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(54) **Flashing system for sealing a joint of a set of at least two roof penetrating structures**

(57) Flashing system, for sealing the joint of a set of at least two roof penetrating structures placed directly next to each other in the roof slope, comprising extreme members: bottom member (1), top member (2), side members (3), and an intermediary member in the form of a trough (4) for draining water, located between the

adjacent side edges of the roof penetrating structures, with side arms covered by the sheeting of the adjacent roof penetrating structures, **characterised in that** the top members (2) are secured to the common trough (4) with fasteners made of a plastically deformable material, permanently connected to the trough (4).

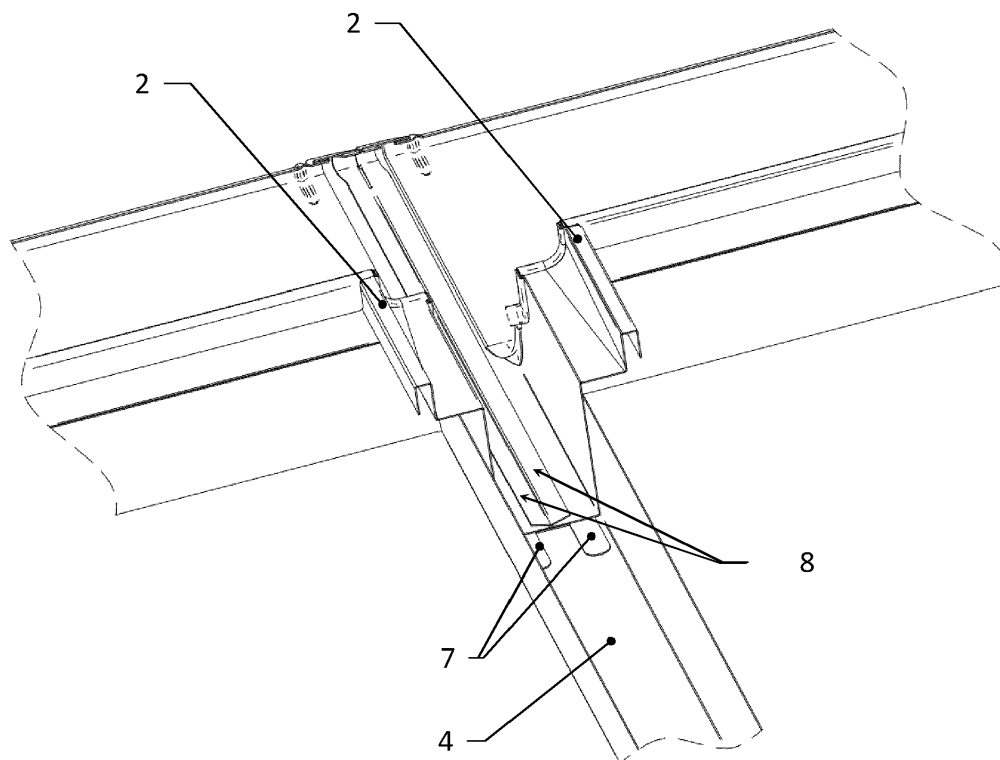


Fig. 3

Description

[0001] The invention concerns a flashing system for sealing a joint of a sloping roof covering with at least two roof penetrating structures, e.g. roof windows installed in their direct vicinity.

[0002] When any type of roof penetrating structure is installed, in particular roof windows, it is essential to ensure that all edges of their joint with the roof covering are tight. Usually a flashing is used for this purpose, comprising:

- a bottom member, installed first,
- side members, arranged symmetrically,
- a top member, installed as the last member closing the circuit.

[0003] For roof windows installed in sets, intermediary members to seal the space between the set window edges are necessary.

[0004] Flashing solutions for such window sets are known *inter alia* from the market. Usually, the sealing of the outer edges does not differ from the techniques used for single roof penetrating structures, while rectangular U-shaped troughs are typically used for sealing the space between the window edges and for draining water.

[0005] The method of fastening individual components to one another and to the roof covering is a significant characteristic in all solutions. A solution where the flashing system components are shape-adapted for joining together when roof windows are installed next to each other is known from FR 2473595. However as the joint is formed by asymmetrical "male" and "female" components, the flashing system for a single roof window must be fitted with various flashing components for opposite window frame sides, which increases the number of its components.

[0006] DE 3206871 C1 (WO 03074812) shows a sheet component of the flashing for a roof penetrating structure and a flashing system including at least two such sheet members. According to the patent description, a flashing component may be installed standalone providing the sealing between a roof penetrating structure and a structure surrounding the roof surface or it may be installed with overlapping, providing the sealing between the adjacent structures. Flashing members specifically adapted for connecting the adjacent side members of the sealing collar shown in the patent contain a flexible member that enables a tight connection of two flashing members of the same profile.

[0007] The objective of the proposed invention is a flashing system for joining directly adjacent roof penetrating structures so that the distance between these structures is as short as possible and at the same time the system is consistent and the installation is easy, with no need for using tools in a particularly inaccessible place, which is the space between the roof penetrating structures. It is significant both for the possibility of in-

stalling more, in particular roof windows, on the same surface, as well as for aesthetic qualities of the installed system.

[0008] The invention is distinguished by the flashing component system for sealing the space between two windows installed directly next to each other in a roof slope, comprising a trough, fitted with plastically deformable straps of a permanently deformable material, advantageously it would be the same material as the one used for the trough, for tool-free fastening of top components of the flashing, and a cover, protecting a joint formed in this way from weather. The straps may also be initially, at the production stage, shaped to form catching members for putting in the top components.

[0009] The whole flashing system according to the invention, providing the sealing of the joint of at least two roof penetrating structures placed next to each other in the roof slope, consists of known typical components: a bottom member, top member, side members and an intermediary member in the form of a trough for draining water, located between the adjacent side edges of the roof penetrating structures. The component names comply with the location of individual components on an inclined roof slope. The arms of troughs advantageously with a U-shaped profile, are shielded from weather by sheeting of the adjacent roof penetrating structures. The trough is therefore a component that connects the sheeting of two adjacent structures, providing the continuity of protection against weather and additionally it is a channel for draining excess water.

[0010] The method for securing the mentioned components to the roof structure is an essential issue. For extreme components, like the bottom members or side members, they are typically secured to the side walls of the roof penetrating structure with typical fasteners like nails or screws. However, securing the intermediary components between the roof penetrating structures installed next to each other is a big assembly problem, due to the lack of space for using metal working tools. The troughs or the top members overlapping them are among such components. It can be solved by use of fasteners that do not require tools.

[0011] In the proposed solution the top members of the flashing system are secured to the common trough with straps of a plastically deformable material, advantageously the same material as the trough. Typically, the system assembly starts with the bottom member, next the side members and intermediary members, or troughs, are installed. The trough is fitted at one end with an assembly strip, which is an extension of its bottom, to secure it to the roof structure in the part protected from weather by the top member and the roof covering. A permanently secured trough is a base member for securing the top member, for this purpose using fasteners of a plastically deformable material, advantageously straps of the same material as the trough, which may be connected at the production stage to the trough bottom along its profile or may be formed from the same piece of metal

as the trough. The straps after the full bend at the edges of the top members adjoining the trough bottom form a block, holding the top members down to the trough. The bend axis may be selected in any way, in addition the straps after bending must at least partially hold the surface of the relevant top member down.

[0012] The most advantageous solution is when the strap bend axis is perpendicular to the longitudinal trough profile and parallel to the top member edge. Thus formed joint allows other additional fasteners, e.g. screws or nails to be eliminated, at the same time providing durable and rigid fastening of the top member in this structure part. A qualitatively similar effect is obtained for initial forming of fasteners, advantageously straps in such a way that they form catches for putting the top member edges in. Other securing points of the top member may, due to the spatial freedom, use known traditional fasteners. However, it is possible and advantageous to use the proposed solution in the form of straps also for securing the top members to the side members, thus eliminating the need for using tools and other fasteners.

[0013] In the place where two adjacent top members and the trough are joined, a cover protecting them against weather is applied. The cover, in its part mating the top members, has advantageously a U-profile, with arms inclined at an acute angle to its base. At the same time at the side edges of the top members similar arms parallel to the trough are formed, inclined at an acute angle to the base surface, forming after assembly guides for inserting the cover. The opposing inclination angles of the guide arms and the cover restrict the freedom of movement of the cover so that it may only be put in or out. The cover may be protected against accidental going out either with an additional edge formed at its one end located after assembly under the roofing, or in any known way.

[0014] The solution according to the invention is presented in the embodiments shown in pictures, where the individual figures present:

- Fig. 1 - the system in an exploded view,
- Fig. 2 - the trough in a perspective view,
- Fig. 3 - the system area in the place where the top members are connected to the trough before the installation,
- Fig. 4 - the same area after the installation,
- Fig. 5 - the same area with the cover,
- Fig. 6 - the cover profile in a view perpendicular to the roof slope,
- Fig. 7 - the system according to the second embodiment,
- Fig. 8 - the system according to the third embodiment,
- Fig. 9a and 9b - cover embodiments.

[0015] A complete flashing system according to the invention, in the first embodiment for two roof penetrating structures, shown in Fig. 1, consists of a bottom member 1, top member 2, side members 3 and a trough for drain-

ing water, located between the adjacent side edges of the roof penetrating structure, and a cover 5.

[0016] Fig. 2 shows the trough 4 in its upper part, secured to the roof structure. The trough 4 at its one end is fitted with an assembly strip 6, being an extension of its bottom. The length of the assembly strip 6 matches the position of the roof structure component used for securing the trough 4. The assembly strip after the installation is advantageously located in the part protected from weather by the top member 2 and the roof covering. The fasteners may be e.g. nails or building screws. A fastener, advantageously made of one piece of metal sheet, with two straps 7, used after bending for securing the top member 2 is permanently secured to the trough.

[0017] Fig. 3 shows the area of the flashing system in the place where the top members 2 are connected to the trough 4 in the condition between the installation of the top members 2 and next bending the strap 7.

[0018] Fig. 4 shows the same members in the condition fully secured to the roof structure after the bending of the straps 7 at the top member 2 edge. The height of the side arms of the trough 4 and their inclination to the base surface match the roof penetrating structure sheeting shape. The minimum required height of the side arms of the trough 4 is determined by its function as a water draining channel. The most advantageous solution in terms of space savings is when the side arms of the trough 4 are perpendicular to its base. However, specific solutions may require a different inclination of the side arms, in addition they must be shielded from weather by the sheeting of the adjacent roof penetrating structures. The trough 4 is a member to which both adjacent top members are secured with straps 7, connected to the trough 4 bottom, laid along its profile. The full bend of straps 7 at the edges of the top members 2 adjoining the trough 4 bottom presses the top member 2 surfaces against the trough 2. The strap 7 bend axis is perpendicular to the longitudinal trough 4 profile and at the same time it is advantageously parallel to the edge of the top member 2 around which the straps 7 are bent. A joint formed in this way ensures a durable and rigid fastening of the top member 2 in this part of the structure.

[0019] The last stage of the system assembly is putting on the cover 5 protecting the joint of the top members 2 with the trough 4 against weather, which is shown in Fig. 5. The cover 5 has an inverted U-profile made of a flat piece of metal sheet with arms inclined at an acute angle to its base. The proposed shape of the cover 5 profile is shown in Fig. 6 in a view perpendicular to the roof slope. At the same time at the side edges of the top members 2 similar arms 8 parallel to the trough 4 are formed, also seen in Fig. 6, inclined at an acute angle to the base surface of the top member 2. The arms 8, after assembly of the two top members 2 next to each other, form guides for inserting the cover 5 and restrict its freedom of movement to the possibility of its putting in and out only. The cover 5 shown in various embodiments in Fig. 9a and Fig. 9b, is protected against accidental going out with a

transverse edge 9 formed at its top end, after the installation located under the roofing. The edge 9 after putting the cover 5 into its destination, meshes the top edge of the top member 2, protecting the cover 5 against accidental going out of the set position. While putting the cover 5 in, the edge 9 should be elastically pulled aside, and next if needed it should be pressed against the edge of the top member 2 to protect the cover against uncontrolled going out. The condition of the system after its completed assembly is shown in drawings Fig. 5 and Fig. 6.

[0020] In the second embodiment, catch members 7' are used as fasteners instead of straps 7, formed initially in the trough bottom in a way enabling the top member 2 edge to be put in. This solution is shown in Fig. 7. The catch members, as in the first embodiment, advantageously may be straps of the same material as the trough 4, they may also have any form and shape.

[0021] In the third embodiment the strips 7 or catch members 7' are formed by bending of one piece of metal sheet along the designated edges. When the straps 7 are used, this solution is functionally tantamount to the solution shown in the first embodiment. But when the catch members 7' are used as retaining members, this solution is functionally identical to the solution shown in the second embodiment. This solution, for straps 7 and catch members 7' in the trough bottom is shown in fig. 8. Also another solution is possible, not shown in the drawing, where straps 7 or catch members 7' are located on both arms of the trough 4.

Claims

1. Flashing system, for sealing the joint of a set of at least two roof penetrating structures placed directly next to each other in the roof slope, comprising extreme members: bottom member, top member, side members, and an intermediary member in the form of a trough for draining water, located between the adjacent side edges of the roof penetrating structures, with side arms covered by the sheeting of the adjacent roof penetrating structures, **characterised in that** the top members (2) are secured to the common trough (4) with fasteners made of a plastically deformable material, permanently connected to the trough (4).
2. Flashing system as claimed in claim 1, **characterised in that** the top members (2) are secured to the common trough (4) with straps (7).
3. Flashing system as claimed in claim 1, **characterised in that** the top members (2) are secured to the common trough (4) with catch members (7').
4. Flashing system as claimed in claim 1, **characterised in that** the top members (2) are secured to the

common trough (4) with straps (7) or catch members (7') formed together with the trough from one piece of sheet metal.

5. Flashing system as claimed in claim 1, **characterised in that** the trough (4) in its water draining part has a U profile.
6. Flashing system as claimed in claim 1, **characterised in that** the straps (7) are connected to the trough (4) bottom.
7. Flashing system as claimed in claim 1, **characterised in that** the straps (7) are connected to the trough (4) arms.
8. Flashing system as claimed in claim 1, **characterised in that** the catch members (7') are connected to the trough (4) bottom.
9. Flashing system as claimed in claim 1, **characterised in that** the catch members (7') are connected to the trough (4) arms.
10. Flashing system as claimed in claim 2, **characterised in that** the straps (7) after bending during the assembly at the top member (2) edges form a block, pressing the top members (2) against the trough (4).
11. Flashing system as claimed in claim 1, **characterised in that** the trough (4) has at its one end an assembly strip (6) being an extension of its bottom.
12. Flashing system as claimed in claim 11, **characterised in that** the assembly strip (6) is secured to the roof covering structure in the area protected from weather by the top member (2) or by the outer covering layer.
13. Flashing system as claimed in claim 1, **characterised in that** it has a cover (5) protecting the connection of the side edges of two adjacent top members (2) against weather, and strips (7) or catch members (7') in the trough (4) before bending out.
14. Flashing system as claimed in claim 1, **characterised in that** the top members (2) have at their side edges arms (8), inclined at an acute angle to the top member (2) surface parallel to the roof slope.
15. Flashing system as claimed in claim 13, **characterised in that** the cover (5), in its part in touch with the arms (8) of the adjacent top members (2) has a shape of the inverted U letter with arms inclined at an acute angle to its basis.

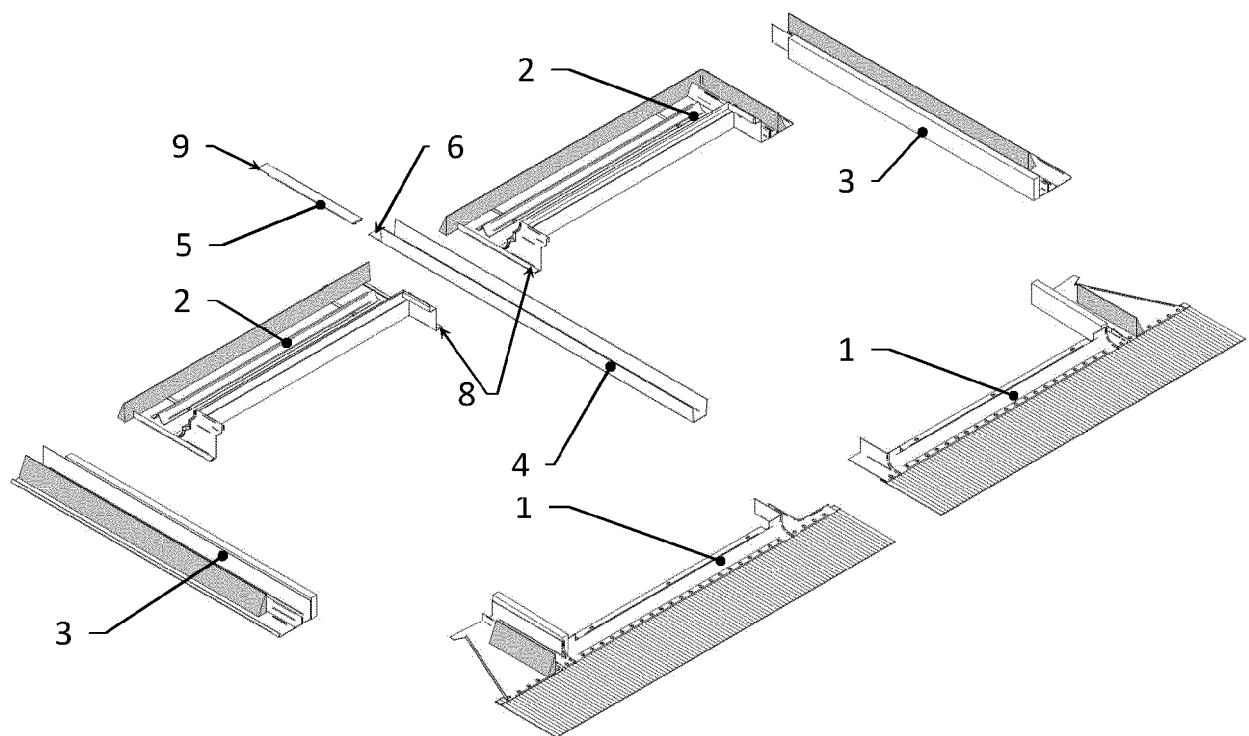


Fig. 1

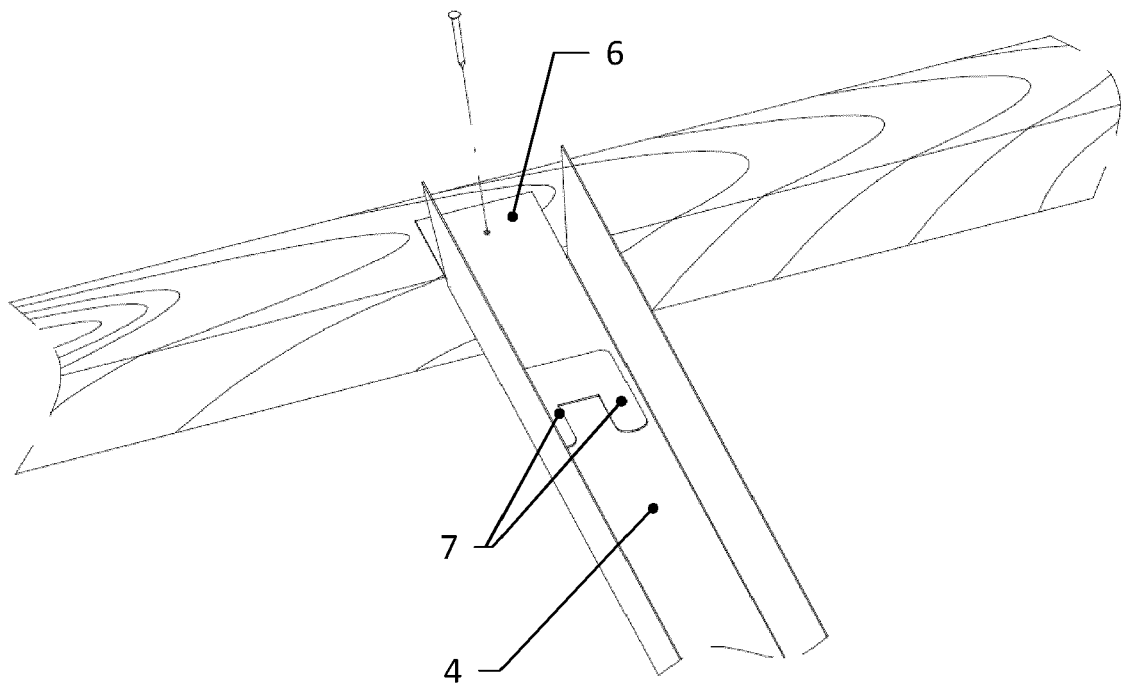


Fig. 2

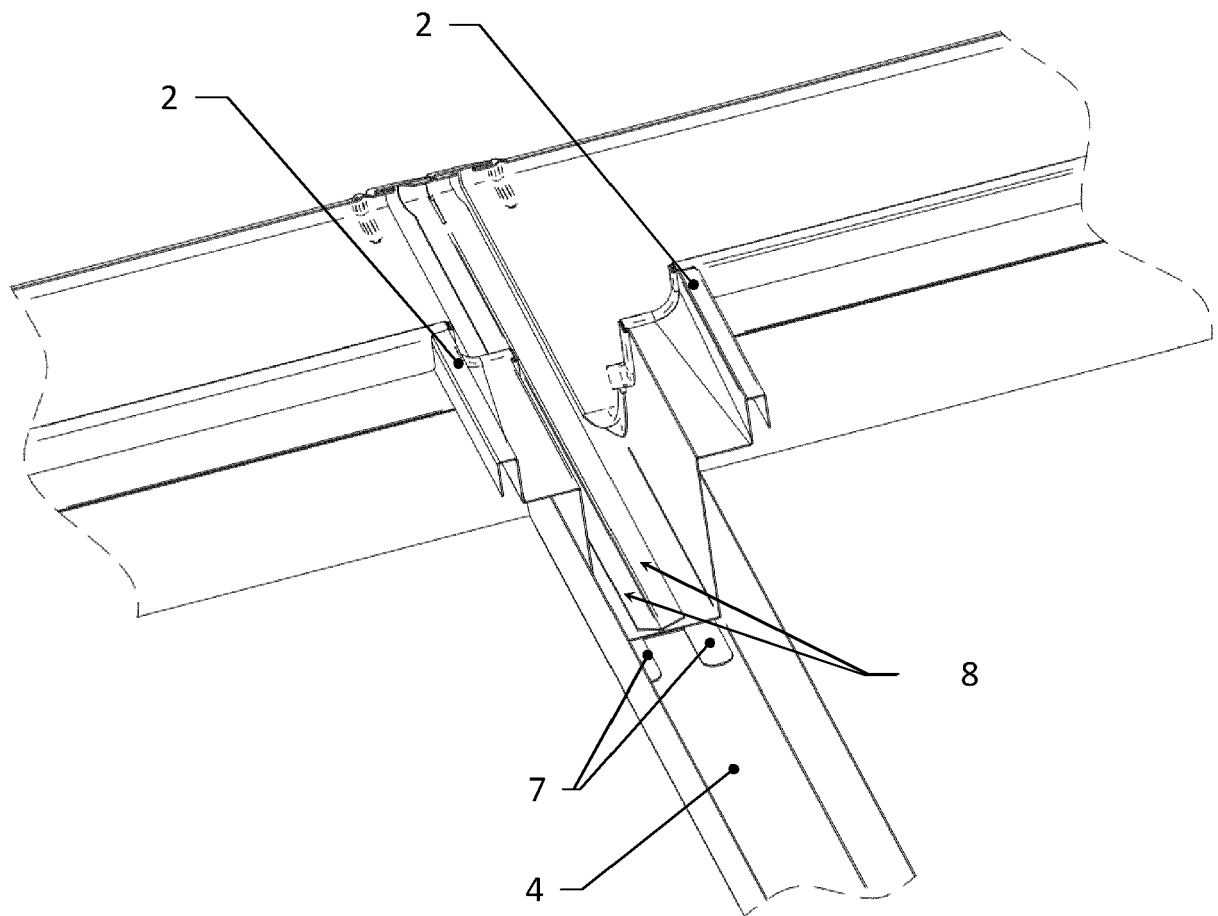


Fig. 3

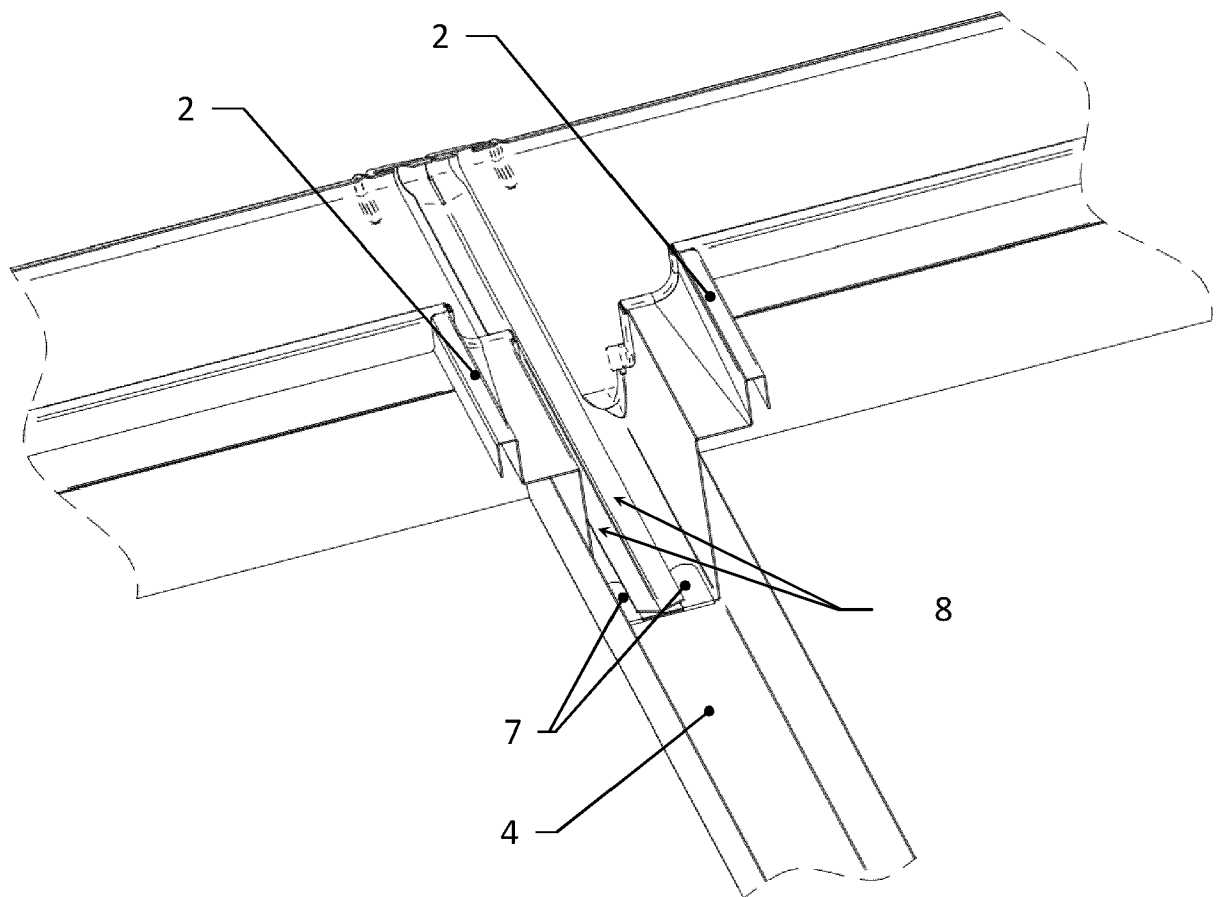


Fig. 4

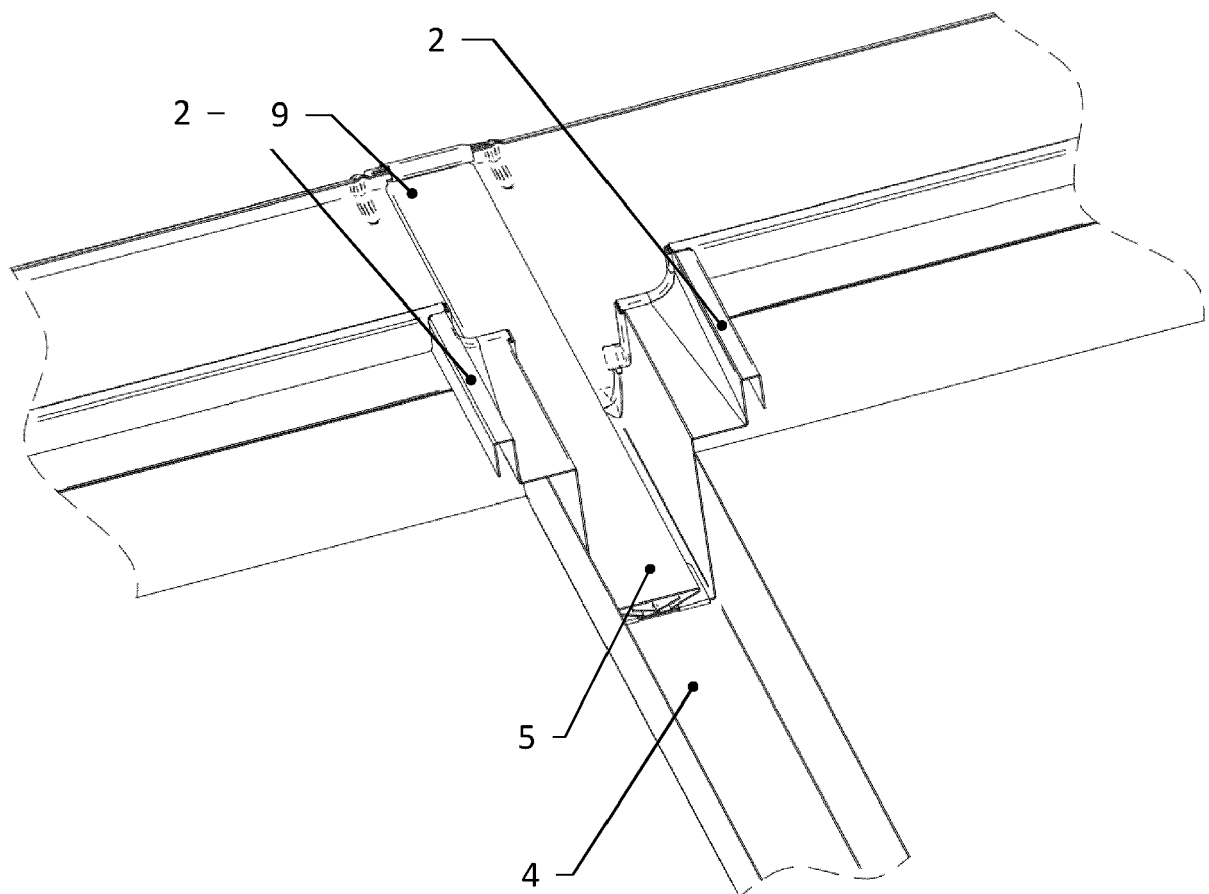


Fig. 5

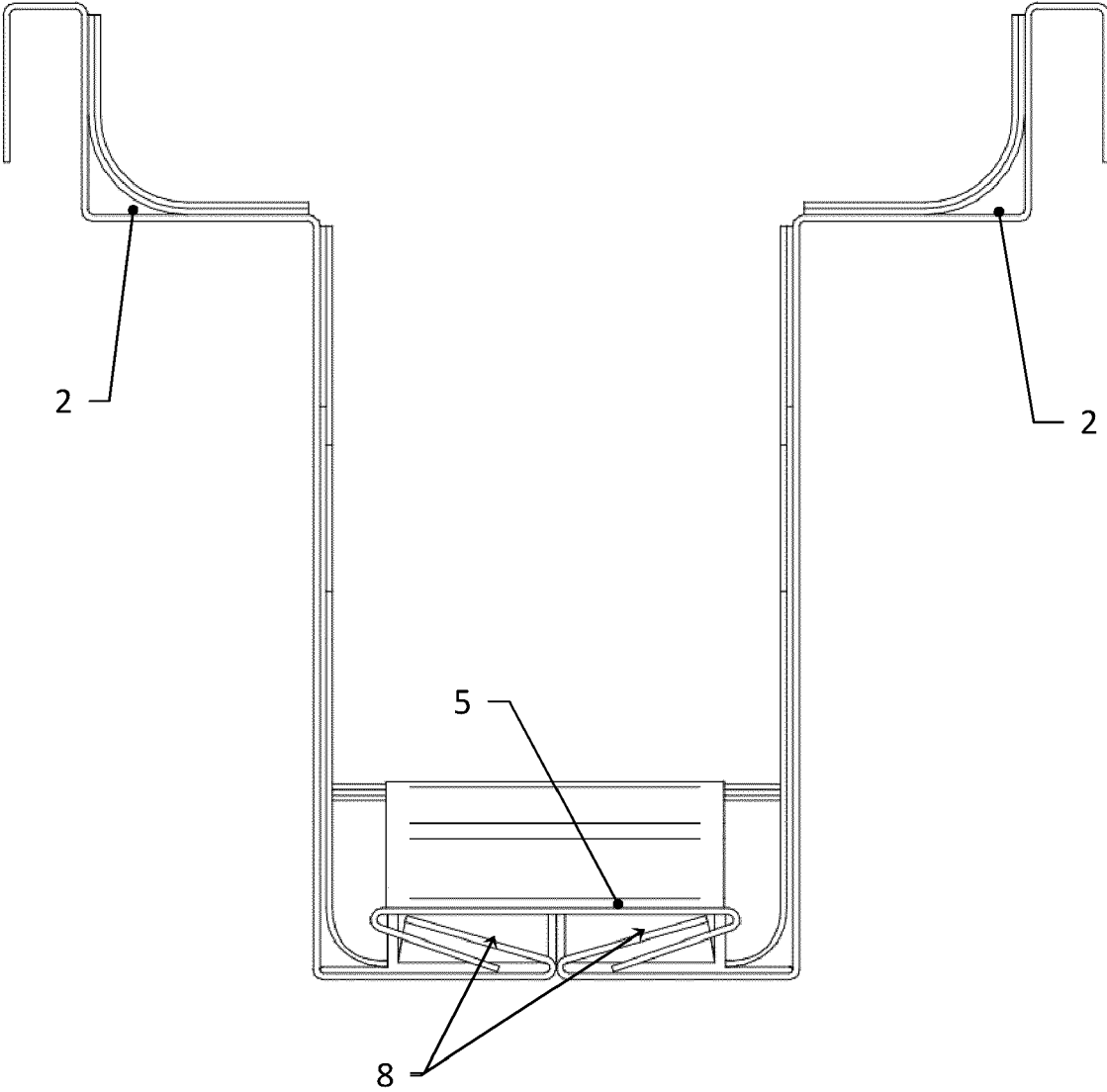


Fig. 6

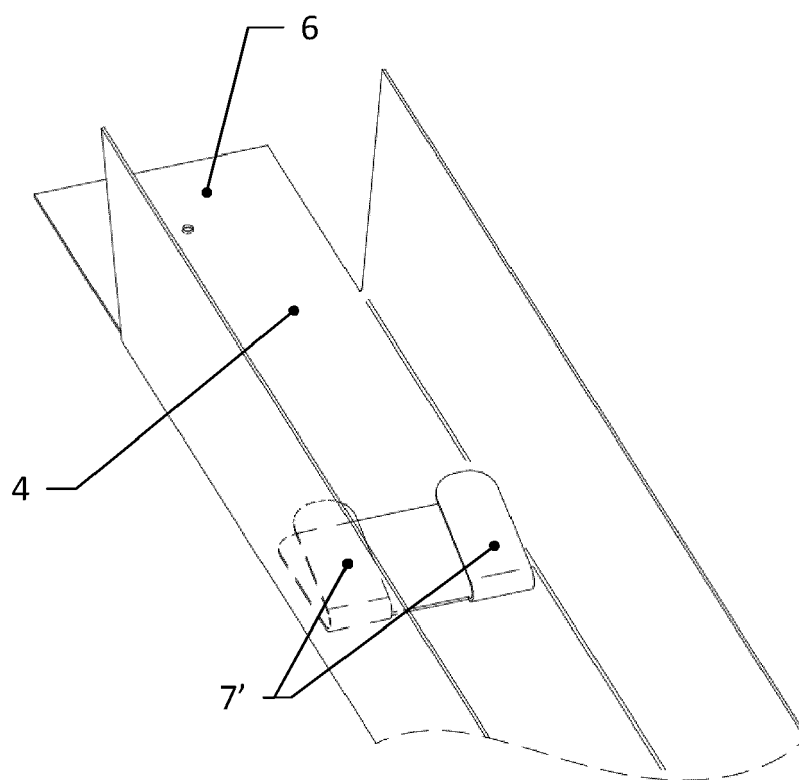


Fig. 7

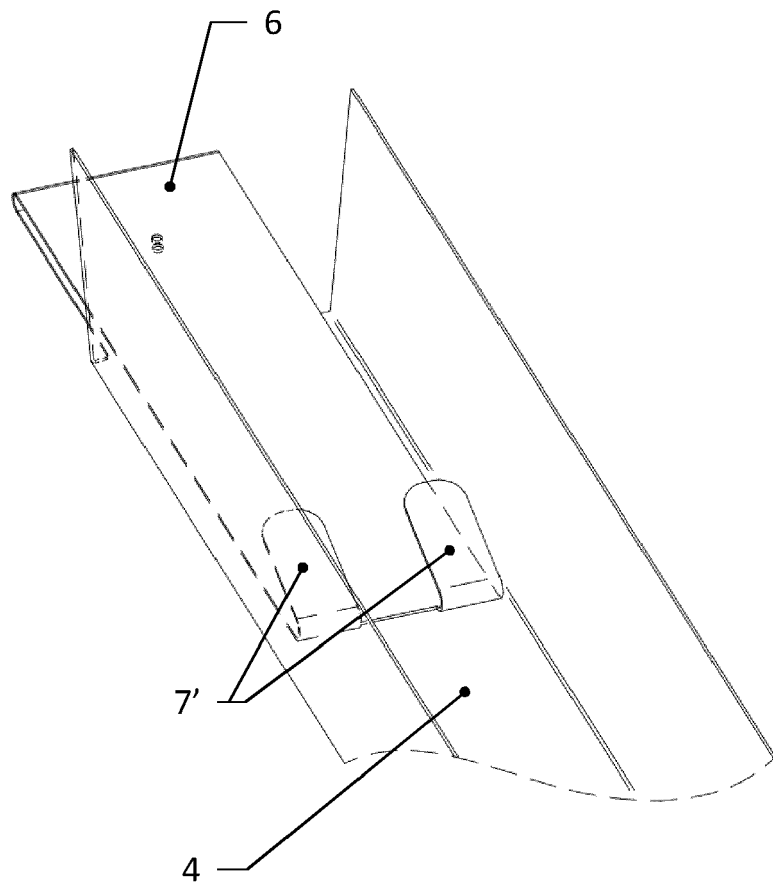


Fig. 8

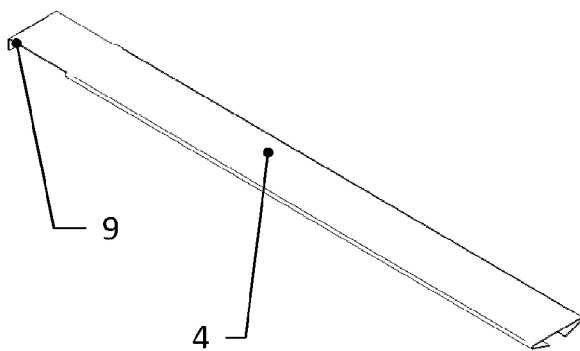


Fig. 9a

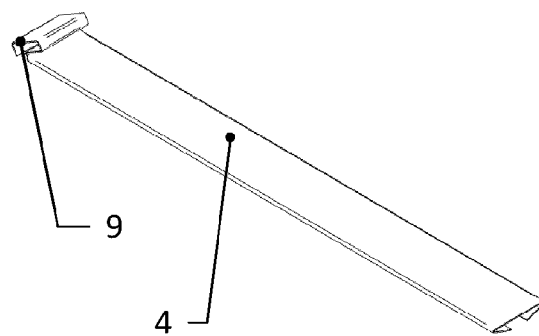


Fig. 9b



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 3203

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2004/055294 A1 (VKR HOLDING AS [DK]; HENRIKSEN JENS-ULRIK HOLST [DK]; FAURHOLDT JESPER) 1 July 2004 (2004-07-01) * page 1, line 3 - line 13 * * page 8, line 24 - page 15, line 12; figures 1-4 * -----	1-15	INV. E04D13/03 E04D13/147
A	DE 32 06 871 C1 (VELUX GMBH BAUZUBEHOER) 1 June 1983 (1983-06-01) * column 2, line 28 - line 34 * * column 3, line 34 - column 6, line 4; figures 1-7 * -----	1-15	
A	WO 2004/055291 A1 (VKR HOLDING AS [DK]; HENRIKSEN JENS-ULRIK HOLST [DK]) 1 July 2004 (2004-07-01) * page 1, line 3 - line 6 * * page 9, line 4 - page 14, line 12; figures 1-7 * -----	1-15	
A	DE 80 00 998 U1 (STEEB CHRISTIAN) 17 April 1980 (1980-04-17) * page 1, line 1 - line 5 * * page 3, line 19 - page 6, line 22; figures 1-6 * -----	1-15	TECHNICAL FIELDS SEARCHED (IPC) E04D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 22 May 2012	Examiner Giannakou, Evangelia
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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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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22-05-2012

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- DE 3206871 C1 [0006]
- WO 03074812 A [0006]