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(54) **PLUG CONNECTOR FOR CONNECTING ENDS OF WINDOW PROFILES**

(57) Plug-in joining member (1) designed to make connections between ends of window frame profiles is formed as an elongated piece with nearly U-shaped cross-section and comprising a bottom wall (2) and side walls (3) adjacent to the bottom wall (2) down its side edges. Side walls (3) of the joining member (1) are provided with friction claws (4), arranged at the both sides of the central line (O) and turned towards the central line (O) of the joining member (1). The joining member (1) also has at least one central stop (5, 5'). Cam radiuses R_1, R_2, R_3, R_4 in working portions (4A) of each subsequent friction claw (4) on a specific side wall (3) gradually increase from each far end of the joining member (1) towards the central line (O) of the joining member (1), whereas tips (7) of working portions (4A) of friction claws (4), after having them bent out to working positions, are arranged at the same elevations above the bottom wall (2).

Preferably, uniform stiffness of all friction claws (4) is maintained and tips (7) of working portions (4A) of friction claws extend outwardly to the same distance with reference to the longitudinal central axis (O_1) of the joining member (1).

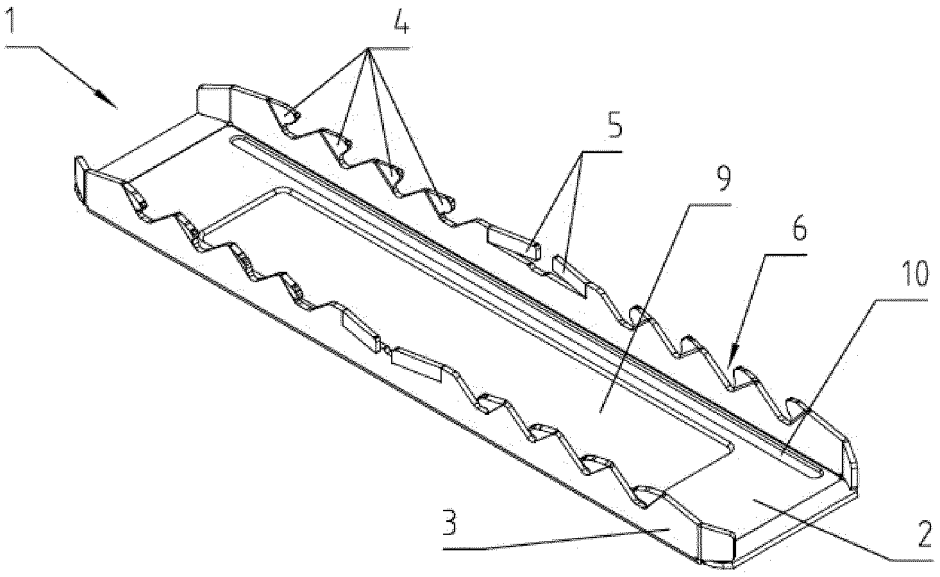

Fig. 1

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Description

Subject of the invention

[0001] The invention refers to a plug-in joining member designed to make connections between ends of profiles for window frames, in particular hollow profiles for frames of insulating struts for glass panels.

State of the art

[0002] The patent description PL 205223 B1 discloses a plug-in joining member for hollow profiles, in particular for strut frames or ladder insulating profiles for glass panels, where the joining member has a formed body with the U-shaped cross-section. The body contains a bottom wall, also referred to as the central wall, together with two side walls adjacent thereto provided with a plurality of side stopping members shaped as friction claws arranged one after another in line with the direction of hollow profile insertion. At least some of the friction claws on the both side walls is arranged crosswise to the direction of insertion with an offset and with some space between them.

[0003] In turn, the description of the utility model PL 65674 Y1 discloses an U-shaped straight joining member for sandwich-glazed glass panels, where the joining member comprises a central wall and two side walls with springy wedged latches arranged in side walls and central stopping latches that are bent outwardly of side walls planes. The bending offsets outwards the side walls planes are different for springy wedged latches and central stopping latches and gradually increase for each subsequent springy wedged latch being located closer to the central line of the joining member, where the bending offset outwards the side wall planes is the largest for central stopping latches. The length of the springy wedged latches located closest to the front plane exceeds the lengths of other spring wedged lathes. For needs of that description the central line of the implement is understood as a straight line perpendicular to the longitudinal central axis of the joining member and passing its mid-length point.

[0004] Moreover, the document EP 2 281 994 T3 discloses a plug-in joining member for hollow profiles of spacing frames or for inner muntin bars in glass panels made of thermal insulating glass. Preferably, the joining member has an U-shaped cross-section with a central bridge and side bridges, where stops for limiting the insertion range are provided nearby side bridges as well as it has one or more flexible, springy holding members. One holding member of higher stiffness as compared to other holding members is arranged next to the insertion limiters nearby the side bridge.

Aim of the invention

[0005] The invention is intended to develop a design for a plug-in joining member so that to assure reliable and efficient fixation of the joining member inside a profile channel.

Essence of the invention

[0006] The invention is described with details in the independent Claim 1 and refers to a plug-in joining member for connecting ends of window profiles. The plug-in joining member is formed as an elongated piece with an U-shaped cross-section and comprises a bottom wall and side walls adjacent to the bottom wall down its side edges, whereas the joining member has friction claws, where the friction claws at the both sides are turned towards the central line of the joining member. Moreover, the joining member comprises at least one central stop. The essence of the invention consists in the fact that the cam radius for the working portion of each subsequent friction claw on each specific side wall gradually increase down the both direction from far ends of the joining member towards its central line, whilst tips of working portions on friction claws after having the said friction claws bent out to their working positions are arranged at the same elevation above the bottom wall.

[0007] Preferably, the same stiffness is maintained for all friction claws, which enables uniform adhesion of all friction claws and prevents the joining member from undesired deformation of its side walls.

[0008] It is also beneficial when friction claws protrude outwardly to the same distance from the longitudinal central axis of the joining member, which also contributes to uniform adhesion of all friction claws.

[0009] In addition, it is also desirable when elevation of side wall in the concaved areas upstream each friction claw gradually increases from the joining member far ends towards its central line. Therefore the joining member forms a structure of a beam with principally constant bending strength.

[0010] An additional benefit is achieved when the depth of concavities upstream the friction claws, understood as the distance between tips of friction claws after having them bent out and concave bottoms, measured on the projection onto the plane defined by the bottom wall of the joining member, is highest for friction claws located next to the joining member ends and next to its central line. Such a design makes it possible to adjust stiffness of friction claws so that the stiffness of friction claws would be the same both for the ones nearby the joining member ends and the ones located in between.

[0011] The most beneficial embodiment of the invention assumes that the joining members have four friction claws with the same stiffness provided on each side wall between the end of the joining member and its central line.

[0012] In addition, one longitudinal central beading and two side beadings are desirable in the bottom wall of the joining member, where side beadings extend at each side of the central beading and the central beading bottom

extends lower than the bottoms of side beadings.

[0013] If so, it is preferred that the central beading is deeper than side beadings.

[0014] It is also justified that side beading are longer than the central beading.

[0015] Yet another beneficial embodiment of the invention assumes that friction claws are provided on side walls down longitudinal side beadings.

[0016] Owing to differentiated cam radius of each friction claw the joining member according to the present invention makes it possible that each subsequent friction claw inserted into the channel of a hollow profile makes a wider scratch than the preceding claw. It mitigates or even eliminates an effect of the joining member slip during its insertion. As a consequence, fixation of the joining member inside a hollow profile is more reliable and durable. The effect of fastening is more reliable since each subsequent friction claw has a larger cam radius at the same height so that it enters between edges of a scratch made by the previous friction claw. Principally equal stiffness of all friction claws leads to uniform holding action of all friction claws, and no friction claw weakens the fastening effect of an adjacent one. The uniform stiffness of friction claws with various cam radiuses is achieved by differentiation of side wall height in concaved areas upstream each subsequent friction claw as well as differentiation of concavity depth upstream each friction claw. As a consequence, all friction claws act with the same force with no weakening of the effect from an adjacent friction claws. Moreover, for the best effect all the friction claws should extend to the same distance with respect to the longitudinal central axis of the joining member. In addition, application of beadings with various lengths and various elevation of their bottoms, in particular beading with various depth leads to much less stringent requirements to the tolerance for the joining member height. Furthermore, arrangement of friction claws down side beadings in the joining member bottom enables easy insertion of joining members into profiles.

Description of drawing

[0017] The invention is presented in its example embodiments on the accompanying drawing, wherein:

Fig. 1 presents the joining member according to the present invention in the top axonometric view,
Fig. 2 presents a top view of the joining member,
Fig. 3 presents a side view of the joining member,
Fig. 3A presents a detail from Fig. 3,
Fig. 4 presents the end-side fragment of the joining member in its side view prior to having the friction claws bent out,
Fig. 5 presents a front view of the joining member,
Fig. 6 presents a side view of another embodiment of the joining member,
Fig. 7 presents a top view of the joining member according to the embodiments from Fig. 6,
Fig. 8 presents the front view of the joining member according to the embodiments from Fig. 6,
Fig. 9 presents a bottom axonometric view for the joining member according to the embodiments from Fig. 6, and
Fig. 10 presents a detailed view to the side wall of the joining member.

Embodiments of the invention

[0018] Plug-in connecting member 1 for connecting ends of window frame profiles is formed as an elongated piece with an U-shaped cross-section. The joining member 1 comprises a bottom wall 2 and side walls 3 adjacent to the bottom wall down its side edges. Side walls 3 of the joining member 1 are provided with friction claws 4, arranged at the both sides of the central line O and turned towards that central line O. The central line is understood, similarly to the state-of-the-art, as a line extended perpendicularly to the central longitudinal axis of the joining member and positioned in the half-length of the joining member. According to the embodiment presented in Fig. 1 to Fig. 5 the joining member 1 has a central stop implemented as central limiters 5 arranged on each side wall 3 within the region of the central line O. Moreover, according to this embodiment, the joining member 1 has four friction claws 4 on every side wall 4 and on the both sides of the central line O, which makes sixteen friction claws 4 altogether. The exact number of friction claws may vary for specific embodiments of the joining member, but the minimum number of friction claws, indispensable for reliable operation of the joining member is two friction claws on every side wall at the both sides of the central line.

[0019] Cam radiuses R_1, R_2, R_3, R_4 in working portions of each friction claw 4 on a specific side wall 3 before having them bent out gradually increase from each end of the joining member 1 towards the central line O of the joining member 1. For instance, these radiuses may equal: R_1 = 0.23mm, R_2= 0.33mm, R_3=0.43mm and R_4=0.53mm for one embodiment of the invention or R_1 =0.08 mm, R_2=0.21mm, R_3=0.35m and R_4=0.49mm for another embodiment.

[0020] The working portion 4A of each friction claw 4 is understood as the portion that remains in contact with an inner surface of a frame profile to be joined and that makes a scratch in that profile.

[0021] For the embodiments disclosed herein the tips 7 of working portions 4A in friction claws 4, after having been bent from the manufacturing positions to the working positions, are aligned at equal elevations above the bottom wall 2. At the same time the tips 7 of working portions 4A in friction claws 4 extent outside the joining member 1 to the same distance with respect to the longitudinal central axis O_1 of the joining member 1. It is the most beneficial embodiment of the joining member 1, however other configurations of friction claws are also possible within the scope of the invention.

[0022] In general, stiffness of friction claws depend on many factors, not only on their shapes but also on height of the side walls 3 in the concaved areas 6 upstream a specific friction claw 4 as well as on depth of these concavities 6. For the invention embodiment that is presented herein the height values h_1, h_2, h_3 and h_4 of the side wall 3 in the concaved areas 6 upstream each friction claw gradually increase from each far end of the joining member 1 towards the central line O of the joining member 1.

[0023] Furthermore, the depths l_1 and l_4 of concavities 6 upstream each friction claw 4, measured on the projection onto the plane defined by the bottom wall of the joining member 1 between the tip 7 of each friction claw 4 after having it bent out and the bottom point 8 of the concavities 6 are the deepest for the friction claws 4 located close to the joining member 1 ends and for the ones that are the most adjacent to the central line O for each side wall 3. The bottom points 8 of each concavity 6 are understood as those points of concavities 6 that are within the closest distances to the respective end of the joining member 1. In particular, the depths l_1 and l_4 of the outermost friction claws 4 exceed the depths l_2 and l_3 for the mid-length friction claws 4. Specifically, $l_2 = l_3$. The depths l_1 and l_4 may be mutually equal or not but beneficially they exceed the depths l_2 and l_3. As consequence, the uniform stiffness of all friction claws 4 is maintained after having them bent out to the working position.

[0024] The bottom wall 2 comprises one longitudinal central beading 9 as well as two longitudinal side beadings 10. The bottom 11 of the central beading 9 is arranged lower than bottoms 12 of side beadings 10. The example offset b, understood as the difference between vertical positions of bottoms 11 and 12, is 0.1 mm. In particular, the central beading 9 is deeper than the side beadings 10.

[0025] Furthermore, lengths of side beadings 10 exceed the length of the central beading 9, which is shown in details in Fig. 2, whilst all friction claws 4 provided on side walls 3 are deployed down the length of side beadings 10. For other embodiments that are not depicted in drawings, friction claws can be also deployed outside the area defined by side beadings.

[0026] In another embodiment of the invention that is disclosed in Fig. 6 to Fig. 9 a different central stop is applied, in particular a central pin 5' is shaped on side walls 3 instead of central limiters 5.

[0027] Fig. 10 presents a side view of a fragment of the side wall 3 of the joining member 1 after having the friction claws 4 bent out to their working positions. As one can easily see, all tips 7 of working portions 4A in friction claws 4 are arranged down a single straight line O_2, at the same elevation above the bottom wall 2 of the joining member 1. Since cam radiuses gradually increase, so that $R_4 > R_3 > R_2 > R_1$, the chord length - widths of working portions 4A of friction claws 4 increase as well: $s_4 > s_3 > s_2 > s_1$. These chords define the contact areas with inner surfaces of frame profiles, which is reflected in the width of scratches made by friction claws on these surfaces: $e_4 > e_3 > e_2 > e_1$. Owing to the foregoing design with the aforementioned geometrical relationships the resistance forces Z_2, Z_3 and Z_4 against pulling the joining member 1 with the force of F are respectively higher, which enables high reliability and efficiency of connections between frame profiles with the use of joining members 1.

Reference numbers:

[0028]

1 - plug-in joining member,

2 - bottom wall

3 - side walls

4 - friction claws

4A - working portions of friction claws

5 - central stops

5' - central stopping pin

6 - concavity

7 - tip of the working portion of the friction claw

8 - concavity bottom

9 - central bead

10 - side beads

11 - bottom of the central bead

12 - bottom of side beads

O - central line

O_1 - longitudinal central axis

O_2 - straight line drawn thorough tips of working portions on friction claws

R_1,...R_4 - cam radiuses for working portions of friction claws

h_1,..., h_4 - elevations of concavity bottoms on side walls

l_1,..., l_4 - depths of concavities

s_1,..., s_4 - chords to define working parts of friction claws

e_1,..., e_4 - widths of scratches made by each specific friction claw in inner surfaces of frame profiles

F - force, necessary to pull a joining member from a frame profile

Z_1,...Z_4 - resistance force against the pulling force F

b - offset between levels of beading bottoms 11 and 12

Claims

1. A plug-in joining member (1) for connecting ends of window profiles, formed as an elongated piece with an U-shaped cross-section, having a bottom wall (2) and side walls (3) adjacent to the said bottom wall (2) down its side edges, where the joining member (1) has friction claws (4) provided on side walls (3) on both sides of the central line (O) and turned towards the said central line (O) of the joining member (1), and having at least one central stop, **characterized in that** cam radiuses (R_1, R_2, R_3 and R_4) of working portions (4A) for each subsequent friction claw (4) on each specific side wall (3) gradually increase down the both directions from far ends of the joining member (1) towards its central line (O), whilst tips (7) of working portions (4A) on friction claws (4) after having the said friction claws (4) bent out to their working positions are arranged at the same elevation above the bottom wall (2).

2. The joining member according to Claim 1, **characterized in that** uniform stiffness of all friction claws (4) is maintained.

3. The joining member according to Claim 1 or 2, **characterized in that** tips (7) of working portions (4A) of friction claws (4) extend outwardly to the identical distance with respect to the longitudinal axis (O_1) of the joining member (1).

4. The joining member according to any of the Claims 1 to 3, **characterized in that** elevation (h_1, h_2, h_3 and h_4) of the side wall (3) in the areas of concavities (6) and upstream each subsequent friction claw (4) provided on every specific side wall (3) gradually increase down the direction from the both far ends of the joining member (1) towards its central line (O) of the joining member (1).

5. The joining member according to any of the Claims 1 to 4, **characterized in that** the depths (l_1,l_4) of concavities (6) upstream each friction claw (4), measured on the projection onto the plane defined by the bottom wall (2) of the joining member (1) between the tip (7) of each friction claw (4) after having it bent out and the bottom point (8) of the concavities (6) are the deepest for the friction claws (4) located close to the joining member (1) far ends and for the ones that are the most adjacent to the central line (O) for each side wall (3).

6. The joining member according to any of the Claims 1 to 5, **characterized in that** four friction claws (4) with uniform stiffness are provided on each side wall (3) within the area from the respective far end of the joining member (1) to its central line (O).

7. The joining member according to any of the Claims 1 to 6, **characterized in that** the bottom wall (2) comprises one longitudinal central beading (9) and two longitudinal side beadings (10) arranged at the both sides of the central beading (9), where the bottom (11) of the central beading (9) extends lower than bottoms (12) of side beadings (10).

8. The joining member according to Claim 7, **characterized in that** the central beading (9) is deeper than side beadings (10).

9. The joining member according to Claims 7 or 8, **characterized in that** lengths of side beadings (10) exceed the length of the central beading (9).

10. The joining member according to any of the Claims 7 to 9, **characterized in that** friction claws (4) provided on side walls (3) are deployed down the length of side beadings (10).

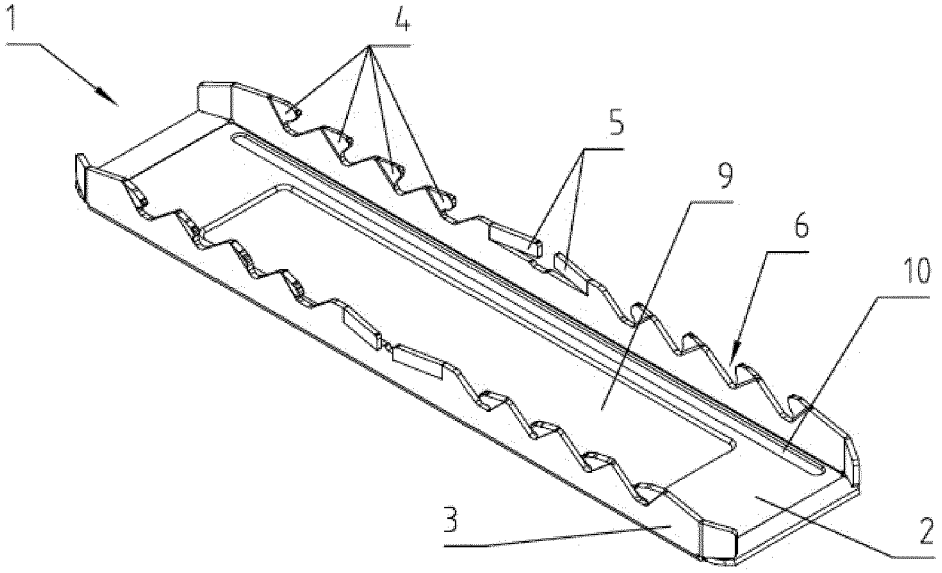

Fig. 1

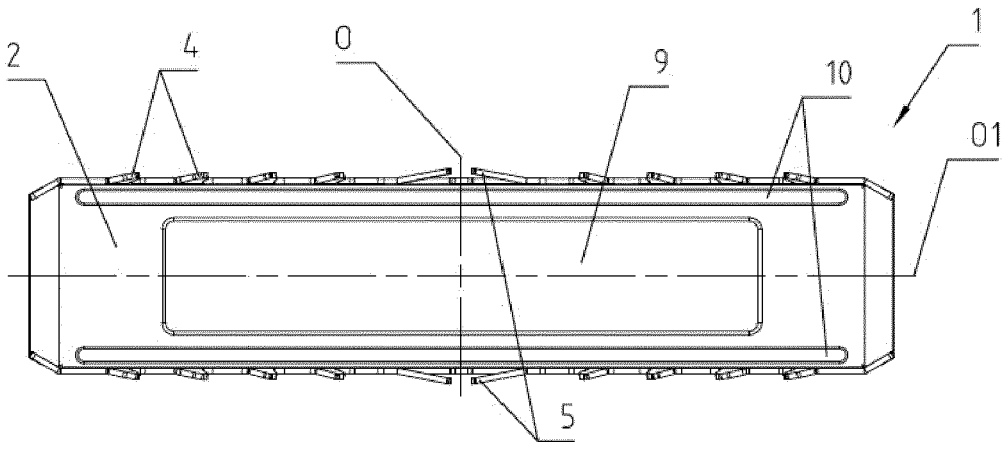

Fig. 2

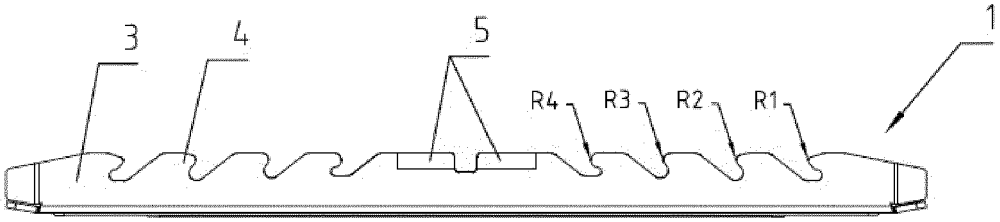

Fig. 3

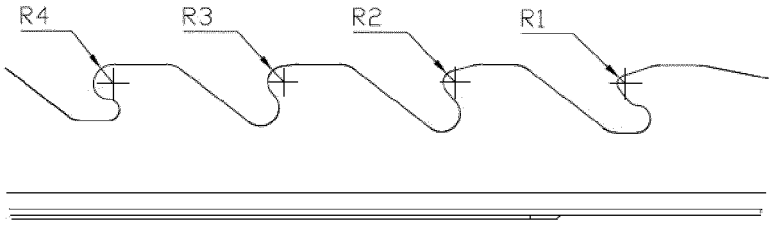

Fig. 3A

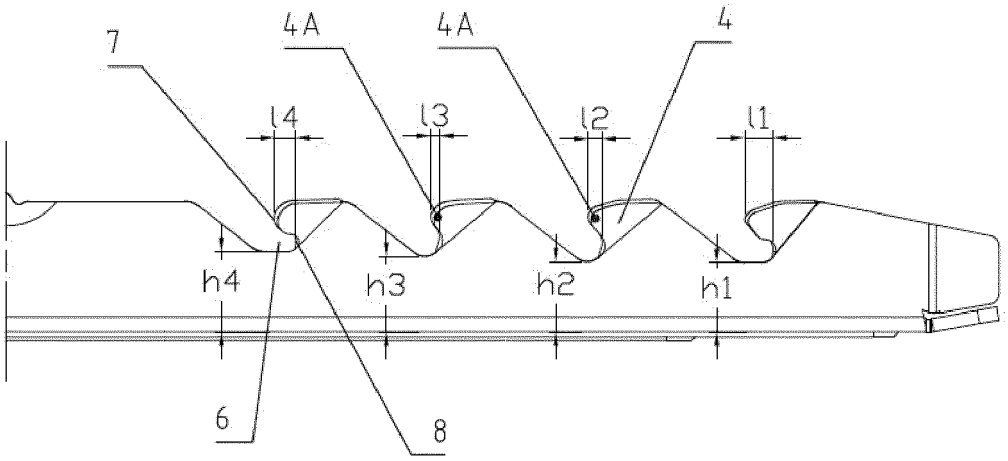

Fig. 4

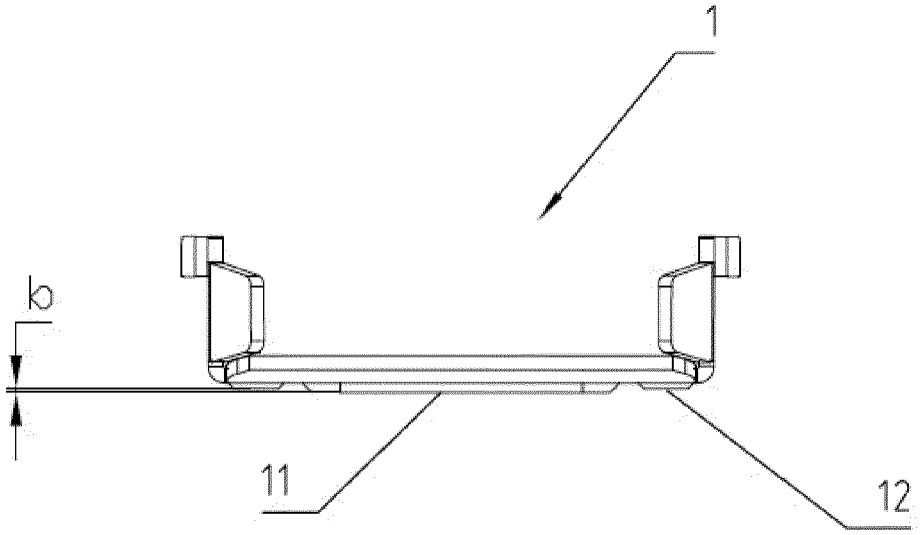

Fig. 5

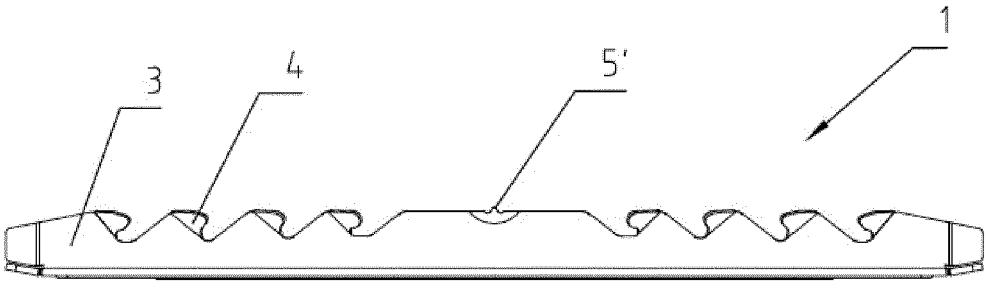

Fig. 6

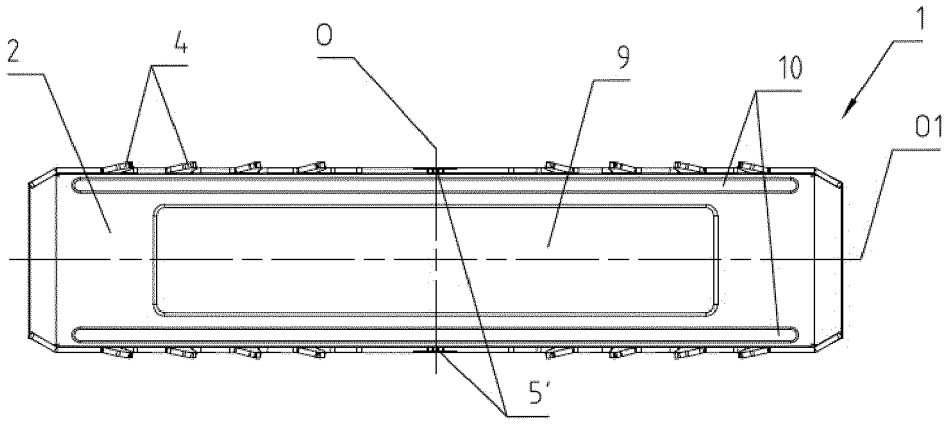

Fig. 7

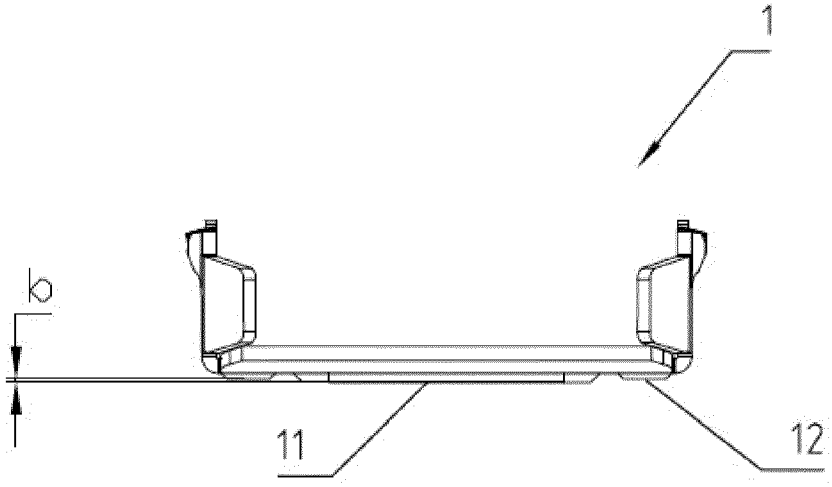

Fig. 8

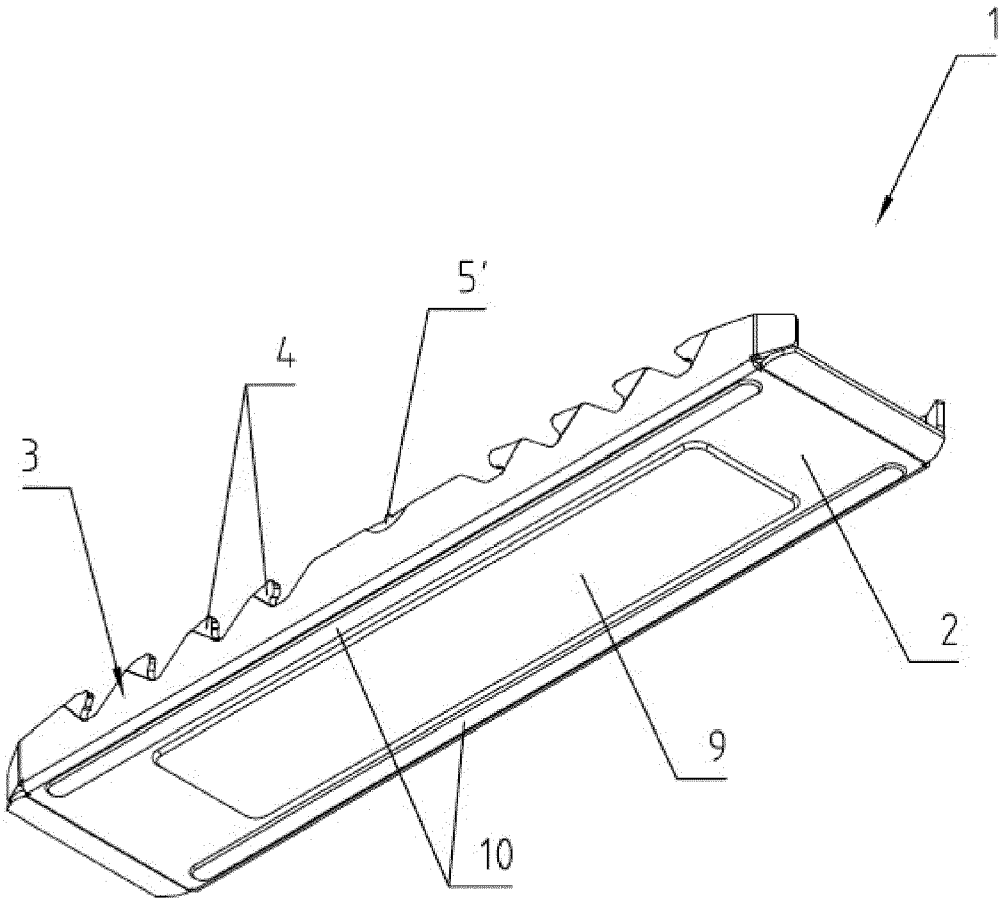

Fig. 9

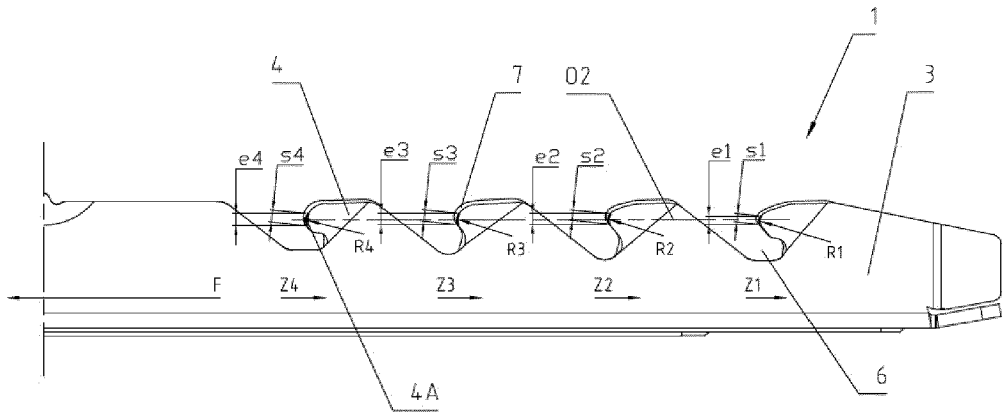

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 6464

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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Y	* figures 3,5 *	4	
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A	DE 20 2014 104222 U1 (KRONENBERG MAX [DE]) 11 December 2015 (2015-12-11) * figure 2 *	4	

TECHNICAL FIELDS SEARCHED (IPC)

E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 September 2020	Verdonck, Benoit

CATEGORY OF CITED DOCUMENTS

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17-09-2020

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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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- PL 65674 Y1 **[0003]**
- EP 2281994 T3 **[0004]**