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(54) **A MOUNTING BRACKET FOR INSTALLATION OF A WINDOW IN A ROOF STRUCTURE**

(57) The mounting bracket (6) for installation of a window has a first bracket leg (7) for fastening to the roof structure, and, for fastening to a frame member of the window, a second bracket leg (8) extending from the first bracket leg (7) at an angle. The angle is essentially orthogonal in an unloaded condition of the mounting bracket (6). At least one flange (9) extends at an angle from the second bracket leg (8) so that an edge (10) of the flange (9) faces other bracket leg (7). In a first load condition, in which forces act on the mounting bracket (6) so as to diminish the angle (α), a first torque threshold (T1) is provided, beyond which plastic deformation of the mounting bracket (6) occurs, and in a second load condition, in which forces (F2) act on the mounting bracket (6) so as to increase the angle (α), a second torque threshold (T2) is provided, beyond which plastic deformation of the mounting bracket (6) occurs, the second torque threshold (T2) being different from the first torque threshold (T1). In the first load condition, deformation of the mounting bracket (6; 106) occurs primarily in a first deformation zone (11) in the first bracket leg (7), and in the second load condition, deformation of the mounting bracket (6; 106) occurs primarily in a second deformation zone (12) in the first bracket leg (7).

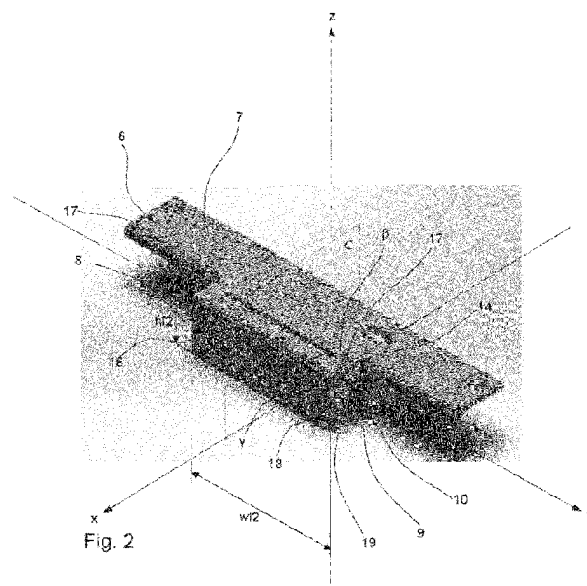


Fig. 2

Description

[0001] The present invention relates to a mounting bracket for installation of a window in a roof structure, said window comprising a frame including a top frame member, a bottom frame member and two side frame members, the mounting bracket comprising a first bracket leg for fastening to the roof structure, and, for fastening to a frame member, a second bracket leg extending from the first bracket leg at an angle, the angle being essentially orthogonal in an unloaded condition of the mounting bracket. The invention furthermore relates to a window for installation in a roof structure provided with a plurality of such mounting brackets.

[0002] The term "unloaded condition" in this context means that the mounting bracket experiences only the inherent loads coming from holding the window in place in the roof structure. No externally induced loads, such as loads coming from wind or snow acts on the bracket in the unloaded condition.

[0003] A mounting bracket of the above-described kind is for instance known from WO 2010/009727 A1. The mounting bracket has been made amply stiff so as to be able to hold the window in place even under severe circumstances, such as tough weather.

[0004] One downside is, however, that when the window is subjected to for instance an impact, the mounting brackets hold, but other parts of the window break.

[0005] Improving the properties as regards impacts or other sudden changes of the load conditions, has been addressed in the prior art, including the ones described and shown in published applications Nos EP1361331A2, US 2008/086960 A1 and KR20120089053A.

[0006] Although the above-mentioned suggested solutions provide for some absorption of forces during certain load conditions, there is still room for improvement.

[0007] With this background, it is an object of the present invention to provide a mounting bracket of the kind mentioned in the introduction and which provides for improved impact-resistant properties.

[0008] This and further objects are achieved by a mounting bracket of the kind mentioned in the introduction, which is furthermore characterized in that in a first load condition, in which forces act on the mounting bracket so as to diminish the angle, a first torque threshold is provided, beyond which plastic deformation of the mounting bracket occurs, and that in a second load condition, in which forces act on the mounting bracket so as to increase the angle, a second torque threshold is provided, beyond which plastic deformation of the mounting bracket occurs, the second torque threshold being different from the first torque threshold.

[0009] The first load situation, in which forces act on the mounting bracket so as to diminish the angle, corresponds for instance to a situation of a wind load acting on the window, the wind pulling in the window in a direction out of the roof structure. The second load situation, in which forces act on the mounting bracket so as to in-

crease the angle, corresponds for instance to a situation of a snow load acting on the window, the snow pressing on the window in a direction into the roof structure. Due to the provision of different properties in the two directions, the combination of features aimed at is achieved, and it is possible to design the mounting bracket to have sufficient stiffness to be able to resist for instance snow loads without experiencing plastic deformation. However, when subjected to more severe loads, such as an impact, the second torque threshold will be exceeded and the mounting bracket will yield. The plastic deformation that the mounting bracket experiences in this situation will absorb a major part of the energy from the impact. Thereby less strain is put on the remaining window structure.

[0010] Thereby is obtained a mounting bracket that holds when subjected to severe weather conditions, but yields when subjected to even larger loads, such as impacts.

[0011] The fact that the mounting bracket itself yields provides for a simple solution keeping the number of parts needed for mounting the window low. It also provides for a compact design. The fact that the plastic deformation of the mounting bracket alters the angle between the two bracket legs essentially without any deformation of for instance the holes provided in the mounting bracket for fastening the mounting bracket to the window and roof structure provides for a continuously secure and relatively well-defined fastening of the window to the surrounding roof structure even after an impact load.

[0012] Further details and advantages of the present invention will appear from the appended claims and the non-limiting examples of embodiments, which will be described below with reference to the schematic drawings, where

Fig. 1A is a perspective view of a window according to one embodiment of the invention adapted to be mounted in a roof structure,

Fig. 1B is a fragmentary perspective view, on a larger scale, of the lower right-hand corner of a window as shown in Fig. 1A with a prior art mounting bracket in a first installation position,

Fig. 1C is a view corresponding to Fig. 1B, with the prior art mounting bracket in a second installation position,

Fig. 2 is an isometric view of a mounting bracket in a first embodiment according to the invention,

Fig. 3 is a front view of the mounting bracket in the first embodiment, indicating a first deformation zone,

Fig. 4 is a side view of the mounting bracket in the first embodiment,

Fig. 5 is a front view of the mounting bracket in the first embodiment, indicating a second deformation zone;

Fig. 6 is an isometric view corresponding to Fig. 2, with the mounting bracket of the first embodiment in a deformed state,

Fig. 7 is a front view of the mounting bracket of Fig. 6, Fig. 8 is a side view of the mounting bracket of Fig. 6, Fig. 9 is an isometric view of a mounting bracket in a second embodiment according to the invention, and Fig. 10 is an isometric view of a plurality of mounting brackets in the second embodiment, in a supply condition of the window according to the invention.

[0013] Fig. 1A shows a window 1 adapted to be installed in a roof structure (not shown). The window 1 comprises a frame including a top frame member 2, a bottom frame member 3 and two side frame members 4, 5. The window 1 is mounted in the roof structure by means of a number of mounting brackets as will be described in the following. The window 1 also comprises a sash 1a hingedly connected to the window frame. The general structure of the window 1 including parts of the sash 1a are known *per se* and will not be described in further detail.

[0014] For mounting the window 1 in the roof structure, a plurality of mounting brackets is provided. In Fig. 1B, a prior art mounting bracket 6' mounted at the lower right-hand corner of the side frame member 4 of the window of Fig. 1A represents said plurality of mounting brackets. The number of mounting brackets necessary for mounting the window may depend on the window size etc, but usually a plurality of four to eight mounting brackets is used. The installation level in the mounted position provided in Fig. 1B is an alternative to the standard installation level in the mounted position shown in Fig. 1C. In the mounted position shown in Fig. 1C, the mounting bracket 6' is mounted on bottom frame member 3 of the window of Fig. 1A, to provide another installation level of the window 1 in relation to the surrounding building structure. Markings on the window frame are associated with respective grooves for use with the plurality of mounting brackets in a desired level. Details regarding the mounting bracket 6' and the installation thereof are described in Applicant's European patent application with the publication No. 2578763A1.

[0015] Fig. 2 shows a mounting bracket 6 according to a first embodiment of the invention in closer detail. Reference is also made to Figs 3 to 5, showing further views of the mounting bracket 6 in the first embodiment.

[0016] In Fig. 2, an orthogonal co-ordinate system x-y-z is shown for clarity reasons only. The components of the mounting bracket 6 may be defined by any other system of orientation.

[0017] The mounting bracket 6 comprises a first bracket leg 7 for fastening to the roof structure, and a second bracket leg 8 for fastening to a frame member 2, 3, 4 or 5 of the window 1. The second bracket leg 8 extends from the first bracket leg 7 at an angle α in the embodiment shown. It is also conceivable that the first and second bracket legs 7, 8 are not adjoining but that an intermediate element or section is present. The mounting bracket is in Figs 2 to 5 shown in an unloaded condition,

and as is seen, the angle α is essentially 90° in the unloaded condition of the mounting bracket 6. Referring to the co-ordinate system, the first bracket leg 7 extends essentially in the xy plane and the second bracket leg 8 essentially in the yz plane in the embodiment shown.

[0018] In the first embodiment, two flanges 9 extend at an angle β from the second bracket leg 8, so that an edge 10 of the flange 9 faces the first bracket leg 7. In the embodiment shown, a gap 19 is present between the edge 10 and the first bracket leg 7. In the depicted first embodiment, the edge 10 is proximal to the first bracket leg 7 in the unloaded condition such that the gap 19 between the edge 10 and the first bracket leg 7 is approximately 0.2 mm across the whole length of the flange edge 10. The term "proximal" envisages gaps in the order 0.1 to 0.3 mm. Also skewed gaps presenting a varying distance between the flange edge and opposing bracket leg are conceivable. However, it is also conceivable that the edge 10 of the flange 9 is located adjacent to the first bracket leg 7, i.e. no gap present.

[0019] In the depicted first embodiment, the angle β between flange 9 and the bracket leg 8, from which the flange 9 extends, is essentially 90° . That is, the angle β is the angle measured in the xy plane in the co-ordinate system. However, other values for the angle β are conceivable, preferably in the range of 45° to 135° , probably more preferred 70° - 110° , most preferred 80° - 100° , in order to provide for a sufficiently robust design of the flanges acting as stiffening ribs. For embodiments where the angle β is larger than 90° , the opposing bracket leg should extend further than is the case of the first embodiment of Figs 2 to 5 so as to be able to be abutted by the flange edge in that position of the flange.

[0020] The angle γ between the flange 9 and the opposing bracket leg 7 is essentially orthogonal in the embodiment shown. Referring to the co-ordinate system, angle γ is the angle measured in the yz plane. It is noted that both of the angles γ and β are orthogonal in the first embodiment shown in Figs 2 to 8 in order to obtain a robust construction. However, combinations of various sizes of angles for both β and γ are conceivable.

[0021] Embodiments comprising just one flange or more than two flanges are also conceivable; however, embodiments with an essentially symmetric arrangement of more than one flange around a symmetry plane C are preferred in order to ensure a uniform deformation, as will be further described below.

[0022] The flanges 9 in the first embodiment are integrally formed with the second bracket leg 8. The integrally formed flanges 9 have been obtained by bending and extend from each end 18 of the second bracket leg 8. Embodiments with flanges that are not integrally formed with the mounting bracket leg, from which they extend, or combinations of integrally and not integrally formed flanges, are conceivable. Non-integral flanges could for instance be added, for instance welded or bolted, onto the respective mounting bracket leg. A mounting bracket with three or four flanges may for instance comprise an

integrally formed, bent flange at each end of the second bracket leg and one or more flanges added onto the second bracket.

[0023] As is seen, the flanges 9 of the first embodiment are substantially triangular with a straight free edge 20. This is beneficial with regard to maximizing the stiffness of the flanges 9 acting as stiffening ribs in the first load condition, while minimizing the overall weight of the mounting bracket. Nevertheless, other shapes of flanges are conceivable, for instance rectangular or flanges with a convexly or concavely curved free edge.

[0024] Although described mainly in this context as if the flanges 9 extend from the second bracket leg 8 so that their edges 10 are proximal to the first bracket leg 7, it is understood that the opposite, namely that the flanges 9 extend from the first bracket leg 7 in such a way that the flange edges 10 are proximal to the second bracket leg 8, is also conceivable.

[0025] Referring now in particular to Fig. 4, the forces acting on the window 1 in various load conditions will be described. In the installation position shown in Fig. 4, the first bracket leg 7 is fixed to the roof structure and a frame member of the window 1 is fastened to the second bracket leg 8. Forces F1 and F2 acting on the window 1 are transferred to the mounting bracket 6 as will be described in the following:

In a first load condition, forces F1 act on the window 1 and are transferred to the mounting bracket 6 so as to diminish the angle α . The mounting bracket 6 of the first embodiment deforms elastically. The gap 19 is minimized, if not already closed, as the edge 10 of the flange 9 is brought into abutment with the other bracket leg 7 than the one 8 it extends from. As there prior to deformation was a gap 19, essentially contact between the flange edge 10 and the first bracket leg 7 will arise. In case of an initially skewed gap narrowing away from the interconnection 13 between the first bracket leg 7 and the second bracket leg 8, the contact zone will become more point-shaped.

[0026] The flanges 9 acting as stiffening ribs in the first load situation provide for a first torque threshold T1 in the first embodiment. As mentioned above, the mounting bracket is so designed as to be able to withstand even severe yet commonly occurring loads in this situation, such as wind loads acting on the window.

[0027] In a second load condition, forces F2, as indicated in Fig. 4, act on the window 1 and are transferred to the mounting bracket 6 so as to increase the angle α . The flange edge 10 is being brought out of its proximity to the other bracket leg 7, and thus the flanges 9 lose their effect as stiffening ribs in this load situation. Hence, the mounting bracket 6 is provided with a second torque threshold T2 in this load situation, beyond which plastic deformation of the mounting bracket 6 will occur. The second torque threshold T2 is thus mainly dictated by the remaining design of the mounting bracket, which will be discussed below.

[0028] The mounting bracket 6 is so designed as to be

able to withstand even severe yet commonly occurring loads in this situation, such as snow loads acting on the window, without exceeding the second torque threshold T2, i.e. only deforming elastically. However, when subjected to larger loads, such as an impact, the second torque threshold T2 will be exceeded and the mounting bracket 6 will deform plastically thereby absorbing energy from the impact protecting other parts of the window and surrounding structure.

[0029] The second torque threshold T2 is smaller than the first torque threshold T1, but embodiments where the opposite is the case might be envisaged.

[0030] In the first load condition, when the window 1 is subjected to forces F1, deformation of the mounting bracket 6 in the first embodiment occurs primarily in a first deformation zone 11 in the first bracket leg 7. As indicated in Fig. 3 showing the mounting bracket 6 of the first embodiment, the first deformation zone 11 is essentially line-shaped and extends along a line 15. The line 15 is essentially parallel to the longitudinal extension of the interconnection 13 of the first bracket leg 7 with the second bracket leg 8. The line 15 is also offset from the interconnection 13 so as to intersect a point of contact 14 between the first bracket leg 7 and the flange edge 10. The point of contact 14 is essentially the point of contact farthest away from the interconnection 13, since this will be the natural bending point in the first load situation.

[0031] Variations in the flange design providing for variations in the shape of the first deformation zone may be envisaged. For instance, a rounded tip of the flange where the free flange edge and the abutment flange edge meet may provide for a broader, more strip-shaped, first deformation zone.

[0032] In the second load condition, deformation of the mounting bracket 6 occurs primarily in a second deformation zone 12 in the first bracket leg 7. The second deformation zone 12 is delimited by the interconnection 13 and the line 15 and is marked by a darker colour in Fig. 3. In the second load situation, deformation will occur in whole or parts of the second deformation zone 12 depending on the specific design of the area.

[0033] In Fig. 5, the mounting bracket 6 of the first embodiment has a weakening geometry in the second deformation zone 12. In the embodiment shown, the weakening geometry is in the form of a slit 16 but could also take other forms. The slit is, in the embodiment shown, essentially centrally placed in the second deformation zone 12 and extending with its longitudinal extension essentially parallel to the interconnection 13 and with equal distance to the line 15 and the interconnection 13. The particular position and orientation of the slit may vary.

[0034] The dimensions of the slit 16 may be varied according to specifications and legislative regulations and furthermore taking into account climate conditions including the risk of extreme weather. In the first embodiment of the mounting bracket 6 shown in Fig. 5, the slit 16 extends across approximately 70-90 percent of the width wd2 of the second deformation zone 12 and across ap-

proximately 5-15 percent of the height hd_2 of the second deformation zone 12. This arrangement provides for areas in the second deformation zone indicated in Fig. 5, which areas will undergo the most plastic deformation.

[0035] Other percentages, arrangements and combinations of weakening geometries are conceivable and may for instance include a number of small holes or perforations, two or more slits arranged in an array, areas of smaller material thickness than the remaining second deformation zone etc. possibly resulting in other deformation areas than the ones indicated.

[0036] In the first embodiment, the first bracket leg 7 is essentially T-shaped in that the width of the first bracket leg 7 at the second deformation zone 12 is essentially identical to the width wd_2 of the second deformation zone 12, while the width wl_1 of the remainder of the first bracket leg 7 is larger than the width wd_2 of the second deformation zone. The relationship between the narrower and the wider part of the first bracket leg is around 0.45, but may vary between 0.40-0.50 or even 0.30-0.60 so as to fit well to various sizes and types of windows and roof structures.

[0037] The overall height hl_1 of the first bracket leg is essentially 1.5-3 times the height hd_2 of the second deformation zone 12, but may also vary so as to fit to various sizes and types of windows and roof structures. The width wl_2 of the second bracket leg 8 is essentially equal to the width wd_2 of the second deformation zone 12 but may also vary.

[0038] As mentioned earlier, the first torque threshold T_1 and the second torque threshold are different from each other. In the first embodiment, the first torque threshold T_1 is substantially larger than the second torque threshold T_2 . Typical ratios $T_1:T_2$ are 1.5 to 5, but depending on the window, expected loads and use, however, other ratios are envisaged.

[0039] In Figs 6 to 8, the configuration of the mounting bracket 6 of the first embodiment following an impact is shown. As may be seen, the mounting bracket 6 has undergone plastic deformation in the deformation zones described in the above. Hence, the first bracket leg 7 has been twisted and slightly bent, the slit 16 has been stretched, and the gap 19 between the edge 10 and the first leg 7 has widened.

[0040] Referring now to Figs 9 and 10, a second embodiment of the mounting bracket according to the invention will be described. Elements and parts having the same or analogous function as in the first embodiment of Figs 2 to 8 carry the same reference numerals to which 100 has been added. Only differences relative to the first embodiment will be described.

[0041] One difference relevant to the present invention is that the flanges 109 are angled slightly outwards and form another angle (corresponding to angle β described with reference to Fig. 2) than orthogonal with the second bracket leg 108.

[0042] Furthermore, the edge 110 has an extension providing a point of contact 114 between the edge 110

and the first bracket leg 107.

[0043] The configuration of the mounting bracket 106 in this second embodiment furthermore includes a profiling of the edge of in particular the first bracket leg 107 which enables accommodation of a corresponding mounting bracket installed on an adjacent window.

[0044] In a presently preferred embodiment of the window according to the invention, a plurality of mounting brackets 106 of the second embodiment is provided separately from the window, for instance the window 1 of Fig. 1, in a supply condition.

[0045] The mounting brackets 106 of the plurality provided with the window 1 in the supply condition may as shown in Fig. 10 include four mounting brackets 106. In the embodiment shown, these mounting brackets 106 are stacked on each other in a stacking unit 150 which is able to accommodate all four mounting brackets 106, and if necessary several more mounting brackets. The stacking unit 150 includes a set of protruding fingers 151 introduced through the respective slits 116 of the mounting brackets 106.

[0046] The invention should not be regarded as being limited to the embodiments shown in the drawings and described in the above. Several modifications and combinations may be carried out within the scope of the appended claims.

[0047] Itemized list of embodiments:

Embodiment 1. A mounting bracket (6; 106) for installation of a window (1) in a roof structure, said window (1) comprising a frame including a top frame member (2), a bottom frame member (3) and two side frame members (4, 5), the mounting bracket (6; 106) comprising a first bracket leg (7; 107) for fastening to the roof structure, and, for fastening to a frame member (2, 3, 4, 5), a second bracket leg (8; 108) extending from the first bracket leg (7; 107) at an angle (α), the angle (α) being essentially orthogonal in an unloaded condition of the mounting bracket (6; 106),

characterized in that

in a first load condition, in which forces (F_1) act on the mounting bracket (6; 106) so as to diminish the angle (α), a first torque threshold (T_1) is provided, beyond which plastic deformation of the mounting bracket (6; 106) occurs, and that

in a second load condition, in which forces (F_2) act on the mounting bracket (6) so as to increase the angle (α), a second torque threshold (T_2) is provided, beyond which plastic deformation of the mounting bracket (6; 106) occurs, the second torque threshold (T_2) being different from the first torque threshold (T_1).

Embodiment 2. A mounting bracket according to embodiment 1, wherein the mounting bracket (6; 106) comprises at least one flange (9; 109) extending at an angle (β) from the first bracket leg (7; 107) or from the second bracket leg (8; 108) so that an edge (10;

110) of the flange (9; 109) is facing the other bracket leg (8, 7; 108; 107), and wherein, in the first load condition, in which forces (F1) act on the mounting bracket (6) so as to diminish the angle (α), the edge (10; 110) of the flange (9; 109) is being brought into abutment with the other bracket leg (8, 7; 108; 107) providing the first torque threshold (T1).

Embodiment 3. A mounting bracket (6) according to embodiment 2, wherein the edge (10) of the flange (9) is proximal to the first bracket leg (7) in the unloaded condition, a gap (19) between the edge (10) and the first bracket leg (8) being provided, preferably in the range 0.1 to 0.3 mm.

Embodiment 4. A mounting bracket (106) according to embodiment 2, wherein the edge (110) of the flange (109) has an oblique extension providing a gap (114) between the edge (110) and the first bracket leg (107).

Embodiment 5. A mounting bracket (106) according to embodiment 4, wherein the flange (109) forms an angle (β) other than orthogonal with the second bracket leg (108).

Embodiment 6. A mounting bracket (6; 106) according to any one of the preceding embodiments, wherein, in the first load condition, deformation of the mounting bracket (6; 106) occurs primarily in a first deformation zone (11) in the first bracket leg (7), the first deformation zone (11) being essentially line shaped and extending along a line (15), which line (15) is essentially parallel to and offset from the longitudinal extension of the interconnection (13) between the first bracket leg (7) with the second bracket leg (8) so as to intersect a point (14) of contact between the first bracket leg (7) and the flange (9), which point of contact (14) is the point of contact farthest away from the interconnection (13), and wherein, in the second load condition, deformation of the mounting bracket (6; 106) occurs primarily in a second deformation zone (12) in the first bracket leg (7), the second deformation zone (12) being delimited by the interconnection (13) and the line (15).

Embodiment 7. A mounting bracket (6; 106) according to embodiment 6, wherein the mounting bracket (6; 106) has a weakening geometry in the second deformation zone (12), the weakening geometry being in the form of at least one opening and/or at least one area with a smaller material thickness than that of the remaining second deformation zone (12).

Embodiment 8. A mounting bracket (6; 106) according to embodiment 7, wherein the weakening geometry comprises a slit (16; 116) extending with its longitudinal extension essentially parallel to the interconnection (13), preferably with equal distance to the line (15) and the interconnection (13).

Embodiment 9. A mounting bracket (6; 106) according to any one of the previous embodiments, wherein the angle (β) between the at least one flange (9) and the bracket leg (7, 8; 7; 108) from which the flange

(9; 109) extends and/or the angle (γ) between the flange (9; 109) and the other bracket leg (8, 7; 108, 107) is essentially orthogonal.

Embodiment 10. A mounting bracket (6; 106) according to any of the previous embodiments, where the at least one flange (9; 109) is formed integrally with the bracket leg (7, 8; 107, 108) from which the flange (9; 109) extends, preferably the flange (9; 109) is formed by means of bending.

Embodiment 11. A mounting bracket (6; 106) according to any one of the previous embodiments, wherein the at least one flange (9; 109) extends from the second bracket leg (8; 108).

Embodiment 12. A window (1) for installation in a roof structure, comprising a frame including a top frame member (2), a bottom frame member (3) and two side frame members (4, 5), wherein a plurality of mounting brackets (6; 106) according to any one of embodiments 1 to 11 is provided with the window (1) in a supply condition.

Embodiment 13. A window (1) according to embodiment 12, wherein said plurality of mounting brackets (6; 106) is provided separately from the window (1) in the supply condition.

Embodiment 14. A window (1) according to embodiment 13, wherein said plurality of mounting brackets (106) is provided in a stacking unit (150) accommodating said plurality of mounting brackets (106), the mounting brackets (106) being stacked on each other in the supply condition.

Embodiment 15. A window (1) according to embodiment 14, wherein each mounting bracket (106) is provided with a slit (116) and said stacking unit (150) with a set of protruding fingers (151) introduced through the respective slits (116) of the mounting brackets (106) in the supply condition.

- | | |
|----|---|
| 1 | Window |
| 2 | Top frame member |
| 3 | Bottom frame member |
| 4 | Side frame member |
| 5 | Side frame member |
| 6 | Mounting bracket |
| 7 | First bracket leg for fastening to roof structure |
| 8 | Second bracket leg for fastening to frame member |
| 9 | Flange |
| 10 | Edge of flange |
| 11 | First deformation zone (so as to diminish α , wind load) |
| 12 | Second deformation zone (so as to increase α , snow load or impact) |
| 13 | Interconnection between first and second bracket legs |
| 14 | Point of contact between first bracket leg and flange farthest away from interconnection |
| 15 | Line along with which first deformation zone extends, parallel to the interconnection and in- |

	tersecting point of contact	
16	Slit in second deformation zone	
17	Each end of second deformation zone	
18	Each end of second bracket leg	
19	Gap between flange edge and other bracket leg	5
20	Free edge of flange	
106	Mounting bracket (second embodiment)	
107	First bracket leg for fastening to roof structure	10
108	Second bracket leg for fastening to frame member	
109	Flange	
110	Edge of flange	
114	Point of contact	15
116	Slit (weakening geometry)	
150	stacking unit	
151	protruding fingers	20
α	Angle between first and second bracket legs	
β	Angle between the flange and the bracket leg from which the flange extends	
γ	Angle between the flange and the other bracket leg (from which the flange does not extend)	25
C	Symmetry plane through mounting bracket	
F1	Forces acting on the mounting bracket in a first load condition (so as to diminish α)	
F2	Forces acting on the mounting bracket in a second load condition (so as to increase α)	30
T1	Torque threshold for plastic deformation during first load condition	
T2	Torque threshold for plastic deformation during second load condition	35
wl1	Width of first bracket leg (except at second deformation zone)	
hl1	Height of first bracket leg	
wl2	Width of second bracket leg	
hl2	Height of second bracket leg	40
wd2	Width of second deformation zone	
hd2	Height of second deformation zone	

Claims

1. A mounting bracket (6; 106) for installation of a window (1) in a roof structure, said window (1) comprising a frame including a top frame member (2), a bottom frame member (3) and two side frame members (4, 5), the mounting bracket (6; 106) comprising a first bracket leg (7; 107) for fastening to the roof structure, and, for fastening to a frame member (2, 3, 4, 5), a second bracket leg (8; 108) extending from the first bracket leg (7; 107) at an angle (α), the angle (α) being essentially orthogonal in an unloaded condition of the mounting bracket (6; 106), in a first load condition, in which forces (F1) act on

the mounting bracket (6; 106) so as to diminish the angle (α), a first torque threshold (T1) is provided, beyond which plastic deformation of the mounting bracket (6; 106) occurs, and that

in a second load condition, in which forces (F2) act on the mounting bracket (6) so as to increase the angle (α), a second torque threshold (T2) is provided, beyond which plastic deformation of the mounting bracket (6; 106) occurs, the second torque threshold (T2) being different from the first torque threshold (T1),

characterized in that in the first load condition, deformation of the mounting bracket (6; 106) occurs primarily in a first deformation zone (11) in the first bracket leg (7), the first deformation zone (11) being essentially line shaped and extending along a line (15), which line (15) is essentially parallel to and offset from the longitudinal extension of the interconnection (13) between the first bracket leg (7) with the second bracket leg (8) so as to intersect a point (14) of contact between the first bracket leg (7) and the flange (9), which point of contact (14) is the point of contact farthest away from the interconnection (13), and wherein, in the second load condition, deformation of the mounting bracket (6; 106) occurs primarily in a second deformation zone (12) in the first bracket leg (7), the second deformation zone (12) being delimited by the interconnection (13) and the line (15).

2. A mounting bracket (6; 106) according to claim 1, wherein the mounting bracket (6; 106) has a weakening geometry in the second deformation zone (12), the weakening geometry being in the form of at least one opening and/or at least one area with a smaller material thickness than that of the remaining second deformation zone (12).
3. A mounting bracket (6; 106) according to claim 2, wherein the weakening geometry comprises a slit (16; 116) extending with its longitudinal extension essentially parallel to the interconnection (13), preferably with equal distance to the line (15) and the interconnection (13), and preferably essentially placed in the second deformation zone (12).
4. A mounting bracket according to claim 3, wherein the slit (16; 116) extends across approximately 70-90 percent of a width (wd2) of the second deformation zone (12), preferably across approximately 5-15 percent of a height (hd2) of the second deformation zone (12).
5. A mounting bracket according to claim 1, wherein the first bracket leg (7) is essentially T-shaped in that a width of the first bracket leg (7) at the second deformation zone (12) is essentially identical to a width (wd2) of the second deformation zone (12), while a width wl1 of the remainder of the first bracket leg (7)

is larger than the width (wd2) of the second deformation zone (12).

6. A mounting bracket according to claim 5, wherein the relationship between the narrower and the wider part of the first bracket leg (7) is in the range 0.30-0.60, preferably 0.40-0.50, most preferably around 0.45. 5
7. A mounting bracket according to claim 1, wherein an overall height (hl1) is essentially 1.5-3 times a height (hd2) of the second deformation zone (12). 10
8. A mounting bracket according to claim 1, wherein the first torque threshold (T1) is substantially larger than the second torque threshold (T2), typical ratios T1:T2 being 1.5 to 5. 15
9. A mounting bracket according to claim 1, wherein the mounting bracket (6; 106) comprises at least one flange (9; 109) extending at an angle (β) from the first bracket leg (7; 107) or from the second bracket leg (8; 108) so that an edge (10; 110) of the flange (9; 109) is facing the other bracket leg (8, 7; 108; 107), and wherein, in the first load condition, in which forces (F1) act on the mounting bracket (6) so as to diminish the angle (α), the edge (10; 110) of the flange (9; 109) is being brought into abutment with the other bracket leg (8, 7; 108; 107) providing the first torque threshold (T1). 20 25 30
10. A mounting bracket (6) according to claim 9, wherein the edge (10) of the flange (9) is proximal to the first bracket leg (7) in the unloaded condition, a gap (19) between the edge (10) and the first bracket leg (8) being provided, preferably in the range 0.1 to 0.3 mm. 35
11. A mounting bracket (106) according to claim 9, wherein the edge (110) of the flange (109) has an oblique extension providing a gap (114) between the edge (110) and the first bracket leg (107), the flange (109) preferably forming an angle (β) other than orthogonal with the second bracket leg (108). 40
12. A mounting bracket (6; 106) according to claim 9, wherein the angle (β) between the at least one flange (9) and the bracket leg (7, 8; 7; 108) from which the flange (9; 109) extends and/or the angle (γ) between the flange (9; 109) and the other bracket leg (8, 7; 108, 107) is essentially orthogonal. 45 50
13. A mounting bracket (6; 106) according to claim 9, where the at least one flange (9; 109) is formed integrally with the bracket leg (7, 8; 107, 108) from which the flange (9; 109) extends, preferably the flange (9; 109) is formed by means of bending. 55
14. A mounting bracket (6; 106) according to claim 9,

wherein the at least one flange (9; 109) extends from the second bracket leg (8; 108).

15. A window (1) for installation in a roof structure, comprising a frame including a top frame member (2), a bottom frame member (3) and two side frame members (4, 5), wherein a plurality of mounting brackets (6; 106) according to any one of claims 1 to 14 is provided with the window (1) in a supply condition.

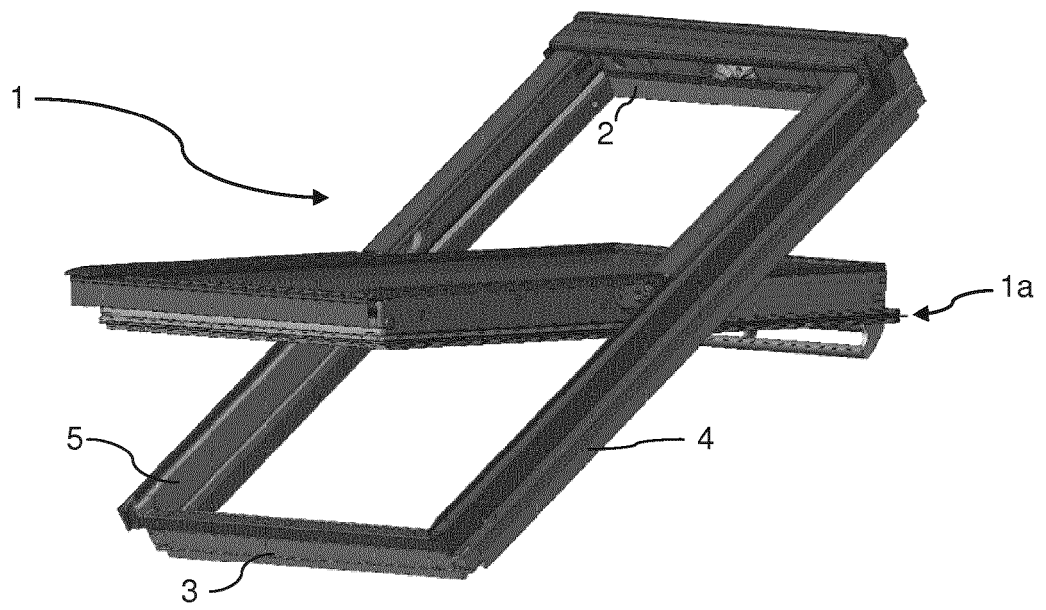


Fig. 1A

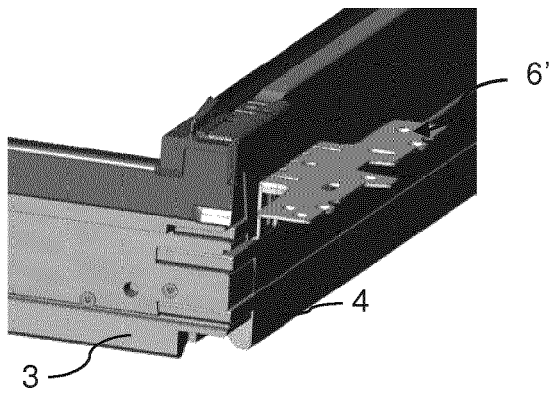


Fig. 1B (PRIOR ART)

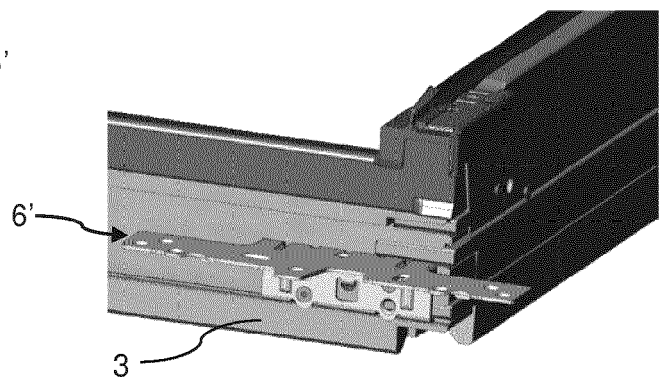
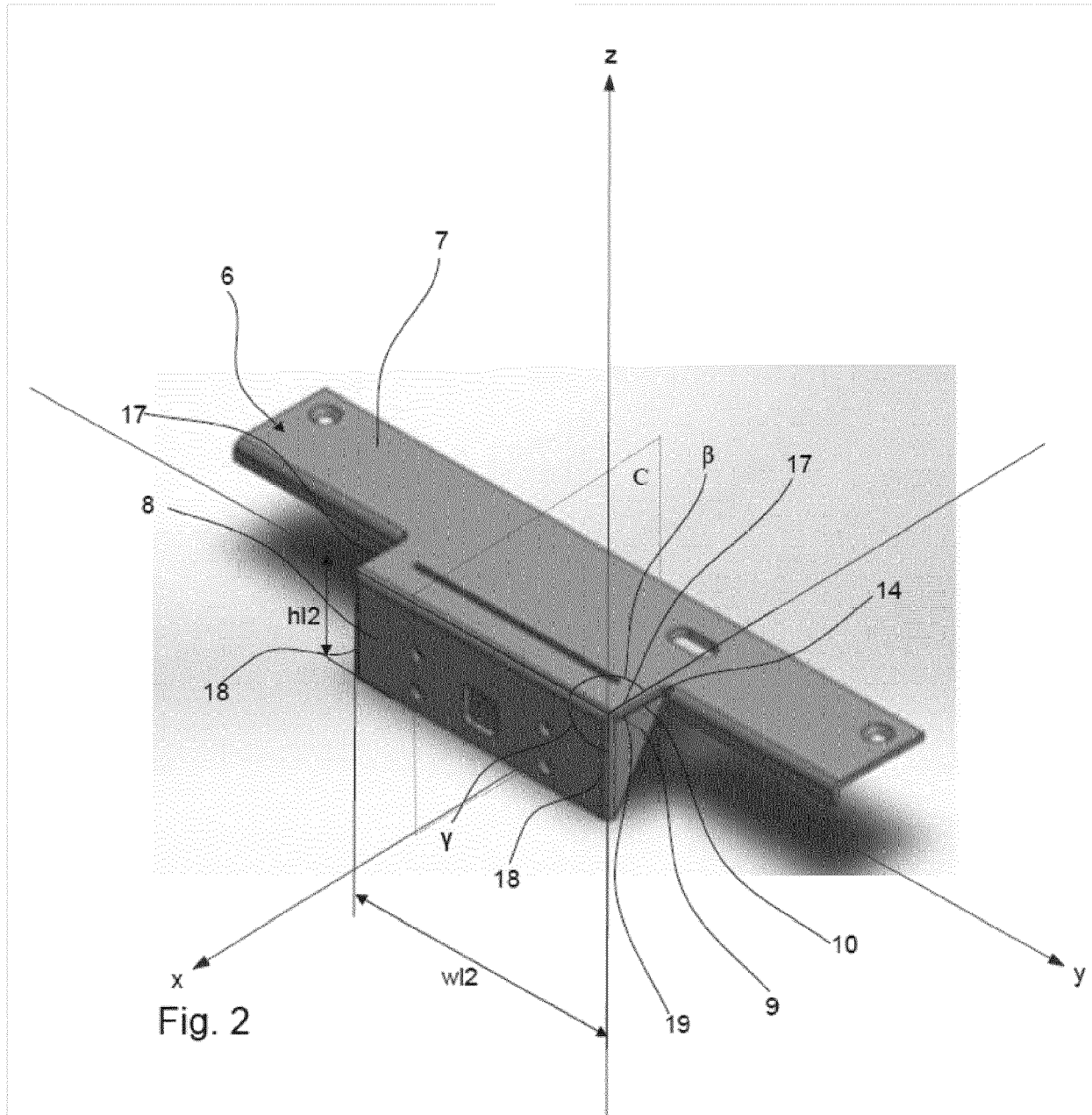


Fig. 1C (PRIOR ART)



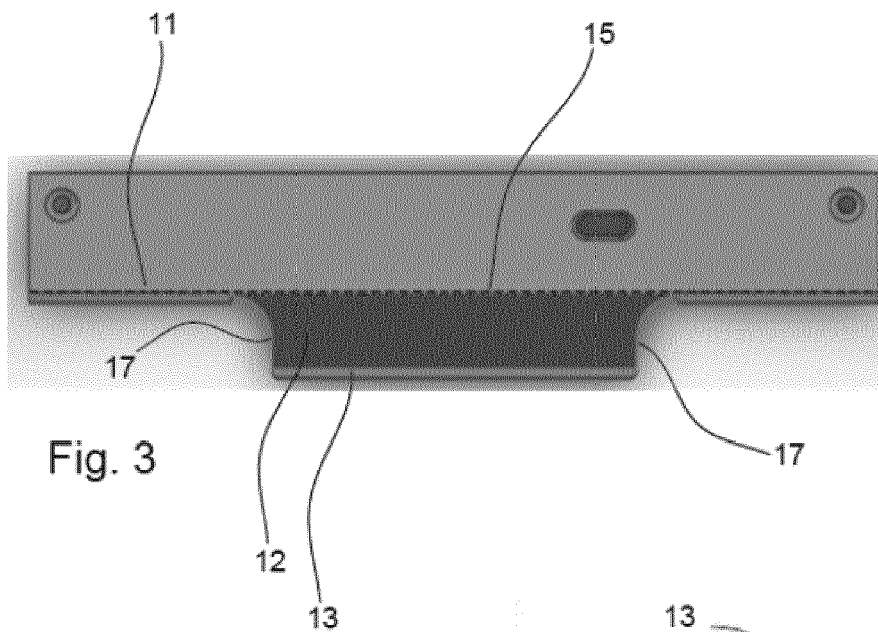


Fig. 3

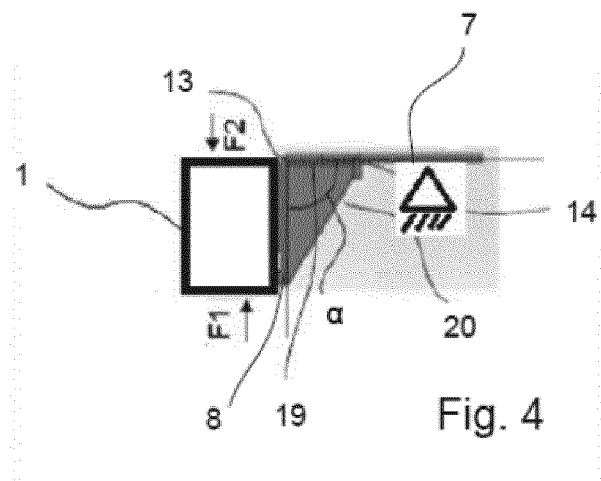


Fig. 4

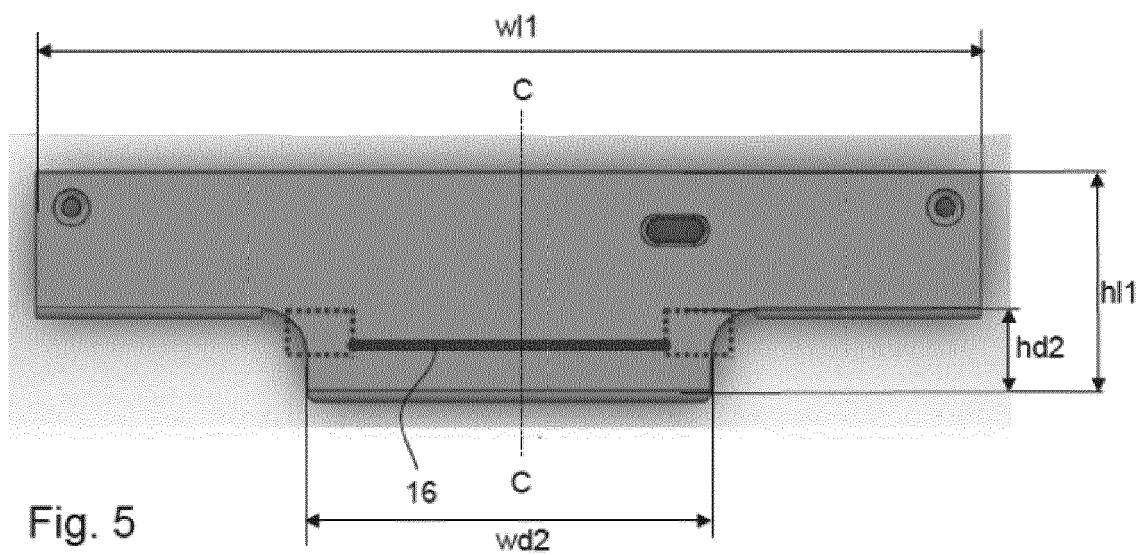


Fig. 5

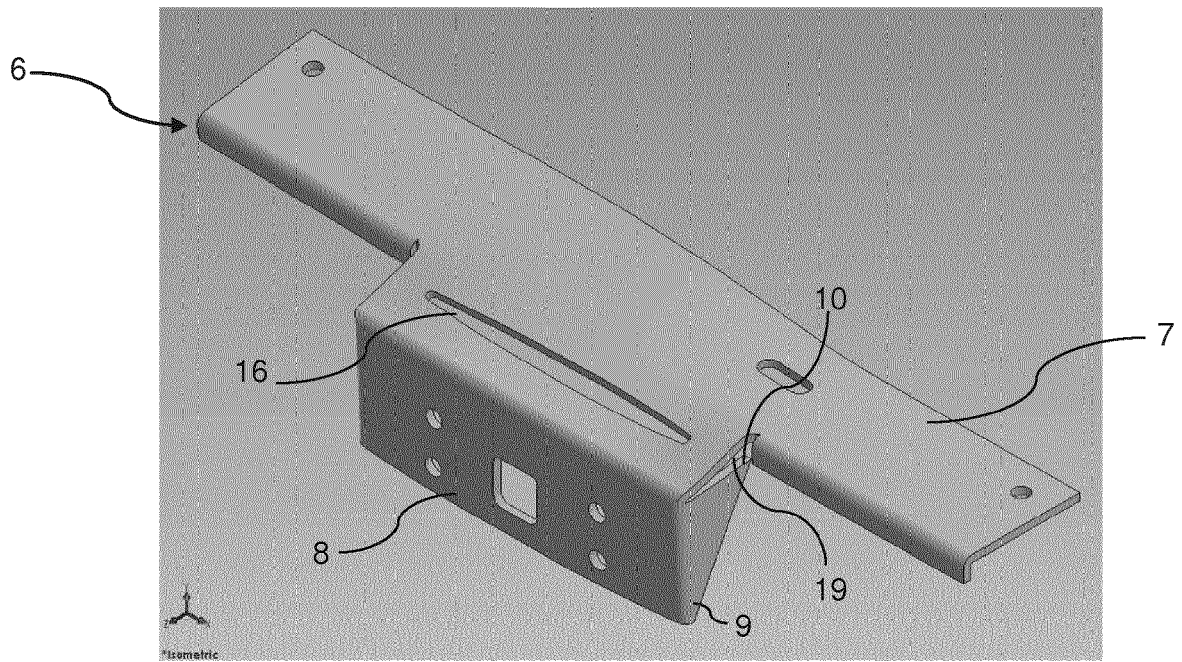


Fig. 6

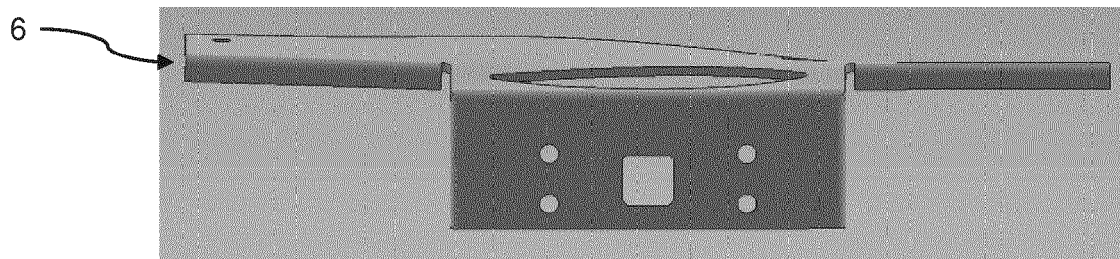


Fig. 7

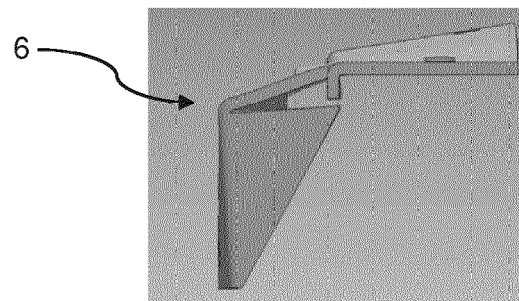


Fig. 8

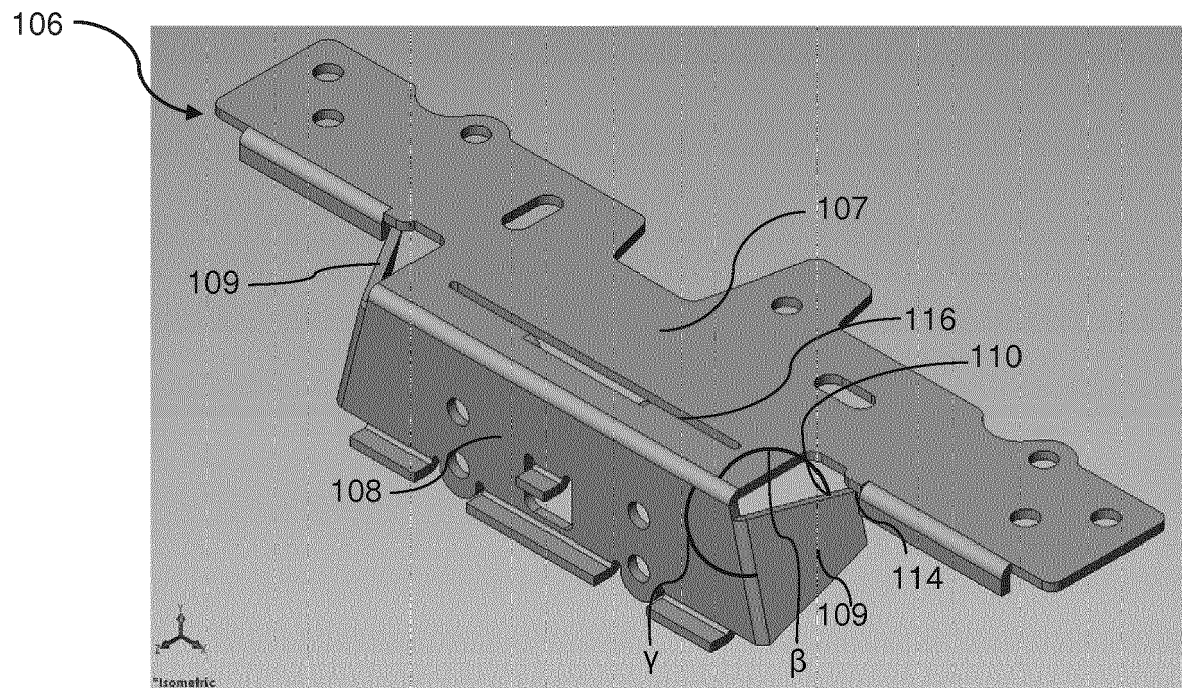


Fig. 9

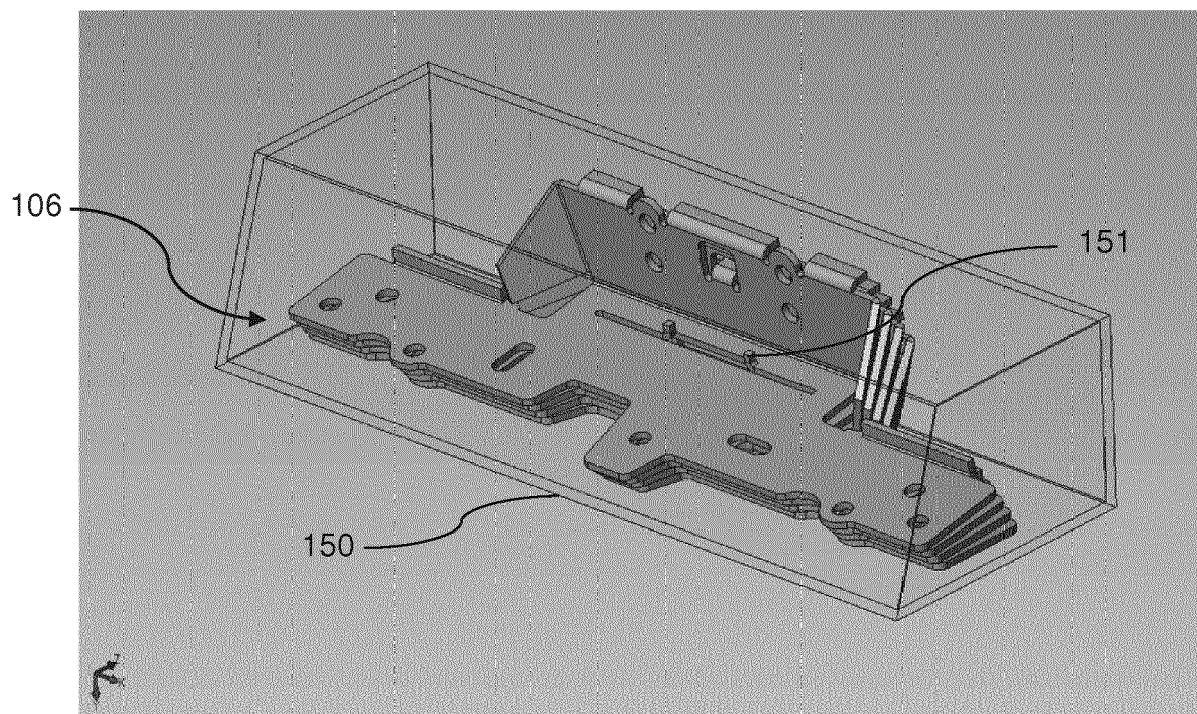


Fig. 10



EUROPEAN SEARCH REPORT

Application Number
EP 19 15 8635

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 213 679 B1 (FROBOSILO RAYMOND C [US] ET AL) 10 April 2001 (2001-04-10) * figures *	1-15	INV. E04D13/03
X	EP 2 578 763 A1 (VKR HOLDING AS [DK]) 10 April 2013 (2013-04-10) * figures *	1-15	
			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 1 April 2019	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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01-04-2019

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			PL 2578763 T3 30-05-2018

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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