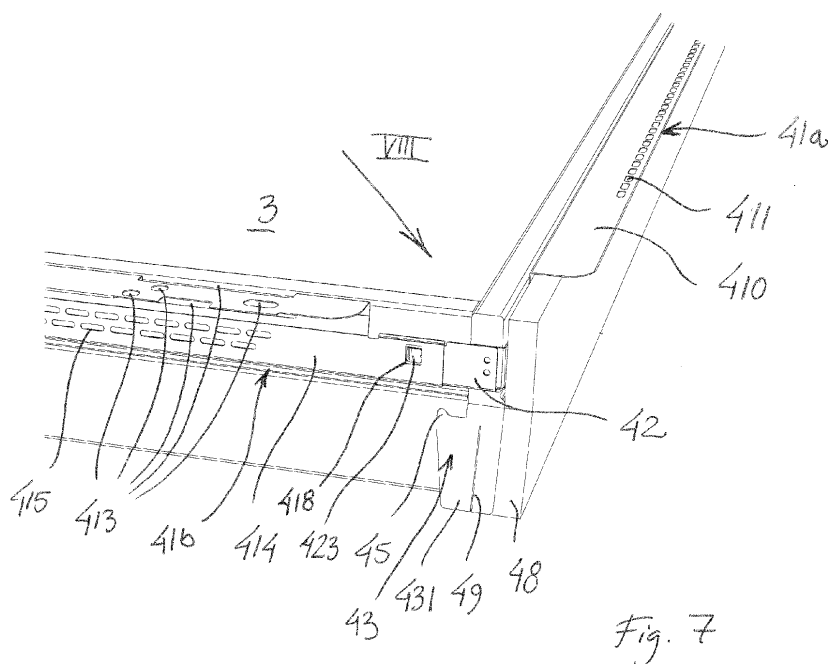
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(54) **An insulating frame for a roof window and a method of mounting a roof window**

(57) An insulating frame (4,5) for a roof window mounted in an inclined roof structure of a building, comprising top, bottom and side members, each including an insulating member (43,55,57), and a plurality of connector brackets (41 a,41 b,42). The connector brackets includes a first set of connector brackets and a second set of connector brackets. The first set of connector brackets

is adapted for connecting the insulating frame to the roof structure and extending over at least half of the length of at least two frame members forming opposite sides of the insulating frame. The second set of connector brackets connects the side members to the top and bottom members of the insulating frame. The insulating frame may further comprise a compressible layer or member (48) on its outer side and/or stiffening members (51).



Description

[0001] The present invention relates to an insulating frame for a roof window mounted in an inclined roof structure of a building, comprising top, bottom and side members, each including an insulating member, and a plurality of connectors brackets, said insulating frame defining an inner opening adapted to surround the frame of the roof window and said insulating frame having an interior side intended to face the interior of the building and an exterior side intended to face the exterior and each frame member having an inner side facing the inner opening and an outer side facing away from the inner opening, where at the length and/or width of the inner opening varies over the height of the frame perpendicular to the plane defined by the frame members, so that at the exterior side the length and width of the inner opening corresponds substantially to the corresponding outer dimensions of the roof window, which the frame is intended to receive, while at the interior side the length and/or width of the inner opening is/are smaller than the corresponding outer dimensions of the roof window. The invention also relates to a method for mounting a roof window in a pitched roof structure.

[0002] Such insulating frames, which are known for example from EP1061199A1, have found wide use and have improved the insulating properties of inclined roof structures with roof windows considerably, but the demands for insulation continues to rise.

[0003] As is well known to the skilled person, the work associated with mounting insulating frames and windows in an inclined roof structure is challenging, not least during heavy winds. It therefore happens that the insulating frame is not mounted correctly. This in turn causes trouble during the subsequent mounting of the window and/or other associated components such as an underroof collar or lining panel and/or influences the insulating properties negatively.

[0004] It is therefore the object of the invention to provide an insulating frame, which is easier to mount correctly, and it is a further object of the invention to provide an insulating frame with even better insulating properties.

[0005] This is achieved with an insulating frame comprising a first set of connector brackets and a second set of connector brackets, said first set of connector brackets being adapted for connecting the insulating frame to the roof structure and extending over at least half of the length of at least two frame members forming opposite sides of the insulating frame, and said second set of connector brackets connecting the side members to the top and bottom members of the insulating frame. The use of two such separate sets of brackets instead of one set serving both to connect the frame members and as mounting brackets as in EP1061199A1 has numerous advantages. Firstly, the first set of connector brackets gives the insulating frame a more continuous support along the length of the frame members, thus preventing skewness and keeping it in place during mounting of

the window. Secondly, as the second set of connector brackets serves only to interconnect frame members, they can be relatively small, meaning that the thermal conductivity at the corners of the insulating frame can be kept low. Thirdly, keeping the corners of the insulating frame relatively simple makes it easier to mount roof windows with mounting brackets at the corners, since the different types of brackets will not come into conflict with each other. And, fourthly, when mounting the roof window relatively deep in the roof, also known as flush installation, corner brackets of prior art insulating frames have been known to get in the way of the flashing and cladding parts needed for water-proofing the joint between the bottom member of the window frame and the roof structure. Some prior art insulating frames have therefore been provided with two different versions of brackets; one for normal installation and one for flush installation. With the present invention this is no longer necessary and hence the use of two separate sets of brackets, which on the face of it seems like a cost increasing solution, in reality decreases costs and reduces the risk of wrongful mounting since the insulating frame is always mounted in the same way.

[0006] The fact that the connector brackets of the first set extend over at least half the length of the respective frame members means that they provide a good and continuous support and further provides stiffness to the frame member, which may thus be prevented from buckling. In one preferred embodiment the connector brackets of the first set extend over more than three quarters of the length of the frame member and in another embodiment these connector brackets extends over substantially the entire frame member but stopping at a distance of 1-10 cm from each end of the frame member.

[0007] Each of the connector brackets of the first set preferably comprises a flange portion projecting away from the frame opening at the exterior side of the insulating frame and being adapted for being attached to the roof structure. This may for example be achieved by using angular brackets arranged with one leg projecting as the flange and the other attached to the outer side of the insulating member. Attaching the connector brackets of the first set to the outer sides of the insulating members has the advantage that the brackets do not form thermal bridges. For the same reason parts of the connector brackets of the first set being in contact with the insulating frame members may have openings or sections of decreased thermal conductivity. This may also potentially contribute to reducing material costs.

[0008] The flange portion is preferably adapted for being attached to battens of the roof structure, but it may also be attached to rafters or to an underroof. The flange need not extend over the entire length of the bracket and it is preferred that the outermost 3-10 cm of the insulating frame member closest to each end is without such a flange.

[0009] Openings or weakening zones through which a nail or screw may be driven may be provided in the flange

portion and/or the flange portion may be provided with other means of attachment, such as spikes or an adhesive.

[0010] The connector bracket flange may be continuous, extending over the majority of the length of the insulating frame member as described above, but it is also possible to use brackets with a number of local flanges, for example for giving room for mounting brackets used for securing the roof window to the roof structure. It is also possible for the flange portion to be only partially interrupted at the intended positions of window mounting bracket or other components of the roof structure or window, the flange having either an opening or recess or being made from a thinner material, which is easily penetrated.

[0011] It is of course also possible to use brackets not having any flanges at all and instead being connected to the roof structure by means of spikes, shackles or straps or to combine different methods of attachment.

[0012] Advantageously, the connector brackets of the first set are adapted for also serving as stiffening members. If using an angular bracket as described above, the necessary stiffness may be achieved simply by making the bracket with a sufficient material thickness, for example by making the flange with a bent edge, but it is also possible to provide the bracket with an additional flange. Such an additional flange may project into the insulating member of the frame, but the effect on the insulating properties of the frame must always be considered.

[0013] The connector brackets of the first set are preferably made from steel by folding or roll forming, but may be made of any suitable material selected from the group consisting of: steel, stainless steel, aluminium, other metals, plastic, ceramics, glass fibre, composites and combinations thereof.

[0014] The insulating members should be made from a dimensionally stable material to ease insertion of the roof window frame into the inner opening, said material preferably being selected from the group consisting of: extruded polyethylene, other polymer foams, mineral wool, cement bound wood fibres, composites and combinations thereof. Extruded polyethylene with a density of approximately 30 kg/m³ has suitable properties for this use.

[0015] The second set of connector brackets, which are used for interconnecting frame members, can be made from the same material as the first set of connector brackets, but common or rust resistant spring steel is well suited for the purpose.

[0016] The actual interconnection is preferably achieved by the connector brackets of the second set being spring locked to the insulating members or to members attached thereto, preferably to the connector brackets of the first set. In a simple and hence cheap embodiment, this is achieved by at least one lug projecting from a connector bracket of the second set being brought into snap-locking engagement with an opening provided in a connector brackets of the first set, the lug being forced

aside when the connector bracket of the first set is inserted in the connector bracket of the first set and snapping back out when it reaches the opening.

[0017] To ensure a good stability of the insulating frame, the connector brackets of the second set are preferably made as an angular bracket where each leg is also of an angular cross-sectional shape, thus giving three-dimensional stability to the joint as will be explained in detail below.

[0018] In another advantageous embodiment at least one frame member is provided with a compressible layer or member on its outer side. This allows the insulating frame to compensate for variations in the opening in the roof structure so that there is always close contact between inner side of the opening and the insulating frame, which is important for the insulating properties. Variations in the roof opening may for example be the result of the opening being made imprecisely or slightly off size, a common standard tolerance when mounting roof windows being 20 mm. When the insulating frame is installed in the roof structure, the compressible layer will give way wherever the roof opening is smaller than the outer dimensions of the insulating frame in the non-compressed state.

[0019] The compressible layer is preferably made from a soft polymer foam, such as foamed polyurethane with a density of 15 kg/m³, which is durable in the rather harsh environment encountered in a roof construction and also fire resistant. To provide the tightest possible fit with the opening in the roof structure the material should preferably be elastic, which is also the case with the polyurethane foam.

[0020] To allow further adaptation of the insulating frame in case the opening in the roof is too small, at least some of the insulating members may be provided with a longitudinal slit extending from the interior side towards the exterior side and allowing the removal of a part of the material of the insulating frame member. Such removal of insulation material will of course influence the overall insulating properties of the finished construction and should therefore be avoided if possible, but as the alternative is often to leave out the insulating frame entirely and as the slit does no harm if not used, this embodiment is nonetheless considered advantageous.

[0021] In another embodiment, the insulating frame includes a ledge on its inner side, which projects underneath the frame of the roof window in the mounted state. It thus envelopes the outer interior corners of the window frame and supplements the insulating material, which is traditionally arranged between the inner side of the opening in the roof structure and a lining panel. The ledge defines an imaginary division of the insulating frame in an exterior part, which is laying along the outer side of the window frame in the mounted state, and an interior part, which is below the window frame in the mounted state. In other words, an exterior part where the length and width of the inner opening corresponds substantially to the corresponding outer dimensions of the roof window

and an interior part where the length and/or width of the inner opening is/are smaller than the corresponding outer dimensions of the roof window, the transition between the exterior part and the interior part being abrupt so that a ledge is formed on the inner side of the insulating frame. It is, however, also possible to make at least some of the insulating members with an oblique inner surface so that when the window is mounted, it slides as far into the opening of the insulating frame as possible under the influence of gravity and, depending on the nature of the insulating material, possibly compresses the insulating member so that it comes to envelope the corner of the window frame.

[0022] Many roof windows are provided with a longitudinal groove in the interior surface of the window frame for receiving and retaining an edge of a lining panel. For improving the insulating properties of the finished structure even further and contributing to keeping the insulating frame in place in relation to the window frame, the ledge of the insulating frame may be provided with a projection projecting towards the exterior side of the insulating frame and being adapted for projecting into a groove in the interior side of the roof window. As the groove is often bevelled towards the outer side of the window frame, the projection is preferably wedge shaped and located on the inner side of the ledge, its base preferably taking up approximately half the width of the ledge. The wedge shape also minimizes the risk of the projection obstructing the subsequent insertion of the lining panel and this insertion may be further aided by making at least a section of the inner side of the insulating frame members closest to the interior side oblique so that the inner opening becomes gradually smaller as the distance from the interior side increases, the oblique inner side section preferably extending all the way from the ledge to the interior side.

[0023] The insertion of the lining panel will often result in the interior part of the insulating members being pushed outwards, away from the inner opening and when using simple clips or brackets of limited size as the second set of connector brackets, this may result in the corner joints between frame members being forced open. To avoid this, the end or ends of at least some of the insulating members may be made oblique so that the interior side of the insulating member is longer than its exterior side, thereby providing additional material compensating for the outwards movement of a neighbouring insulating member. This may be achieved simply by making the insulating member with extra length and allowing the oblique part to project in the state of delivery, but it is also possible to use a compressible material, such as the soft foam described above. The oblique end section preferably extends from the ledge to the interior side.

[0024] In the following, embodiments of the invention will be explained in more detail with reference to the schematic drawing, 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 and partially cut-away view of a roof structure with a frame for a roof window mounted according to the invention,

Fig. 3 is a cross-sectional view along the line III-III in Fig. 2,

Fig. 4 is a cross-sectional view along the line IV-IV in Fig. 2,

Fig. 5 is a cross-sectional view along the line V-V in Fig. 2,

Fig. 6 is a perspective view of an insulating frame according to the invention,

Fig. 7 is an enlarged view of the detail marked VII in Fig. 6,

Fig. 8 shows the connection between a connector bracket of the second set and two connector brackets of the first set in a perspective view with the insulating members removed,

Fig. 9 is a perspective view of a connector bracket of the second set,

Fig. 10 is a perspective and partially cut-away view of a roof structure with a frame for a roof window mounted according to another embodiment of the invention,

Fig. 11 is a cross-sectional view along the line XI-XI in Fig. 10,

Fig. 12 is a cross-sectional view along the line XII-XII in Fig. 10,

Fig. 13 is a cross-sectional view along the line XIII-XIII in Fig. 10,

Fig. 14 is a perspective view of an insulating frame according to another embodiment of the invention,

Fig. 15 is an enlarged view of the detail marked XV in Fig. 14,

Fig. 16 is a perspective sketch of a roof window mounted in a roof structure illustrating the attachment of an underroof collar according to the prior art, Fig. 17 shows the lower end of the left side member of an underroof collar seen from the inner side,

Fig. 18 is a photo of the lowermost right-hand side of a roof window during mounting of an underroof collar, and

Fig. 19 is an enlarged view of the detail marked XIX in Fig. 6.

[0025] An example of a roof structure 1 with rafters 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 provides a distance between the battens and the rafters.

[0026] 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 support on a layer 15 of boards or veneer sheets, but it is possible to use only a membrane.

[0027] Between the rafters 11 is an insulation layer 16, which may be soft or hard, typically consisting of mineral wool, glass wool, wood concrete, 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.

[0028] A frame 2 for a roof window has been mounted in an opening 3 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.

[0029] In the following, items having the same or an analogue function as described for Fig. 1 will be given the same reference numbers even though they may not be identical to those shown in Fig. 1.

[0030] In Fig. 2 a window frame 2 has been installed in an insulating frame 4 according to the invention, the roof structure 1 here being illustrated only by a single rafter 11, a single counter batten 13, a section of the waterproof membrane 14 and short sections of battens 12.

[0031] The insulating frame 4 is supported on the battens 12 via connector brackets 41a,41b as will be described in detail below and window mounting brackets 21, 21' project over the exterior side of the insulating frame, which is substantially at level with the exterior side of the battens. In this case, two different types of window mounting brackets are used, namely a set of traditional angular brackets 21 as in Fig. 1 and a set of more complex brackets 21' at the top and bottom members of the window frame.

[0032] Throughout this text the terms "top", "bottom" and "side" are used to indicate the intended position of different parts in the mounted position even though these parts may be located differently during for example storage and transportation or prior to assembly of the insulating frame. Likewise, the term "interior" and "exterior" are used to indicate that something is intended to face the interior or exterior of the building in which the insulating frame and the roof window are mounted, respectively, and the terms "inner" and "outer" that something is intended for facing towards or away from the inner opening of the insulating frame, respectively, in the mounted state.

[0033] Turning now to Fig. 3, a side member of the insulating frame 4 and of the window frame 2 are shown in cross-section along the line III-III in Fig. 2. As may be seen, the insulating frame has a height H, which allows it to span from the exterior side of the battens 12 to a level below the exterior side of the rafter 11, thus effi-

ciently preventing a heat loss at the gap between the window frame 2 and rafter 11.

[0034] The insulating member 43, which constitutes the major part of the frame member, is made of a material of a dimensionally stable nature having good insulating properties, preferably a polymer foam, such as extruded polyethylene (PE) with a density of approximately 30 kg/m³ and 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 insulating 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.

[0035] In this embodiment, the cross sectional shape of the insulating member 43 is such that a ledge 44 is formed on the inner side facing the opening 3. In the mounted state, the interior side of the window frame 2 abuts the ledge so that the insulating material envelopes the corner of the window frame. This not only adds to the insulating properties of the total structure, but also helps to ensure that the window frame 2 and insulating frame 4 are positioned correctly in relation to each other. Here this effect is enhanced even further by the provision of a projection 45 on the ledge 44 projecting into a groove 23 in the interior side of the window frame 2. In addition to insulating, the projection 45 also helps to guide a lining panel (not shown), which is later to be inserted in the groove 23, into place and for the same purpose the inner side of the insulating frame member below the ledge 44 is slightly oblique.

[0036] It is noted that even though the ledge 44, the projection 45 and the oblique inner side surface is here shown and describe in relation to one embodiment of the invention, these features are not dependent on each other and that one or more of them may be used without the others.

[0037] As may be seen in Figs. 4 and 5 the top and bottom member of this insulating frame are substantially identical to the side members and will therefore not be described in further detail.

[0038] In the embodiment shown the connector brackets 41a,41b used for securing the insulating frame 4 to the roof structure 1 extends over the majority of the length of the respective frame members. This means that the insulating frame is not only supported locally but over the majority of its length and that it can be connected to the roof structure at several places. In Fig. 2 the side member of the insulating frame is connected to four different battens 12, which not only means a good support but also that the insulating side frame member is kept straight, whereas prior art insulating frames have been known to become skewed or bend, which has made the mounting of the window frame difficult.

[0039] In this embodiment the connector brackets of the first set 41a,41b have flanges 410 extending over their entire length and projecting away from the opening 3. 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 insulating frame. It is noted, that the insulating frame need not be attached to the battens or other parts of the roof structure but may simply rest on top of these as the subsequent fastening of the roof window will also secure the insulating frame. However, to keep the insulating frame in place before and during the installation of the window frame therein, it may be advantageous to attach at least some of connector brackets of the first set to the roof structure. For this purpose and for easing the later fastening of the window mounting brackets, a series of holes 411, which allow a clamp, nail or screw to pass, are provided along the length of the flanges.

[0040] The continuous flanges also increase the stiffness of the connector brackets and thus of the insulating frame as such.

[0041] The connector brackets 41a,41b of the first set may be simply cut from sheet metal and bent to form the flange 410, but to reduce the risk of the person mounting the insulating frame cutting himself on sharp edges, at least the outer edge of the flange 410 is preferably made as a bend edge. This has the added advantage of contributing further to the strength and stability of the connector bracket.

[0042] The flanges 410 of the connector brackets of the first set 41a,41b here stops at a distance D from the frame corners as may most clearly be seen in Figs 6 and 7. This has several purposes. Firstly, the amount of material, which may potentially function as a thermal bridge at the corners is minimized. Secondly, the connection of the insulating frame members for the formation of the insulating frame is not hindered by the connector brackets of the first set. Thirdly, when mounting the roof window by means of mounting brackets attached at the corners of the window frame 2, the connector brackets are not in the way. For the latter purpose it may, however, be sufficient to merely provide openings and/or recesses 413 in the connector brackets, which allows flanges of the window mounting brackets or fastenings means such as nails, screws or spikes to pass as shown in the connector bracket used at bottom of the insulating frame in Fig. 7.

[0043] As is best seen in Figs 3-5 the connector bracket of the first set is in this embodiment provided with a second flange 412 also projecting in parallel with the plane of the insulating frame, but into the insulating member 43. This flange is intended to provide strength and stiffness to the frame member and to strengthen the connection between the insulating member and the connector bracket, but is also used for interconnection with the connector brackets of the second set as will be explained later.

[0044] It is currently preferred to insert the second flange 412 in a pre-cut slit in the insulating member and

to attach the connector bracket to the insulating member by means of an adhesive arranged on the inner side of the connector bracket. If making the insulating member by moulding, the connector bracket may be attached by being embedded in the insulating material during the moulding process.

[0045] When the connector brackets of the first set are embodied as described with references to Figs 1-8 and made from stainless steel and the insulating members are made of extruded polyethylene (PE) with a density of approximately 30 kg/m³ there is no need for providing additional members. The brackets and insulating member are in themselves sufficiently strong and stiff to give the insulating frame the needed properties. In other cases, however, it may be expedient to add stiffening members to one or more frame members. Moreover, it may be expedient to apply a surface covering or coating of one or more members if any of them are made of materials, which are not resistant to the climate in a roof structure or not resistant to fire.

[0046] Thermal conductivity is an issue which has to be considered in the design of all parts of the insulating frame and when making the connector brackets of the first set from metal, as is the intention with the bracket shown in the drawing, extra care should be taken to avoid the formation of thermal bridges. The part 414 of the connector brackets of the first set, which is parallel to the outer surface of frame member 43, is therefore provided with a series of holes 415 as seen in Fig. 7, which minimizes the thermal conductivity, but has virtually no influence on the strength and stiffness of the bracket. The bracket could, however, also have been provided with inlays of a different material with more advantageous thermal properties or made entirely from a different material, such as a polymer. Similar holes or structures for minimizing thermal conductivity may be provided in the flanges 410,412.

[0047] In the embodiments shown the connector brackets of the first set 41a,41b are used as points of attachment for the second set of connector brackets 42 used for interconnection the frame members. In Fig. 8 two connector brackets 41a,41b of the first set are shown from the inner side, i.e. in the direction of the arrow VIII in Fig. 7 where the insulating members have been removed. As may also be seen in Fig. 9, the connector bracket 42 of the second set is double-angular shape, having two legs each projecting in the direction of one of the connector brackets of the first set, i.e. here in the direction of the side and bottom of the frame, respectively. Each of these legs are again of an angular shape, having one part 421 arranged in parallel with the outer side of the corresponding insulating member 43, i.e. perpendicular to the plane of the frame, and another 422 corresponding to the second flange 412 on the connector brackets of the first set 41a,41b, i.e. projecting in parallel to the plane of the frame towards the inner opening 3.

[0048] The connector bracket 42 of the second set is inserted in tracks formed in the connector brackets 41a,

41b of the first set, these tracks being formed by folded over parts 416, 417. As may be seen in Fig. 8, one of these folded parts 416 is found only at the end of the connector bracket 41a,41b of the first set and is used only for the connection with the connector bracket 42 of the second set, whereas the other 417 extends almost over the entire length of the connector bracket of the first set and constitutes the second flange 412 mentioned above. Other ways of achieving a precise positioning of the two types of brackets are readily imaginable to the skilled person and it is further to be understood that the connector brackets of the second set may in a similar manner snap on to separate locking members (not shown) provided on the insulating member 43 independently of the first set of connector brackets 41a,41b.

[0049] On the part 421 of the connector bracket of the second set arranged perpendicular to the plane of the insulating frame two small lugs 423 have been cut and pressed slightly up, one on each leg as is seen in Fig. 9. Each of these lugs 423 are adapted to come into engagement with an opening 418 in a connector bracket 41a, 41b of the first set so that the two types of connector brackets are snap-locked to each other, when the connector bracket of the second set is inserted in the connector brackets of the first set as shown in Fig. 8. In Fig. 7 one of these lugs 423 is visible through the opening 418 at the right-hand end of the bottom member.

[0050] At the edge of each lug 423 facing away from its attachment to the connector bracket 42 there is a small deformation 427. This deformation serves three purposes. Firstly, it prevents the lug 423 from coming so far out of the opening 418 in the connector bracket 41a,41b of the first set that it comes to lie on the outer side of thereof in the mounted state, in which case the two connector brackets 41a,41b,42 could slide in relation to each other. Secondly, it reduces the width of the lug just enough to allow it to be pressed back into the opening, which was formed when the lug was cut out, without substantial friction. Thirdly, it contributes to improving the resilience of the lug.

[0051] Oblique end surfaces 424 on the legs of the connector bracket 42 shown in Fig. 9 helps to guide the bracket during insertion in the connector brackets 41a, 41b of the first set and shoulders 425 on the side surfaces are adapted to come into engagement with the ends of the folded edges 416, 417 to stop insertion at the right dept. The lugs keep the connector bracket of the second set from being pulled out unintentionally and the shoulders prevent it from being inserted too deeply.

[0052] It is to be understood that the embodiment described above and shown in the drawing is only one of many embodiment of the invention falling within the scope of the claims and that, for example, the connector brackets of the second set need not be in direct contacts with those of the first set.

[0053] Likewise, It is noted that even though the lugs 423 and the shoulders 425 on the connector bracket of the second set 42 has here been shown and describe in

relation to one single embodiment of the invention and in combination with the folded over parts 416, 417 and openings 418 on the connector bracket of the first set 41a,41b, these features are not dependent on each other and one or more of them may be used without the others.

[0054] The connector brackets 41a,41b,42 shown in the drawing are all intended for being made from sheet metal by cutting and folding, steel being the preferred material due to its strength and stiffness. It is, however, to be understood that one or both sets of brackets may be made in other ways, such as by moulding, and/or from other materials, such as aluminium, stainless steel, polymers or composites and may have different zones made from different materials. Likewise, it is to be understood that all connector brackets of a set need not be identical, but may have different shapes and/or be made from different materials.

[0055] In the embodiment shown in Figs. 1-3, the inner sides of the opening 3 in the roof structure is defined by the side surface of the rafter 11 and the cut made in the batten 12, when making the opening. If, however, the distance between rafters 11 or the width of the window frame 2 is different, the inner side of the opening 3 may be defined by the side surface of one or more trimming joist (not shown) arranged in parallel with the rafters.

[0056] When making the opening 3 in the roof it is not always possible to achieve dimensions corresponding exactly to the outer dimensions of insulating frame 4 and a common standard tolerance when mounting roof windows is 20 mm. To be able to compensate for such variations, the insulating frame 4 is provided with a soft foam layer 48 on the outer sides of the side members. If the opening 3 is made slightly smaller than prescribed, this soft foam layer 48 can simply be compressed during mounting of the insulating frame. In the embodiment shown the soft foam layer 48 has a width of approximately 10 mm, but if wishing to allow for larger tolerances than the common standard, the layer of soft foam can be made thicker. The compressible layer or member 48 is here provided on the outer side of the connector bracket 41a, 41b of the first set to allow optimum compression and a secure attachment of the bracket to the insulating frame.

[0057] Here the compressible foam members 48 are provided only on the side members of the insulating frame, which are in contact with the rafters and cut-off ends of the battens, where the risk of imprecise cutting it biggest, but it is to be understood that the top and bottom members may be made in a similar manner.

[0058] The soft foam layer is preferably made from polyurethane having a density of 15 kg/m³ and a thermal conductivity of 0,040 W/mK, but other materials, particularly other polymer foams or mineral wool may also be used. The material chosen should preferably be resistant to fire and moisture.

[0059] A further independent possibility for adapting the insulating frame is provided by the slit 49 formed in its interior side. This slit allows the removal of the material on the outer side of the slit (the left side in Fig. 3) thus

allowing the insulating frame to be fitted between rafters that are somewhat closer to each other. In the embodiment shown in Figs. 2 and 3 this allows for a further tolerance of approximately 15 mm in addition to the 20 mm allowed by the soft foam.

[0060] Once having mounted the insulating frame 4 and the roof window, the joint between the window and the roof construction has to be made water proof on the exterior side. This is achieved by means of flashing and cladding members as is well known to the skilled person and it is also preferred to apply an underroof collar as described for example in WO2006002629A1, which is then connected to the waterproof membrane 14 of the underroof.

[0061] On the interior side the joint is normally finished by the provision of a vapour barrier (not shown), which prevent vapour from penetrating into the roof structure, and, when window is mounted where it is visible to users of the building, a covering in the form of lining panel (not shown). The vapour barrier may be a collar resembling the underroof collar described above and connected to the vapour seal 17 of the underroof, while the lining panel is usually boards of ply-wood or gypsum inserted in the groove 23 in the interior side of the window frame member at one side and connected to the interior covering 18 at the other.

[0062] The finishing work on the interior side, particularly the insertion of the lining panel in the recess in the window frame, may cause the insulating members 43 of the insulating frame to be forced outwards, away from the opening 3. When the insulating frame 4 is assembled solely by means of brackets 42 as the one shown in Fig. 9, the interior parts of the insulating members are free to move in relation to each other and will therefore be forced apart when moving away for the opening. To avoid this, the ends 431 of the side frame members are made slightly oversize with an oblique surface corresponding in angle to the outer surface of interior part of the insulating frame bottom member when forced outwards.

[0063] In the embodiments shown the insulating material of the top member of the insulating frame is further provided with a small recess 432 as may be seen in Figs 6, 14 and 19. This recess is adapted for housing electronic components (not shown) used for controlling the operation of a motor driven window and it is to be understood that the shape, size and position of the recess may vary and that there may be more than one recess. A slit 433 in the insulating material extending from the recess to the interior side of the insulating frame perpendicular to the length direction of the top frame member is adapted for accommodating cables, wires etc. needed for supplying power, control signals etc. to and from the electronic component(s) in the recess.

[0064] The insulating frame described above is adapted for the mounting of roof windows in a traditional level, but in some buildings the windows are mounted lower in the roof so that their exterior surface is substantially at level with the roofing, also known as flush installation. An

insulating frame 5 adapted for this purpose is shown in Figs 10-15, which correspond to Figs 1-7. Only the differences with respect to the insulating frame and mounting described above will be explained in detail, while features having the same function in both embodiments are given the same reference number and will not be described again.

[0065] As is seen by comparing Figs 11-13 to Figs 3-5, the cross-sectional shape of the frame members of the insulating frame 5 intended for flush installation, hereafter the flush insulating frame, is different from those in the standard insulating frame in that the ledge 54 is located closer to the interior side. This allows the window to be located deeper in the roof and the loss of insulation on the interior side of the window is made up for by a larger portion of the window frame being enveloped in the insulating frame seen in the height direction. 40 mm is the common difference in dept between standard and flush mounting, but in the embodiments shown in the drawing, some of this difference is compensate by the flush insulating frame having a larger height.

[0066] Another difference in the side member of the insulating frame is seen in Figs 14 and 15, which discloses a curved recess 50 on the inner exterior side of the side member of the insulating frame, opposite the bottom member. The purpose of this recess is to give room for the flashing component (not shown) used on the exterior side of the window to drain water off the window and onto the roofing below the window. Since the window is installed relatively deep in the roof, the flashing member used at the bottom member of the window has to "lift" the water up to the level of the roofing, which, as is known to the skilled person, is achieved by it having a smaller slope than the inclination of the roof. As the slope can of course not be negative, the gutter-like flashing component used for this purpose takes up space which has to be provided in the insulating frame. Consequently, the bottom member 55 of the insulating frame is also provided with a gutter-like recess 56 corresponding in shape to the shape of the flashing member. In this case the angle of the recess 56 is not sufficient for it to reach up to the level of the roofing and an additional block of insulating material 6 having an oblique exterior surface in continuation of the recess has therefore been provided. It is, however, to be understood that some flashing members will be able to span a space between the bottom member 55 of the insulating frame and the first batten 12 carrying the roofing, in which case the additional block 6 can be dispensed with, and/or that the additional block could be replace with an auxiliary batten.

[0067] In the embodiment shown, the side members of the insulating frame are made with curved recesses 50 at both ends so that the right and the left side member are identical and the risk of erroneous mounting reduced. In normal use the recesses at the top are superfluous and the top member 57 is therefore provided with projections 571 at both ends at the exterior side, these projections filling out the recesses 50 wholly or partially in

the mounted state as may be seen in Fig. 14.

[0068] A further consequence of the deep position of the window and hence of the bottom member 55 of the insulating frame is that a connector bracket on the bottom member of the insulating frame will not reach the battens. As may be seen in Figs 13-15 the bottom member is therefore provided only with a stiffening member 51, corresponding in design to the connector bracket 41b used at the top and bottom of the standard insulating frame but lacking the flange 410 used for interconnection to the roof structure.

[0069] The top member 57 of the flush insulating frame could in principle be provided with a connector bracket, but in this embodiment it has been chosen to use a frame member, which is identical to that at the bottom 55 except for the gutter-like recess, meaning that they can be made from the same base components. This also means that the first sets of connector brackets here includes only two brackets 41a arranged at opposite sides of the insulating frame, whereas the standard insulating frame includes four brackets, one on each frame member.

[0070] Still a further consequence of the flush installation is, at the mounting brackets used for mounting the roof window will also be in the way if located at the top and bottom of the window as in Fig. 2. In Fig. 10 these brackets 21' have therefore been moved to the side member of the window frame. This in turn means that the connector bracket of the first set at the side member of the flush insulating frame has to be provided with openings 513 corresponding to those 413 provided in the connector bracket of the first set at the bottom member of the standard insulating frame as is seen in Fig. 15.

[0071] When the insulating frame 4 and the window frame 2, or possibly the whole window, have been mounted in the roof structure, it is common practice to install an underroof collar 7 to make the joint between them and the roof structure water proof as shown in Fig. 16. The collar includes a skirt part 71 intended to lay against the underroof and an inner rim 72 surrounding an opening corresponding in size to the outer dimensions of the window frame. The joints between the roof structure and the insulating frame and between the insulating frame and the window frame are both covered and hence water-proofed by the collar and the insulating frame is thus hidden in Fig. 16.

[0072] Here, the inner rim 72 of the underroof collar is attached to the window frame 2 and the skirt part 71 is attached to the battens 12 and counter-battens 13 by means of staples, but it is also possible to use an adhesive. As may also be seen, the top and bottom members 73, 74 of the collar are made from a plain material, whereas the side members 75 of the skirt are made with a surplus of material to enable to follow the contour of the battens 12 and come all the way down to the underroof membrane 14 between battens. This surplus of material is usually provided by making the side members of the underroof collar from a pleated material, but it is of course also possible to use a material, which is stretchable by

being of an elastic or plastic nature.

[0073] An embodiment of the lower part of a side member of an underroof collar according to the invention is shown in Fig. 17 and the mounting of such a collar is shown in Fig. 18. As may be seen, the skirt is here composed of two parts; an outer part 714 of a pleated material as the prior art collars and an inner part 715 of a straight material, which includes the inner rim 72. In this embodiment the inner part has a width measured perpendicularly to the inner rim of approximately 10 cm and the outer part has a width of approximately 15 cm, both these respective width may be varied, for example for adaptation to different installation situations, different window sizes and differences in the roof structure.

[0074] The inner and outer parts are here connected to each other by means of an adhesive, but depending on the material used for the underroof collar they may also be interconnected by sewing or welding or by means of tape.

[0075] At the inner rim 72 the underroof collar 7 is preferably provided with an adhesive suitable for attaching the collar to the window frame 2. As shown in Fig. 17, this adhesive is preferably protected by a cover strip 76 in the state of delivery, Fig. 17 showing the inner side of the side member intended for use at the left-hand side of the window.

[0076] When mounting the underroof collar 7, the cover strip is first removed from the bottom member 74, which is then attached to the bottom member of the window frame 2. As may be seen in Fig. 18, the bottom member includes a flap 721, which projects at the inner rim 72 and is adapted for being folded around the corner of the window frame. The inner rim of the side member 75 is preferably folded slightly back or down to allow the attachment of the flap to the window frame.

[0077] The side member, which is provided with a similar flap 722 as seen in Fig. 17, is then attached to the side member of the window frame in a similar manner. This results in the two flaps overlapping, which provides an excellent water- and wind-proofing at the corner the window.

[0078] The top member 73 of the underroof collar is preferably embodied in the same way as the bottom member 74 and attached subsequent to the side member, so that flaps thereon overlaps the side members. Accordingly, the only difference between the top and bottom of the collar is the direction of the pleating, which should be arranged with the openings of the fold facing downwards in the mounted state to allow optimal draining. To ensure that the collar is oriented correctly it may be provided with an indication showing for example the intended direction of draining or which end is to be arranged at the top of the window.

[0079] In this respect it is noted, that even though a satisfactory proofing of the structure could be achieved with a different order of attachment, the order described above ensures that the overlaps are consistent with the natural flow direction of water running over the surface

of the underroof and hence provides the optimum water-proofing.

[0080] In the embodiment shown in Figs 17 and 18 the side members 75 of the collar 7 are made with a strip 77 extending in the length direction of the side member at a short distance from the inner rim. This strip is intended to make the material of the collar bend more easily and/or precisely. In this way the strips eases the application of the collar, where the outer 714 part should preferably lay substantially flat against the underroof, while the inner rim 72 should abut the outer side of the window frame 2 and hence be arranged substantially perpendicular to the outer part in the mounted state. The strip 77 is preferably provided in the form of an embossment in the material of the collar, but could also be a weakened section or a strip of material added to the collar material. Similar strips could be employed in/on the top and/or bottom members of the underroof collar.

[0081] As is known from the prior art, the pleating of the outer part 714 of the side members 75 could be fixated with a strip of tape running in the length direction of the side member, but the attachment to the straight inner part 715 will often be sufficient to keep it in place during attachment to the window frame.

[0082] A fixation of the pleating at the outer edge may be advantageous to ensure that the outer part of the collar does not flutter. This could for example be done by providing a spot welding 78 on each of the folded sections of the pleating as indicated in Fig. 17 or at least on some of them. When the extra material provided by the pleating is to be used, these connections can simply be broken one by one and the individual connection should preferably be made so that it may be torn by hand without causing substantial damage to the material of the collar. The use of individual connections has the added advantage that the extra material can be provided only where it is actually needed. Where the extra material is not needed the connections are simply left intact. This means that the finished construction is more orderly and that the risk of noise caused by fluttering and of the collar being torn loose by wind is minimized. Alternatives to the spot weldings are dots of adhesive or glue, staples, stitches, rivets and the like.

[0083] It is noted that even though only a single embodiment of the collar is here shown and describe, the features thereof are not necessarily dependent on each other and may therefore be used independently, an example being the spot weldings 78, which may be used on any pleated collar, and the overlapping flaps 721, 722, which may also be used on collar without pleating.

Claims

1. An insulating frame (4,5) for a roof window mounted in an inclined roof structure of a building, comprising top, bottom and side members, each including an insulating member (43,55,57), and a plurality of con-

nectors brackets (41a,41b,42), said insulating frame defining an inner opening adapted to surround the frame (2) of the roof window and said insulating frame having an interior side intended to face the interior of the building and an exterior side intended to face the exterior and each frame member having an inner side facing the inner opening and an outer side facing away from the inner opening, where the length and/or width of the inner opening varies over the height of the insulating frame perpendicular to the plane defined by the frame members, so that at the exterior side the length and width of the inner opening corresponds substantially to the corresponding outer dimensions of the roof window, while at the interior side the length and/or width of the inner opening is/are smaller than the corresponding outer dimensions of the roof window, **characterized in that**

it comprises a first set of connector brackets (41a, 41b) and a second set of connector brackets (42), said first set of connector brackets being adapted for connecting the insulating frame (4,5) to the roof structure and extending over at least half of the length of at least two frame members forming opposite sides of the insulating frame, and said second set of connector brackets connecting the side members to the top and bottom members of the insulating frame.

2. An insulating frame according to any of the preceding claims, where each of the connector brackets (41a, 41b) of the first set comprises a flange portion (410) projecting away from the inner opening at the exterior side of the insulating frame and being adapted for being connected to the roof structure.
3. An insulating frame according to any of the preceding claims, where the connector brackets (41a,41b) of the first set are attached at the outer sides of the insulating members (43).
4. An insulating frame according to claim 2 or 3, where the flange portion (410) is adapted for being connected to battens (12) of the roof structure, preferably having openings (413,513) or weakening zones through which a nail or screw may be driven and/or being wholly or partially interrupted at the intended positions of mounting bracket used for securing the roof window to the roof structure.
5. An insulating frame according to any of the preceding claims, where the connector brackets (42) of the second set are snap locked to the insulating members (43,55,57) or to members attached thereto, preferably to the connector brackets (41a,41b) of the first set, still more preferred by at least one lug (423) projecting from a connector bracket (42) of the second set being in engagement with an opening (418) pro-

vided in a connector brackets (41a,41b) of the first set.

6. An insulating frame according to any of the preceding claims, where the connector brackets (42) of the second set are preferably made as an angular bracket where each leg is in turn of an angular cross-sectional shape. 5
7. An insulating frame according to any of the preceding claims, where at least one frame member (43) is provided with a compressible layer or member (48) on its outer side, said compressible layer or member preferably being elastic. 10
8. An insulating frame according to any of the preceding claims, comprising an exterior part where the length and width of the inner opening corresponds substantially to the corresponding outer dimensions of the roof window and an interior part where the length and/or width of the inner opening is/are smaller than the corresponding outer dimensions of the roof window, the transition between the exterior part and the interior part being abrupt so that a ledge (44,54) is formed on the inner side of the frame. 15
9. An insulating frame according to claim 8, **characterized in that** said ledge (44,54) is provided with a projection (45) projecting towards the exterior side of the insulating frame and being adapted for projecting into a groove (23) in the interior side of the frame (2) the roof window, said projection preferably being wedge shaped and located on the inner side of the ledge (44,54), its base preferably taking up approximately half the width of the ledge. 20
10. An insulating frame according to any of the preceding claims, where at least a section (431) of at least one end of at least some of the insulating members (43,55,57) is oblique so that the interior side of the insulating member is longer than its exterior side. 25
11. An insulating frame according to any of the preceding claims, where at least some of the frame members are provided with a longitudinal slit (49) extending from the interior side towards the exterior side. 30
12. An insulating frame according to any of the preceding claims, where the connector brackets (41a,41b,42) of the first and/or second set are made of a material selected from the group consisting of: steel, stainless steel, spring steel, aluminium, other metals, plastic, ceramics, glass fibre, composites and combinations thereof. 35
13. An insulating frame according to any of the preceding claims, where the insulating members (43,55,57) are made from a dimensionally stable material, the ma-

terial preferably being selected from the group consisting of: extruded polyethylene, other polymer foams, mineral wool, cement bound wood fibres, composites and combinations thereof.

14. A kit for making an insulating frame according to any of claims 1-21 including a plurality of insulating members (43,55,57), a first set of connector brackets (41a,41b) and a second set of connector brackets (42), said first set of connector brackets being adapted for connecting the frame to the roof structure and extending over at least half of the length of at least two frame members forming opposite sides of the insulating frame, and said second set of connector brackets connecting the side members to the top and bottom members of the insulating frame. 40
15. A kit according to claim 14, further including at least one compressible member (48) adapted for being attached to an outer surface of an insulating member and/or at least one stiffening member (51) adapted for being attached to an insulating member. 45
16. A method of mounting a roof window in an inclined roof structure of a building comprising a roofing material, a batten structure, a supporting arrangement of rafters and an underroof, said method including the steps of:
A) providing an insulating frame according to any of claims 1-13,
B) making an opening in the roof structure having a length and a width corresponding substantially to the outer dimensions of the insulating frame,
C) arranging the insulating frame in the opening in the roof structure,
D) arranging the frame of the roof window in the inner opening of the insulating frame, and
E) fastening the roof window to the roof structure. 50

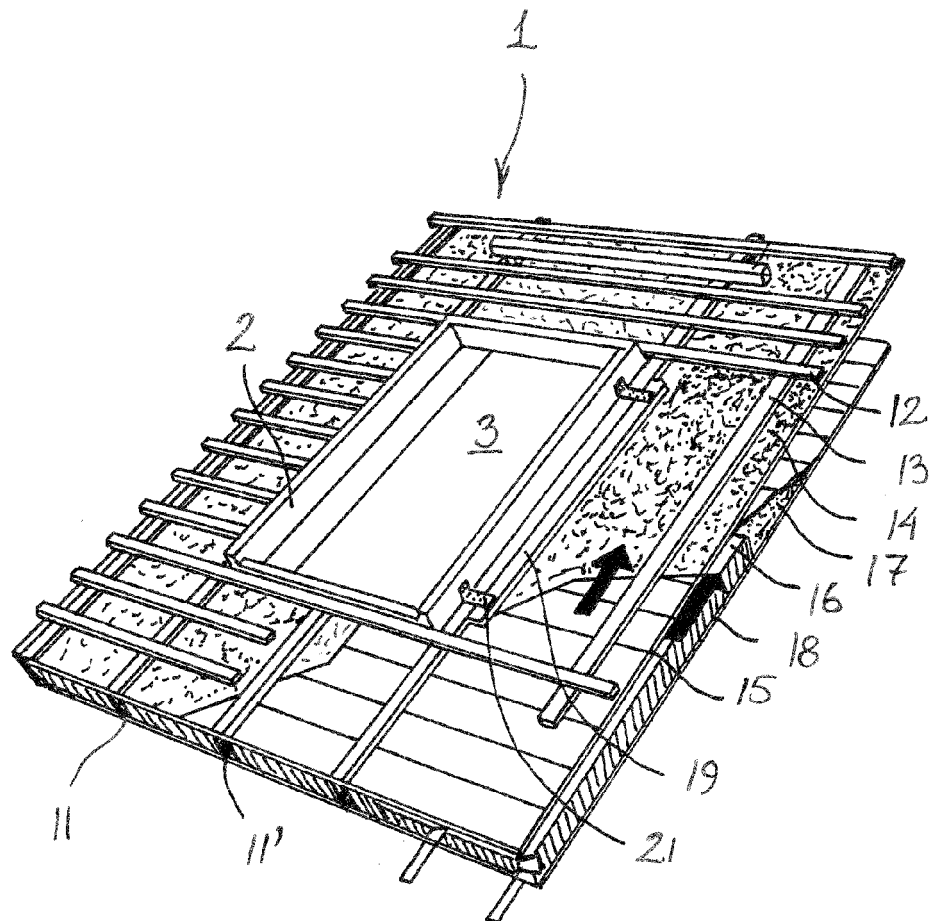
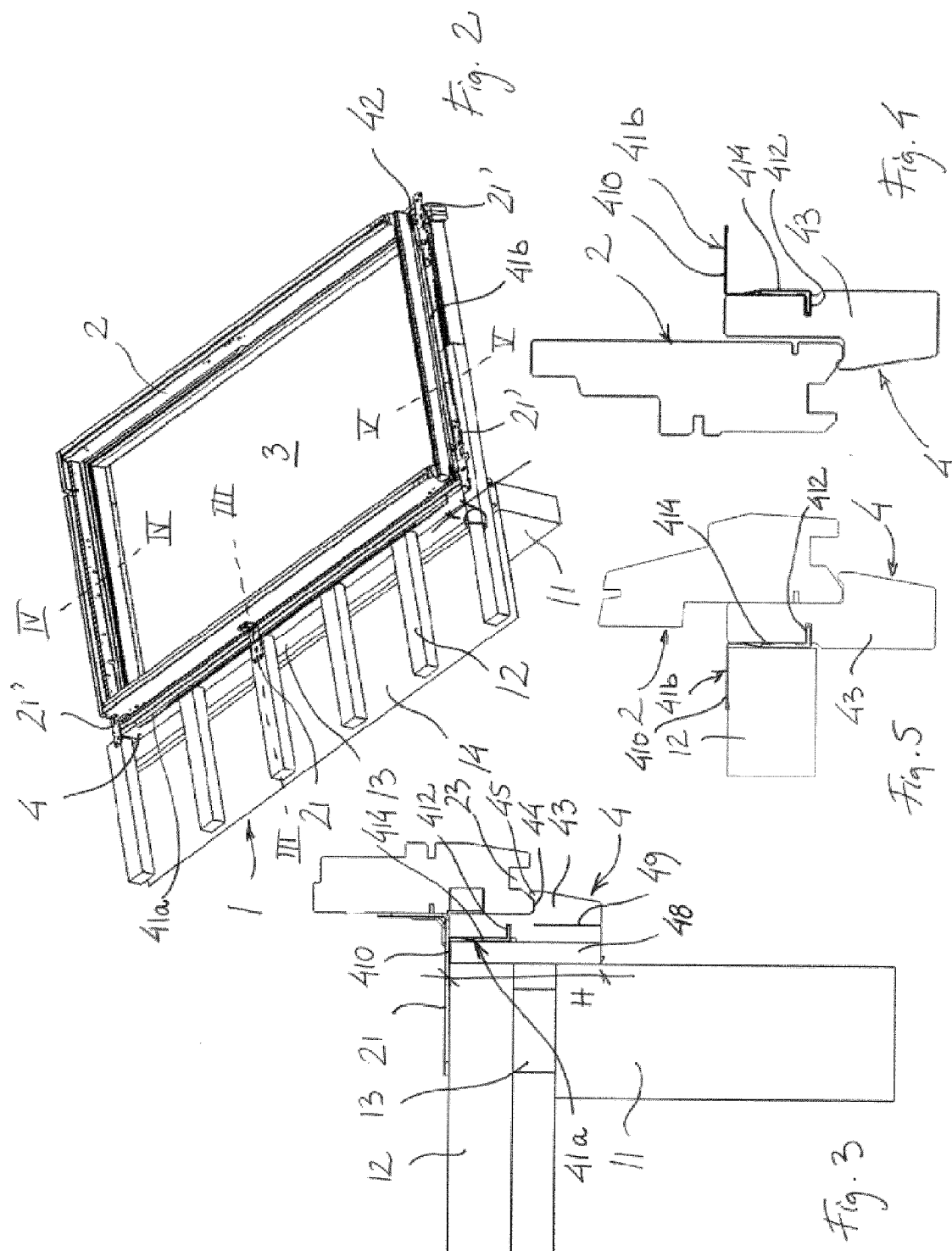
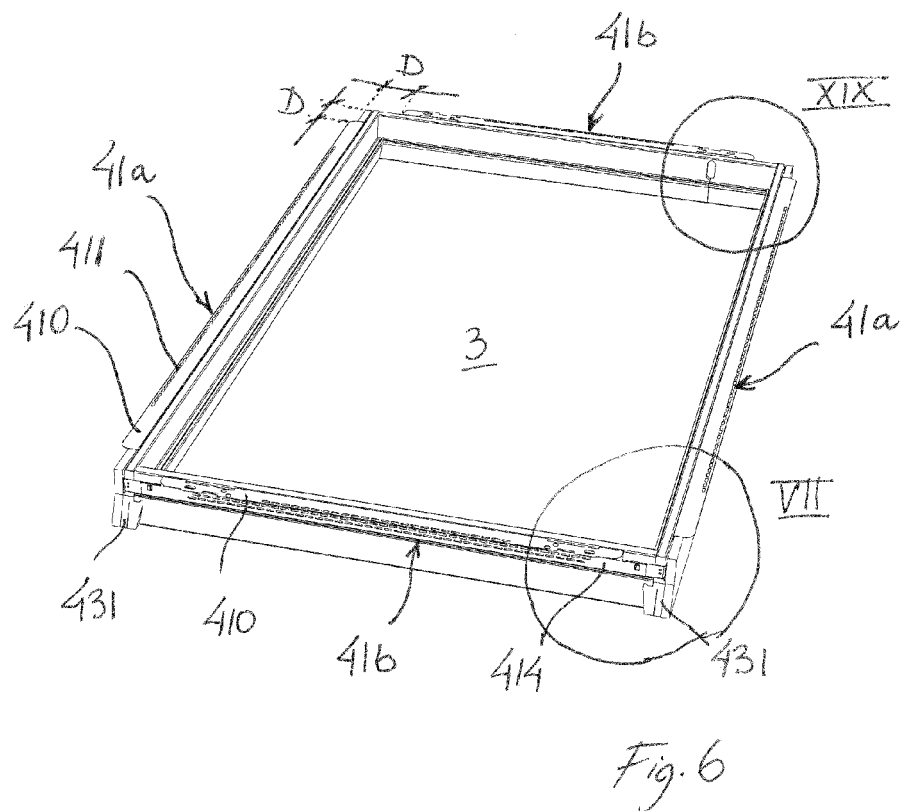
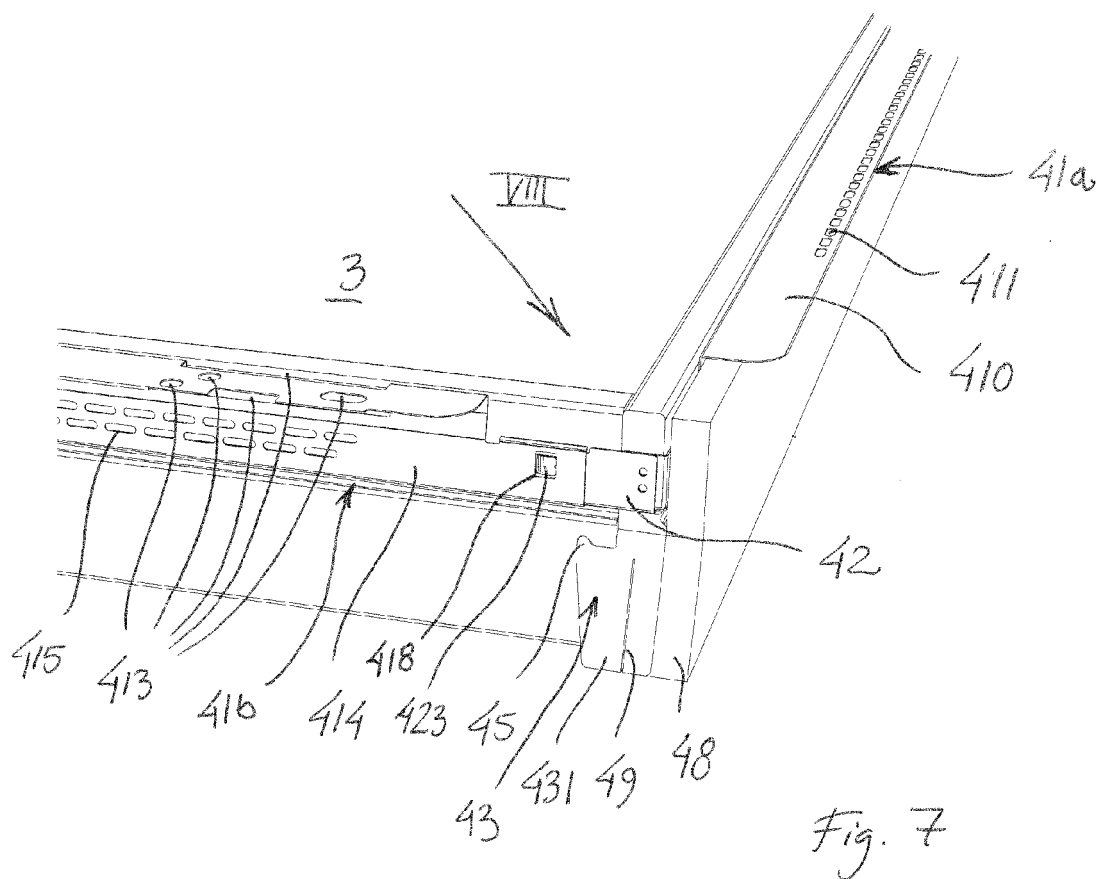


FIG. 1







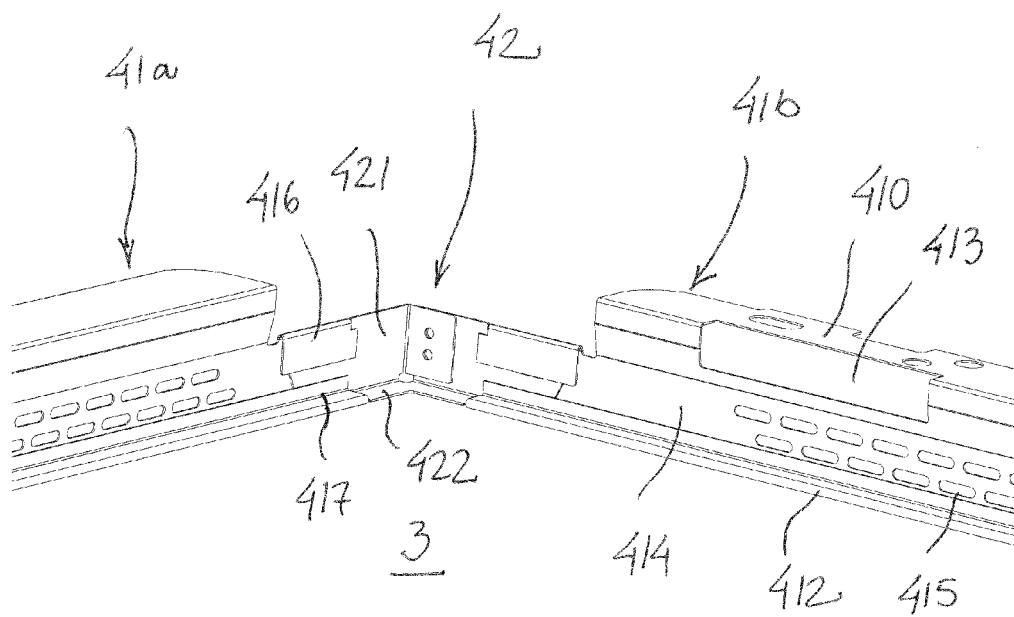
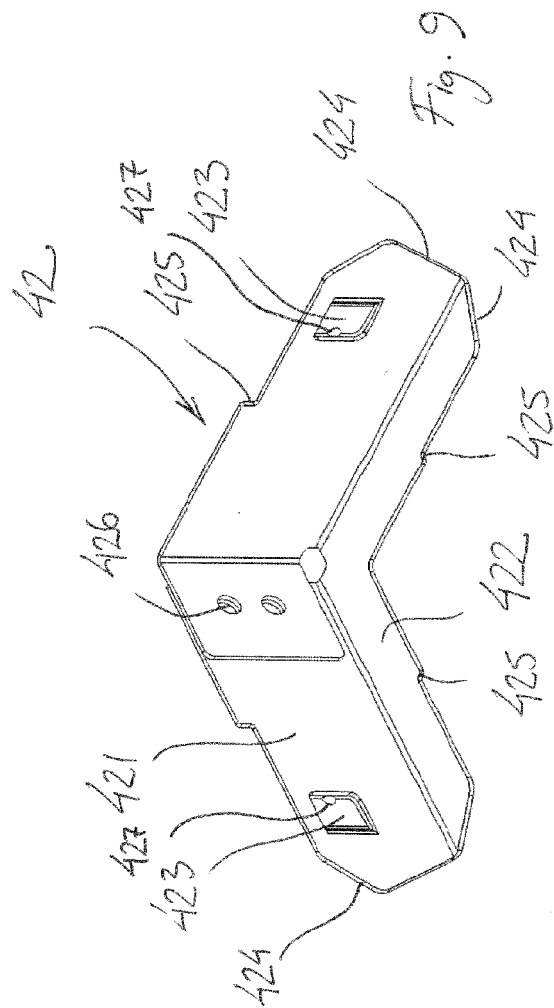
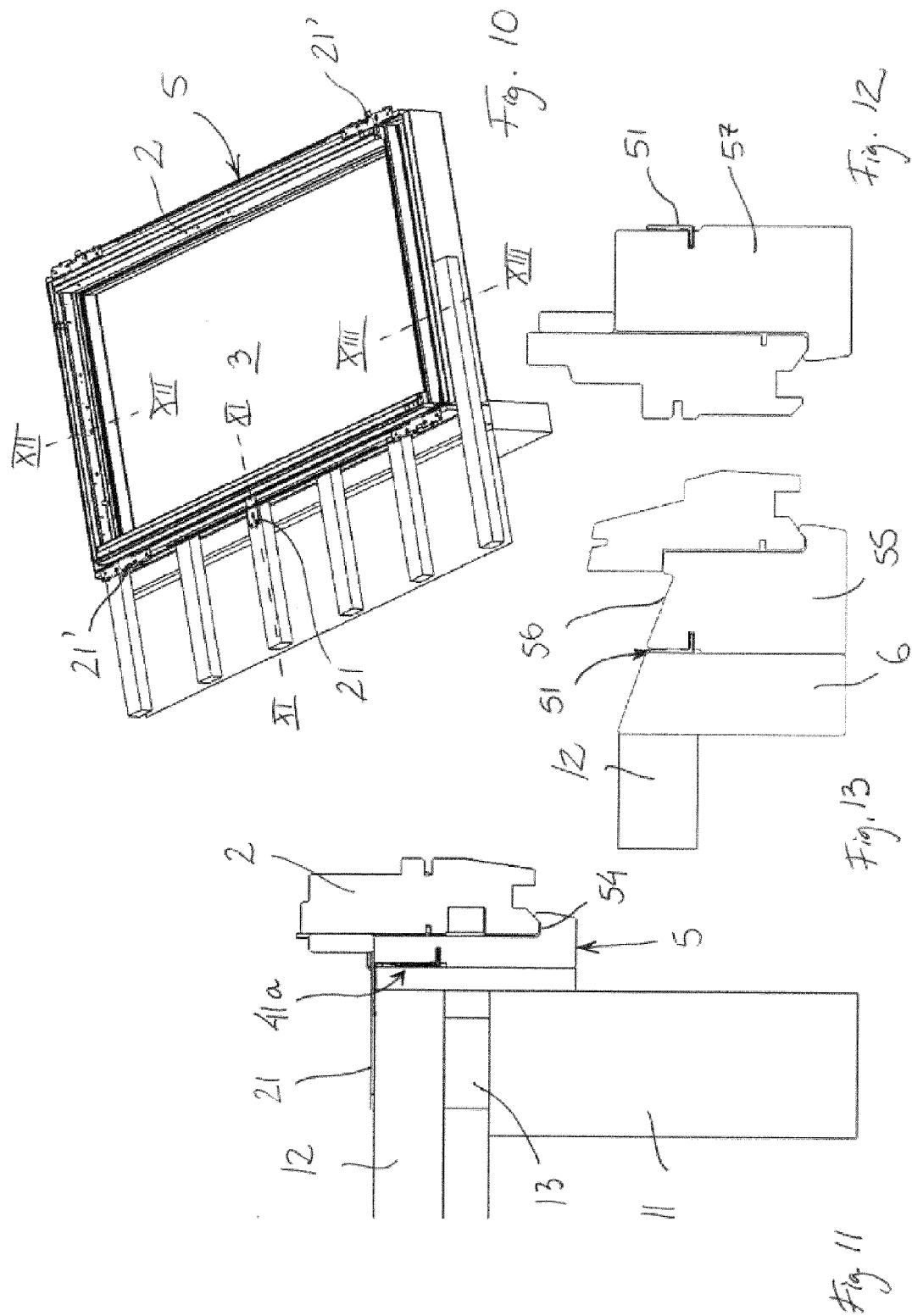
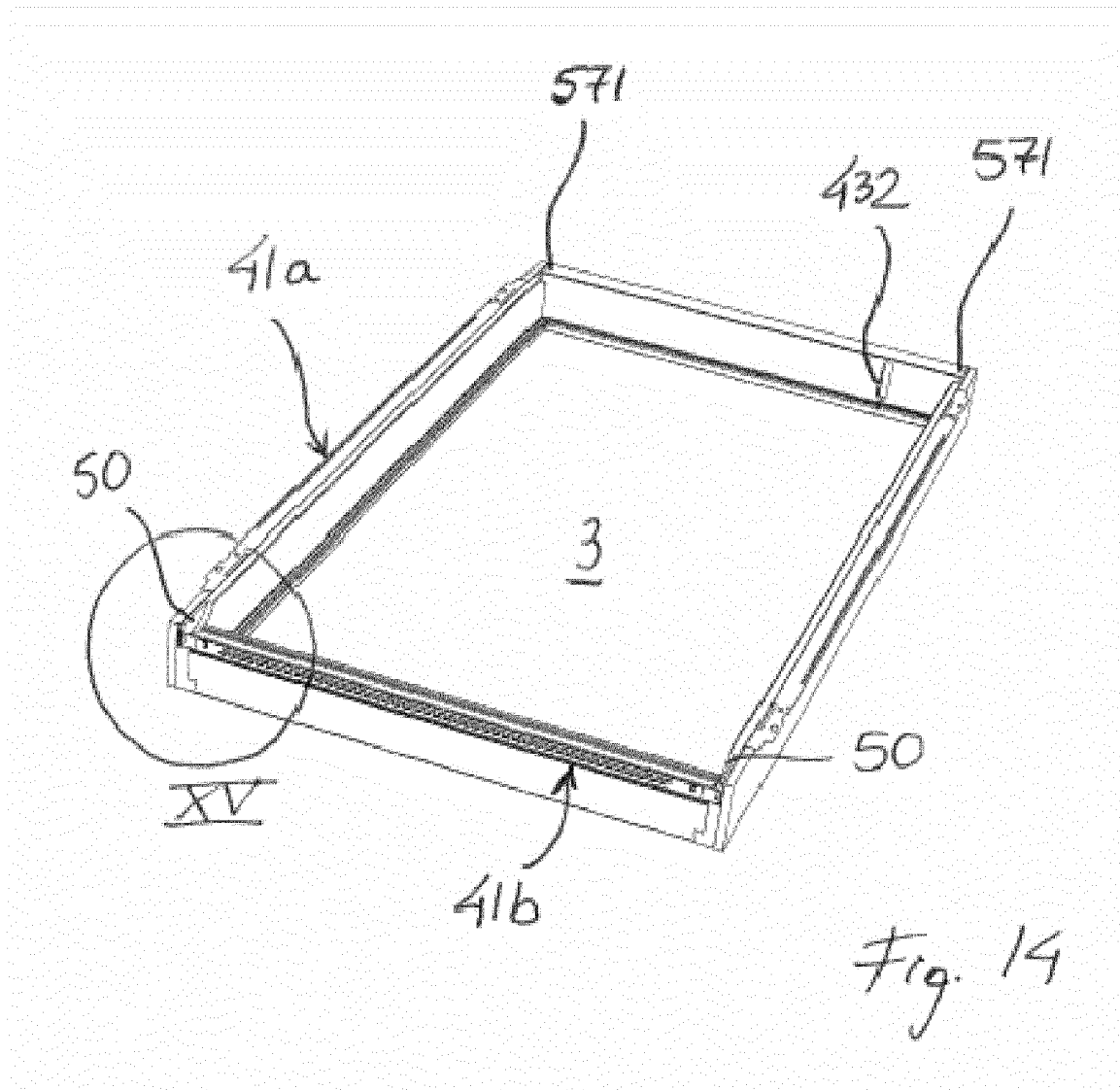


Fig. 8.







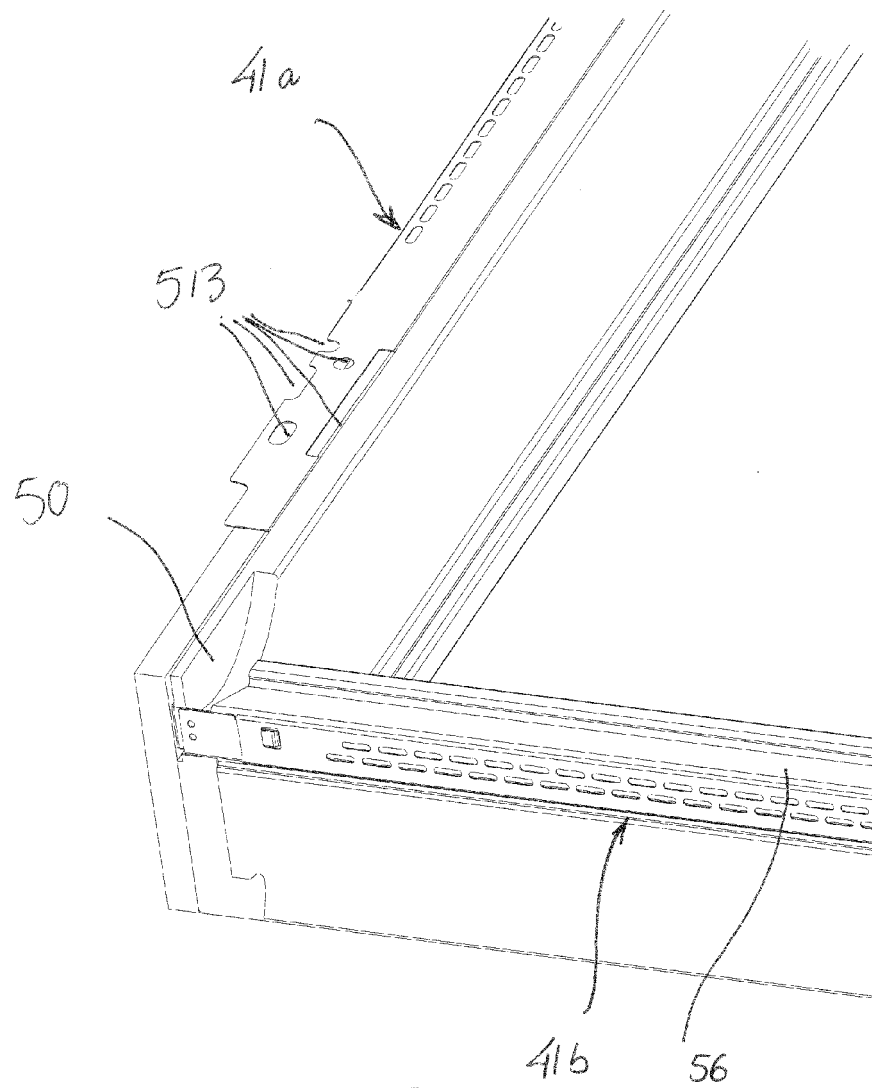
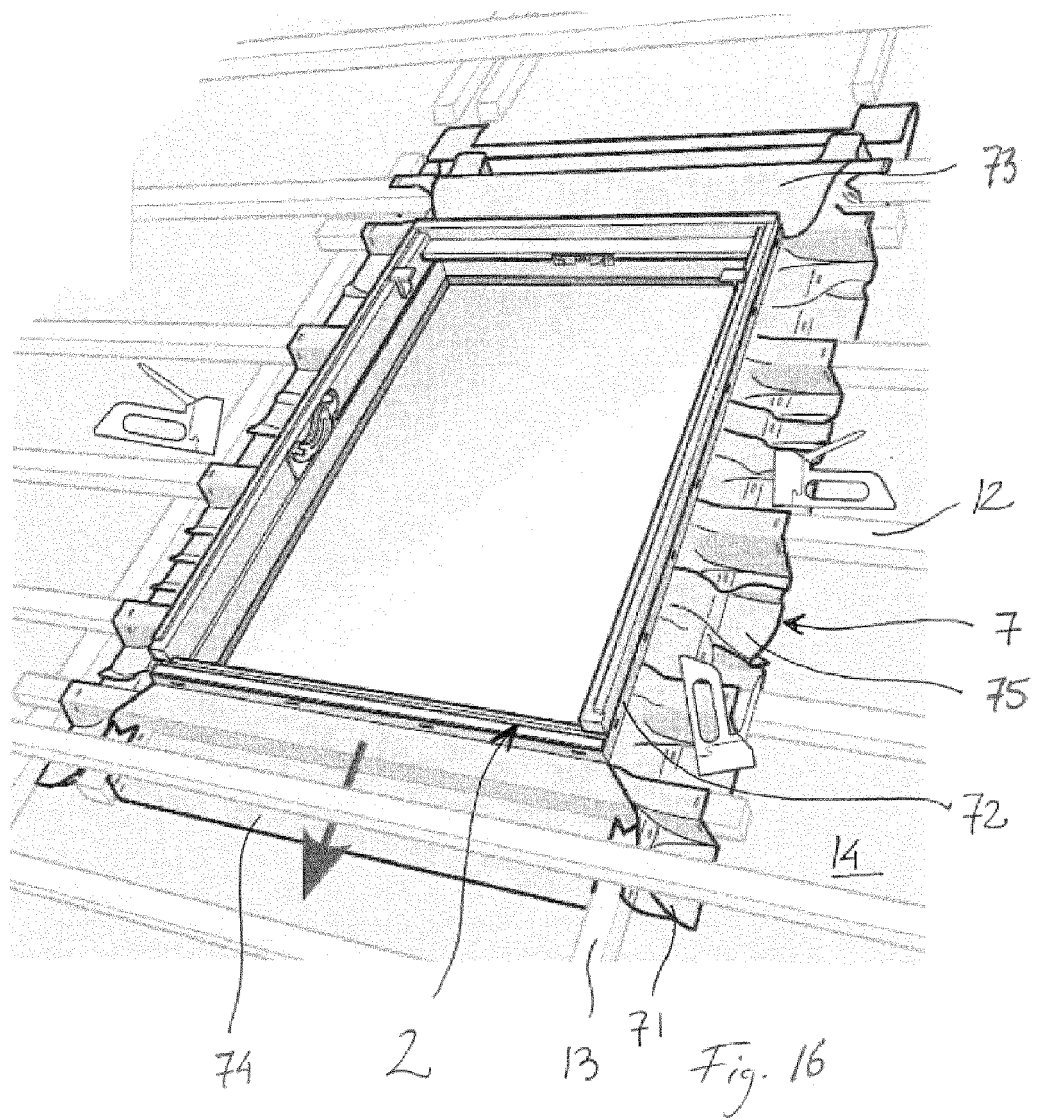


Fig. 15



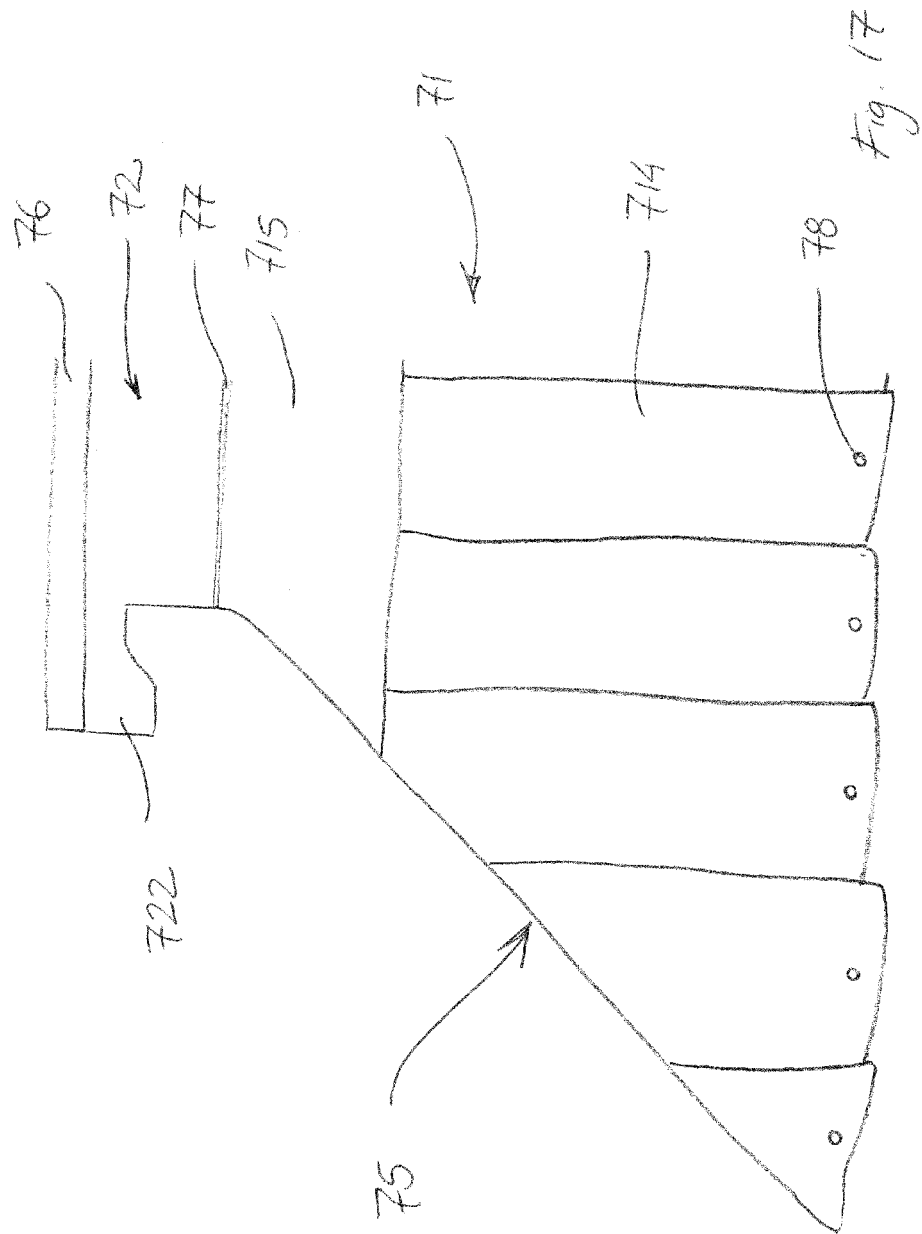


Fig. 17

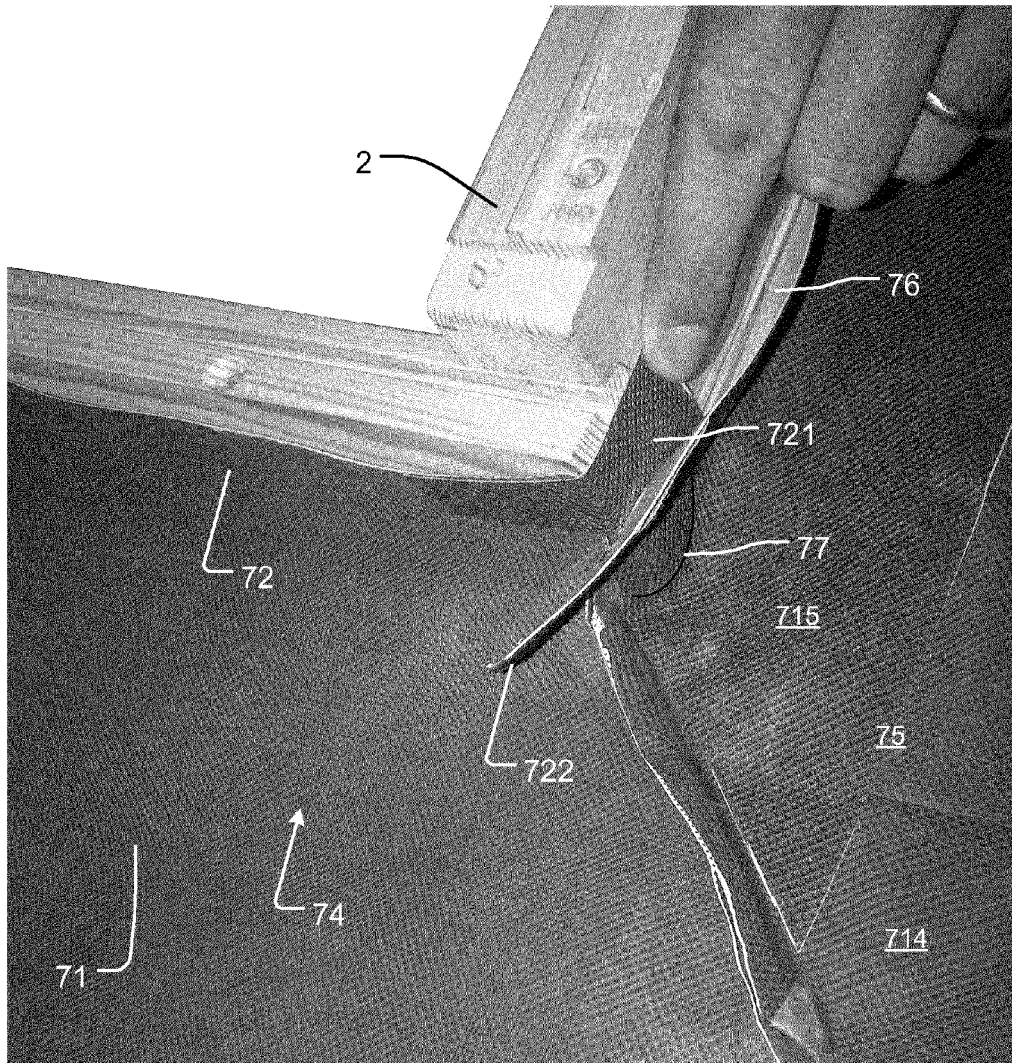


Fig. 18

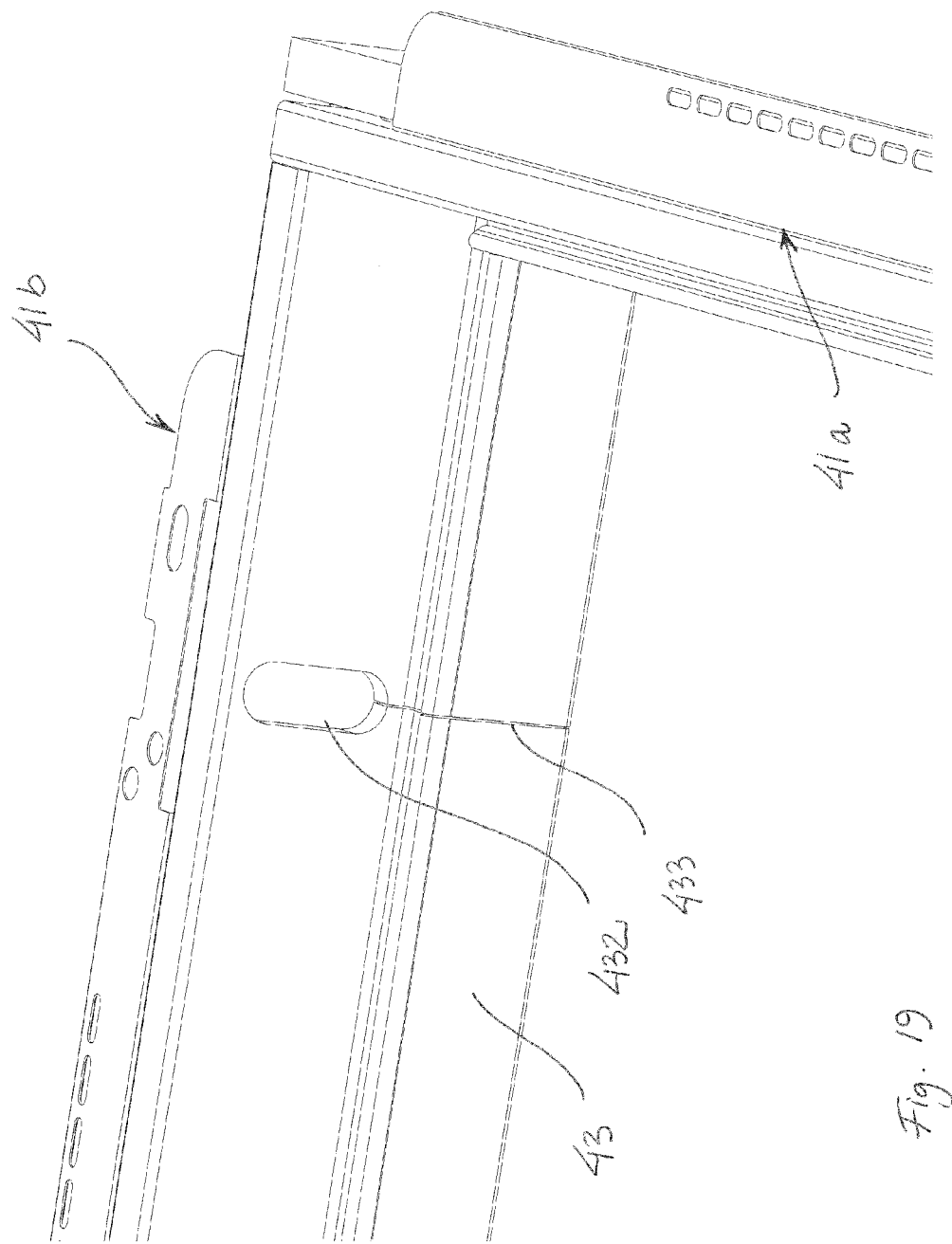


Fig. 19



EUROPEAN SEARCH REPORT

Application Number
EP 13 17 2014

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			E04D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 September 2013	Examiner Tran, Kim Lien
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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19-09-2013

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