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(54) **Window sash assembly with corner fitting**

(57) A window sash assembly further comprising a corner fitting (10) which connects and holds together two abutting sash profile elements (1a, 1b), said corner fitting comprising a first and a second flange (11, 12) which are arranged perpendicular to each other and to the plane of the window sash assembly and which are fastened to the two abutting sash profile elements (1a, 1b). The window sash assembly is characterized in that said corner fitting (10) further comprises a third and a fourth flange (13, 14) where the third flange (13) is arranged to extend perpendicularly from the first flange (11) and where the fourth flange (14) is arranged to extend perpendicularly from the second flange (12) and where the third and fourth flanges (13, 14) are directly connected together and where the third and fourth flanges (13, 14) are arranged on the outside of the window pane such that the third and fourth flanges (13, 14) overlap the outside surface of the window pane.

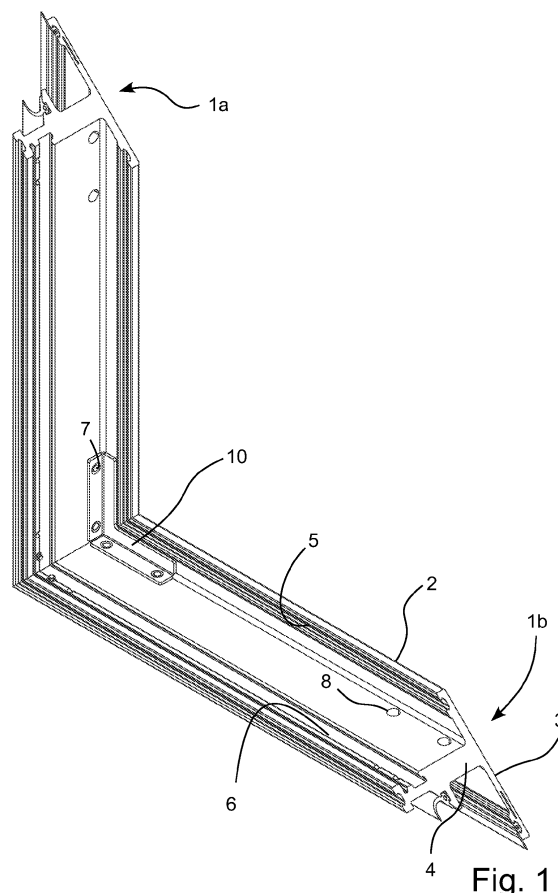


Fig. 1

Description

[0001] The current invention relates to a window sash assembly comprising four window sash profile elements arranged in a rectangular shape and abutting each other at the corners of the window sash assembly and a window pane arranged inside the window sash, and where the window sash assembly further comprises a corner fitting which connects and holds together two abutting window sash profile elements, said corner fitting comprising a first and a second flange which are arranged perpendicular to each other and to the plane of the window sash assembly and which are fastened to the two abutting sash profile elements.

Description of related art

[0002] When constructing window sash assemblies, it is typical to fasten the ends of the window sash profiles together where they abut each other at the corners of the window sash assembly. In most cases this is done to increase the strength of the window sash assembly.

[0003] The connection between abutting sash profile elements can be done in different ways. In some cases, screws are used to screw one profile element to another profile element. This is commonly the case with wooden sashes. In other cases, for example with aluminium frames, a corner fitting in the shape of a 90 degree elbow bracket can be fastened to two abutting profile elements. This could be done for example by pressing a metal corner fitting into a channel in each profile element and then snapping protrusions into recesses in the profile elements to hold the corner fitting in place. More recently, profile elements have started to be glued together. This is common with profile elements made from composite materials. Many other methods are available in the prior art as will be known to the person skilled in the art. However, in certain cases, the prior art methods of connecting abutting profile members have significant drawbacks. For example, gluing can be complicated and messy, corner fittings can either be too big and bulky or not strong enough, etc... For example the corner fitting of US2703159 discloses a bulky fitting which requires a channel portion in the sash profile element underneath the window pane which creates a sash with a very wide profile.

Summary of the invention

[0004] It is therefore a first aspect of the current invention to provide a window sash assembly where the corners are fastened together with a corner fitting which is strong and does not occupy a large amount of space.

[0005] A second aspect of the current invention is to provide a window sash assembly which is more resistant against break-in attempts.

[0006] These aspects are solved in part by providing a sash assembly as mentioned in the opening paragraph

where said corner fitting further comprises a third and a fourth flange where the third flange is arranged to extend perpendicularly from the first flange and where the fourth flange is arranged to extend perpendicularly from the second flange and where the third and fourth flanges are directly connected together and where the third and fourth flanges are arranged on the outside of the window pane such that the third and fourth flanges overlap the outside surface of the window pane.

[0007] In this way, the arrangement of the third and fourth flanges of the corner fitting provide a large amount of strength to the corner fitting while occupying only a small amount of space. Furthermore, due to the fact that the third and fourth flanges overlap the window pane, the window sash assembly is made more resistant against break-in attempts.

[0008] It should be noted that in the embodiments shown in the figures, the third and fourth flange extend from the first and second flanges respectively and in towards the centre of the window sash assembly. However, in other embodiments, the third and fourth flanges could extend away from the centre of the window sash assembly. It should be noted that the phrase "towards the centre of the window sash assembly" should be interpreted in this specification as a vector direction which points from the periphery of the window assembly towards the centre of the window assembly and which is located on a plane which is parallel with the plane of the window assembly. Likewise the phrase "away from the centre of the window sash assembly" should be interpreted as being a vector direction opposite to the above described vector direction. It will be clear to the person skilled in the art, that each of the four profile elements will have their own vector pointing towards the centre of the window assembly and a vector pointing away from the centre of the window assembly.

[0009] Additional aspects of the invention are presented in the dependent claims.

[0010] It should be emphasized that the term "comprises/comprising/comprised of" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof. For example in the main claim, it is stated that the window assembly comprises a corner fitting. However, it should be clear to the person skilled in the art that the window assembly could comprise more than one corner fitting. In fact in most cases, the window assembly will comprise four corner fittings, one arranged at each corner.

Brief description of the drawings

[0011] In the following, the invention will be described in greater detail with reference to embodiments shown by the enclosed figures. It should be emphasized that the embodiments shown are used for example purposes only and should not be used to limit the scope of the

invention.

Figure 1 shows a detailed perspective view of the inside of one corner of a window sash showing a corner fitting.

Figure 2 shows a detailed perspective view of the outside of the corner shown in figure 1.

Figure 3 shows a side view of the corner of figure 1.

Figure 4 shows a front view of the corner of figure 1.

Figure 5 shows a perspective view of one embodiment of a corner fitting.

Figure 6 shows a front view of the corner fitting of figure 5.

Figure 7 shows a second perspective view of the corner fitting of figure 5.

Figure 8 shows a cross section view as defined by the line VIII-VIII in figure 4 but before the screws have been inserted into the collars of the corner fitting.

Figure 9 shows a cross section view similar to figure 8, but after the screws have been inserted into the collars of the corner fitting.

Detailed description of the embodiments

[0012] Figures 1-4 show different views of one corner of a small square window sash assembly. The window sash is comprised of four sash profile elements whereof only two elements 1a, 1b are shown in the figures. The ends of the profile elements are in this embodiment cut at 45 degree angles so that the profile elements can be assembled into a mitre joint as shown in figures 1-4.

[0013] In this embodiment, the sash profile elements have a T-shaped cross section comprising a first flange 2, a second flange 3 and a third flange 4. In this embodiment, the first flange 2 and the second flange 3 are coplanar and form the top portion of the T shaped cross section. The third flange 4 is arranged perpendicular to the first and second flanges and forms the trunk of the T-shaped cross section. It could also be said that the cross section shown in figures 1-4 comprises an L-shaped cross section where the first and third flanges make up the L-shape.

[0014] In this embodiment, it can furthermore be mentioned that the profile elements are formed via a pultrusion process where approximately 80% of the material is comprised of glass fibres arranged along the longitudinal axis of the profile elements and approximately 20% of the material is comprised of a polyurethane matrix. This type of profile element is characterized by having

great strength in the longitudinal direction, but by having a certain amount of weakness in directions which are perpendicular to the longitudinal direction. The advantages and drawbacks of such materials will be known to the person skilled in the art.

[0015] In figures 1-4, a window pane is not shown. However, in the assembled window sash a window pane would be arranged inside the sash profile members. In the example shown in figures 1-4, the window pane would be arranged such that its outer surface would face the first flange 2 of the profile element and its edge would face the third flange 4. A seal (not shown) would be inserted into the groove 5 and the outer surface of the window pane would press up against this seal. The window pane would be held in place by a glazing bead (not shown) which would be snapped into the groove 6 on the third flange 4 of the profile element.

[0016] Figures 1-4 also show a corner fitting 10 which is provided to fasten the abutting profile members 1 a, 1 b to each other and to provide strength to the connection. The corner fitting will be described in more detail with regards to figures 5-9. However, as can be seen from figures 1-4, the corner fitting is placed in the corner of the profile member which is located between the first 2 and third 4 flanges, i.e. in the L-shaped cross section as mentioned earlier on. The corner fitting is fastened to the third flanges 4 of the profile members with screws 7. The screws are inserted into holes 8 made in the third flanges from the sides of the third flanges which are opposite to the sides on which the corner fitting is mounted (see figure 8). The screws are then tightened by screwing them into holes 15 in the corner fitting (see figure 9). In this embodiment, the screws are self-tapping screws which cut threads into the holes in the corner fitting as will be described in more detail later on in this specification. However, it could also be imagined that the screws were machine screws which were screwed into threads in the holes in the corner fitting.

[0017] It can be noted that a small metal angle bracket 9 is also mounted to the third flanges 4 of the two abutting sash profile elements and offset from the corner fitting. It can be seen that in this embodiment, the bracket 9 is mounted to the "outside" surface of the third flange, i.e. on the side of the flange which is opposite to the side on which the corner fitting is fastened. This metal angle bracket 9 further increases the strength of the corner. In particular it can be noted that the corner fitting 10 provides strength against breaking the two profiles apart from each other when for example applying forces which are perpendicular to the profile elements and parallel to the plane of the window. The bracket 9 on the other hand, together with the corner fitting increases the torsional stiffness of the corner connection, i.e. for forces which attempt to twist the profile elements about their longitudinal axes. In order to increase this torsional stiffness as much as possible, the bracket 9 and the corner fitting 10 are placed as far apart from each other as possible. Furthermore, it should be noted that while it would be possible to combine

the bracket 9 and the corner fitting 10 into a single bracket/fitting, this would not be desirable as it would increase the chances of creating a thermal bridge at the corner. By providing two separate brackets, i.e. the metal bracket 9 and the metal corner fitting 10 offset from each other a strong corner connection is provided with good thermal properties.

[0018] Figures 5-9 show the corner fitting in more detail. From the figures it can be seen that the corner fitting comprises a first flange 11, a second flange 12, a third flange 13 and a fourth flange 14. The first and second flanges are arranged perpendicular to each other and the third and fourth flanges are arranged co-planar to each other. The third flange 13 is arranged perpendicular to the first flange 11 and is arranged such that it is connected to the first flange 11 and is arranged to extend from the first flange 11 and in towards the centre of the window sash assembly when the corner fitting is fastened to the window sash assembly. The fourth flange 14 is arranged perpendicular to the second flange 12 and is arranged such that it is connected to the second flange 12 and is arranged to extend from the second flange 12 and in towards the centre of the window sash assembly when the corner fitting is fastened to the window sash assembly.

[0019] As can be seen from the figures, in the current embodiment the third and fourth flanges 13, 14 are integrally formed, in other words they are connected directly together whereas the first and second flanges are not connected directly to each other, but are connected to each other only via the third and fourth flanges. The corner fitting of this embodiment is formed by bending and cutting a piece of plate sheet metal into the shape shown in figures 5-7. The corner fitting could however also be manufactured in other ways as will be understood by the person skilled in the art. The fact that the first and second flanges of the current embodiment are not connected directly to each other is not essential to the invention as such, but is due to the production process used for this embodiment. It can be understood by the person skilled in the art that the main strength of this particular corner fitting comes from the third and fourth flanges and not from the first and second flanges, hence a direct connection between the first and second flanges is not essential. This is in contrast to many of the prior art corner fittings which only comprise a first and second flange which are connected directly together. The first and second flanges in the prior art are made thicker which give a greater strength to the fitting, but this leads to increased space consumption. In many profile elements, such as the one shown in the figures, there is not enough room to place such a prior art type corner fitting.

[0020] From the figures it can also be seen that the first and second flanges 11, 12 are both formed with two holes 15 through which screws can be inserted to fasten the corner fitting to the profile element. The holes are formed with ring shaped collars 16 which extend from the first and second flanges. These collars can be formed

by stamping the holes into the flanges and pressing the collars out. The collars are arranged on the side of the first and second flanges which will be in contact with the profile elements when assembled. Said in another way, the collars are arranged on the sides of the first and second flanges which are opposite to the side of the first and second flanges from which the third and fourth flanges extend.

[0021] The collars 16 have different functions. The first function is to provide a greater surface area into which the screw 8 that is inserted into the hole can bite. The screw which is used to fasten the corner fitting to the profile element, could just screw into the flange of the corner fitting, however, by adding the collars, the screw can establish a much stronger connection to the flange due to the extra surface area. The collars also provide the possibility of adding a thread to the collar and using machine screws instead of self-tapping screws. A second function is to allow the position of the hole in the corner fitting to remain fixed with respect to the hole in the profile element over a longer time period. The collar is inserted into the hole in the profile element and a firm connection is established between the circumference of the collar of the corner fitting and the inner surface of the hole in the profile element. If the collar were not there, then the connection between the corner fitting and the profile element would alone be supplied by the screw and by the friction between the flange of the corner fitting and the flange of the profile element. Since the screw has sharp threads, the sharp threads could cut into the profile element material over time and create a sloppy connection. However, the collar ensures that a firm connection is supplied between the corner fitting and the profile element. As can be seen from figure 9, there is no actual contact between the screw and the inner diameter of the hole itself. It should be noted that figure 9 is schematic and in the actual physical embodiment, there might be contact between the screw and the inner diameter of the hole itself.

[0022] Finally a third function of the collar is to allow a tightening of the connection between the abutting profile elements. This is especially interesting for mitre connections since loose and/or sloppy connections between the profile elements will leave unsightly gaps at the corners. The tightening effect can be provided by three different mechanisms of the collar elements. In all three mechanisms, the holes 15 in the corner fittings are made slightly closer to the corner than the holes 8 in the profile elements. In this way, the holes 15 in the corner fitting are slightly misaligned with the holes 8 in the profile elements. In the first mechanism, the collars are formed with a slight curvature on their outside surface when looking at the collar from the side (ie when looking at the corner fitting along a direction which is parallel to the first and second flanges). As the corner fitting is screwed onto the profile elements, the misalignment of the holes and the curvature of the collars will force the profile elements together in the corner.

[0023] In another mechanism, the collars 16 can be

made such that the outer diameter of the collars is slightly smaller than the inner diameter of the holes 8 in the profile elements. In this way, even though the holes 15 in the corner fitting 10 are misaligned with the holes 8 in the profile elements 1a, 1b, the collars can still be inserted into the holes 8 in the profile elements. The collars are however arranged such that when the screws 7 are inserted into the collars 16 and tightened, the collars expand slightly in diameter (see the exaggerated expansion shown by comparing figures 8 and 9). In this way, the expansion of the collars forces the profile elements towards each other.

[0024] In the third mechanism, the collar is used to allow the screw to align itself properly with regards to the flange. At the start of the procedure, due to the misalignment, the screw might enter the hole slightly crooked. I.e. it does not enter the hole at an angle of 90 degrees to the flange. However, due to the length of the collar, as the screw is screwed further in, it corrects its alignment and ends up being 90 degrees to the flange. During this alignment procedure, the screw can help to push the profile elements together.

[0025] In the current embodiment, the actual corner fitting is arranged such that all three mechanisms work together. It should be noted that it is known in the art to use misaligned holes to provide a tightening of the corner connection, however, the known methods are used with profile elements made of a strong and ductile material, for example aluminium. When the screw is inserted into the misaligned holes, the strength of the aluminium will ensure that the profiles are pressed together. However, with a glass fibre material which is in many ways more brittle/fragile than aluminium, the screw would just cut a new but angled path into the glass fibre material without achieving any tightening of the joint. According to this invention, using collars in the above described way ensures that the screw which is used to fasten the corner fitting to the profile element does not damage the profile element while still providing a tightening of the corner joint.

[0026] As mentioned previously, according to a first aspect of the invention, it is desired to provide a corner fitting which can provide great strength to the corner while not taking up a large amount of space. This is provided by the corner fitting as described above since the third and fourth flange provide great strength to the corner due to the arrangement which gives the corner fitting large cross sectional inertia.

[0027] However, a second aspect of the current invention is to provide extra security against break-in. This is also provided by the corner fitting as described herein. As shown in figures 1-4, the third and fourth flanges 13, 14 of the corner fitting are arranged to lie up against the first flanges 2 of the profile elements 1a, 1b. As described earlier on, when a window pane is arranged in the sash, the first flange of the profile element is arranged on the outer side of the window pane. Likewise, the third and fourth flanges of the corner fitting are also arranged on

the outer side of the window pane. This can be imagined by looking at figure 1 and imagining a window pane placed up against the first flange. Furthermore, the third and fourth flanges are arranged to overlap the outer surface of the window pane. Since the third and fourth flanges of the corner fitting are smaller than the first flanges of the profile elements, the corner fitting is completely hidden by the profile elements, however, should somebody break the first flanges off the profile elements in an attempt to remove the window pane, then the window pane will be held in place by the third and fourth flanges of the corner fittings.

[0028] It can also be mentioned that since the corner fitting is formed as an angle bracket, it will be very difficult for a person to bend the third and fourth flanges of the corner fitting back. The use of a corner fitting for break-in security is therefore much better than if simple flanges were just added along the circumference of the window pane at spaced apart locations.

[0029] It can also be noted that in the current invention the screws which are used to fasten the corner fitting to the profile members are arranged between the outer surface of the window pane and the inner surface of the window plane. In this way, the screws cannot be accessed when the window pane is placed in the window sash.

[0030] In the embodiment shown in the figures, the screws are screwed into the corner fitting from the opposite side of the profile member than the one on which the corner fitting is arranged. However, in another embodiment (not shown), the screws could be screwed through the corner fitting and into a bracket on the outside of the frame. This embodiment has a greater break-in security since the screws will be located underneath the window pane and can therefore not be removed from the outside of the window assembly.

[0031] It should be noted that the above description has described the invention with regards to some specific embodiments, however the scope of protection of the current invention includes all the embodiments which would be available to the person skilled in the art based on the teachings of this specification. For example, while the embodiment of the corner fitting shown in the figures and described in this description is optimized for a sash profile element comprised of a composite material, the invention as described in this specification can also be used with different forms of profile elements. For example, the invention could also be used with a wooden profile element or with an aluminium profile element. Furthermore, the corner fitting can also be used with window frame assemblies based on different types of materials.

[0032] It could also be mentioned that the corner fitting could be formed in different ways. For example, the corner fitting could be formed such that the third and fourth flanges are in the form of triangles joined together such that a single triangular shape is formed at the corner between the outer portions of the first and second flanges and the corner between the first and second flanges.

[0033] It is finally to be noted that a corner fitting with collars as described in this specification could be considered an invention separate from the one described in the claims of the current specification. In the following this invention is described in more detail to provide the basis for a possible divisional application.

[0034] A first embodiment could be described as follows: a window frame or window sash assembly comprising four frame or sash profile elements arranged in a rectangle and abutting each other at the corners of the window frame or window sash assembly, said window frame or window sash assembly further comprising a corner fitting arranged between two abutting frame or sash profile elements, and where the corner fitting comprises a first flange and a second flange which are arranged perpendicular to each other, said first flange arranged to be fastened to a first frame or sash profile element and said second flange being arranged to be fastened to a second frame or sash profile element which is abutting the first frame or sash profile element, **characterized** in that the first and second flanges each comprise a hole, said holes each comprising a ring shaped collar which extends from the outer or inner surface of the first and second flange, said collars being arranged in holes in the first and second frame or sash profile elements. In one embodiment the collars could be formed in the outer surface of the first and second flange and extend outwards away from the centre of the window frame or sash assembly.

[0035] A second embodiment could be based on the first embodiment, but where said frame or sash profile could be made from a composite material comprising fibres arranged in a matrix material. In a further embodiment, the fibres could be arranged predominantly along the longitudinal direction of the profile element.

[0036] A further embodiment could be based on one of the above embodiments but where the distance from the centre of the holes in the corner fitting to the corner of the corner fitting is less than the distance from the centre of the holes in the profile elements to the connection between the abutting profile elements.

[0037] A first embodiment of a method of assembling a rectangular window frame or window sash assembly, could comprise the steps of:

- a. providing a first and a second frame or sash profile element,
- b. placing a hole in the first frame or sash profile element and in the second frame or sash profile element,
- c. holding the first frame or sash profile element and the second frame or sash profile element together in an abutting fashion,
- d. providing a corner fitting comprising a first flange and a second flange, said first and second flanges being arranged perpendicular to each other and each of said first and second flanges comprising a hole with a collar which extends from the outer or

inner surface of the flanges and away from the flanges, and wherein the distance from the corner of the corner fitting to the centre of the holes of the corner fitting is less than the distance between the corner of the window frame or window sash and the centre of the holes in the frame or sash profiles,

e. placing the corner fitting on the window frame or sash such that the collars are placed in the holes in the frame or sash profiles, and

f. inserting screws or rivets into the holes in the corner fitting to fasten the corner fitting to the sash or profile elements.

[0038] In a second embodiment of this method, the outer diameter of the collars could be arranged to be less than the inner diameter of the holes in the frame or sash profiles and the collars could be arranged to expand and cause the profile elements to be pulled together in the corner of the window frame or window sash.

Claims

1. A window sash assembly comprising four window sash profile elements (1a,1b) arranged in a rectangular shape and abutting each other at the corners of the window sash assembly and a window pane arranged inside the window sash, and where the window sash assembly further comprises a corner fitting (10) which connects and holds together two abutting sash profile elements (1a, 1b), said corner fitting comprising a first and a second flange (11,12) which are arranged perpendicular to each other and to the plane of the window sash assembly and which are fastened to the two abutting sash profile elements (1a, 1b), **characterized in that** said corner fitting (10) further comprises a third and a fourth flange (13,14) where the third flange (13) is arranged to extend perpendicularly from the first flange (11) and where the fourth flange (14) is arranged to extend perpendicularly from the second flange (12) and where the third and fourth flanges (13,14) are directly connected together and where the third and fourth flanges (13,14) are arranged on the outside of the window pane such that the third and fourth flanges (13, 14) overlap the outside surface of the window pane.
2. A window sash assembly according to claim 1, **characterized in that** the third and fourth flanges (13, 14) are arranged co-planar.
3. A window sash assembly according to claim 1 or 2, **characterized in that** the third and fourth flanges (13,14) are arranged parallel to the plane of the window sash assembly.
4. A window sash assembly according to any one of

claims 1-3, **characterized in that** the corner fitting (10) is arranged such that the first and second flanges (11, 12) are fastened to the abutting sash profiles (1 a, 1 b) with screws (7) or rivets.

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5. A window sash assembly according to claim 4, **characterized in that** the axes of said screws (7) or rivets are arranged between a plane comprising the inside surface of the window pane and a plane comprising the outside surface of the window pane.

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6. A window sash assembly according to any one of claims 1-5, **characterized in that** the corner fitting (10) is arranged such that the first flange (11) is not connected directly to the second flange (12), but only via the third and fourth flanges (13,14).

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7. A window sash assembly according to any one of claims 1-6, **characterized in that** the corner fitting (10) is manufactured from a piece of plate metal which is bent and stamped into its final shape.

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8. A window sash assembly according to any one of claims 1-7, **characterized in that** said window sash profile elements (1a, 1b) are formed via a pultrusion process and **in that** the window sash profile elements (1a, 1b) are comprised of a composite material which comprises a number of fibres where the majority of the fibres are arranged parallel to the longitudinal axis of the profile element and where said fibres are encased in a matrix material.

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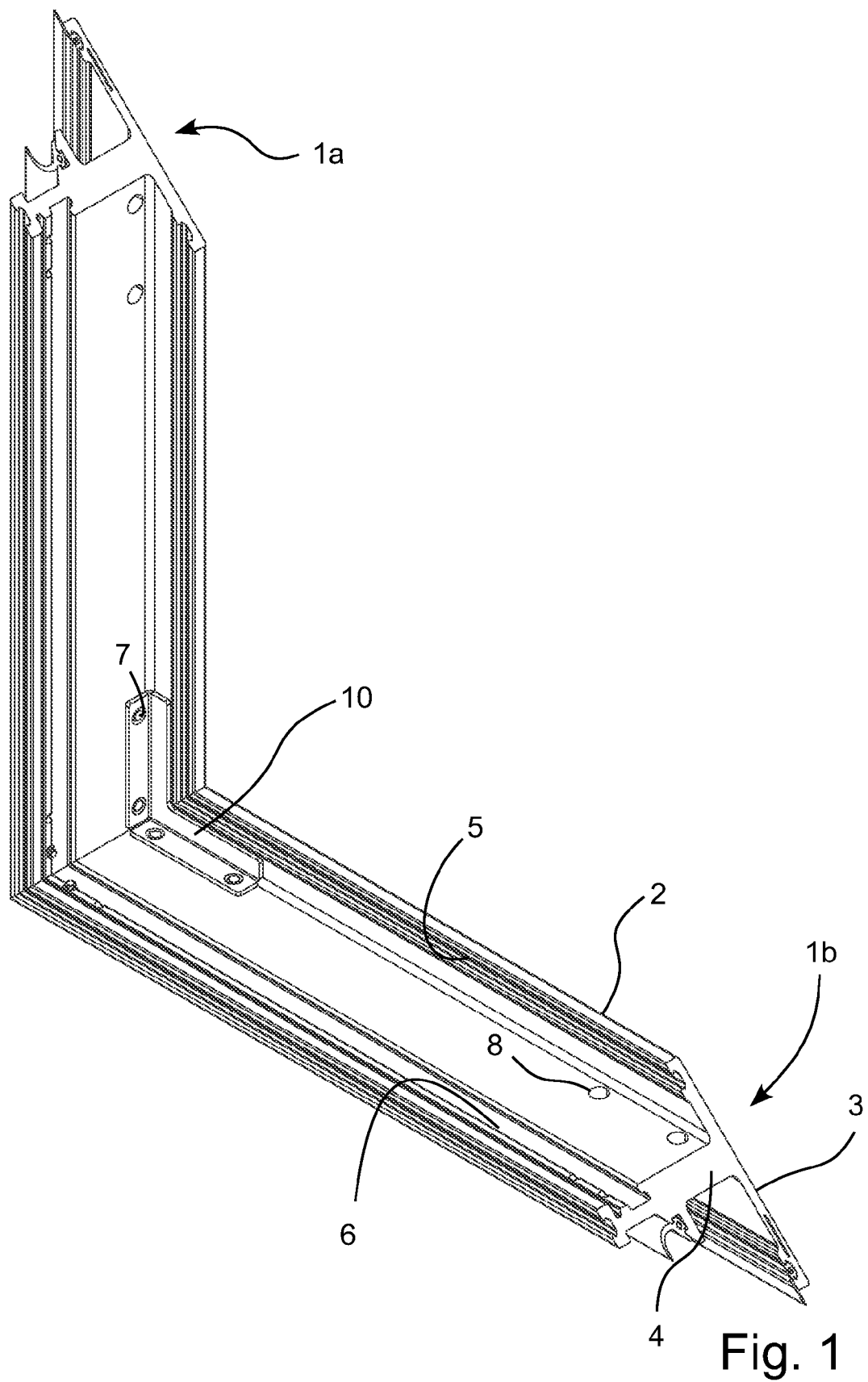
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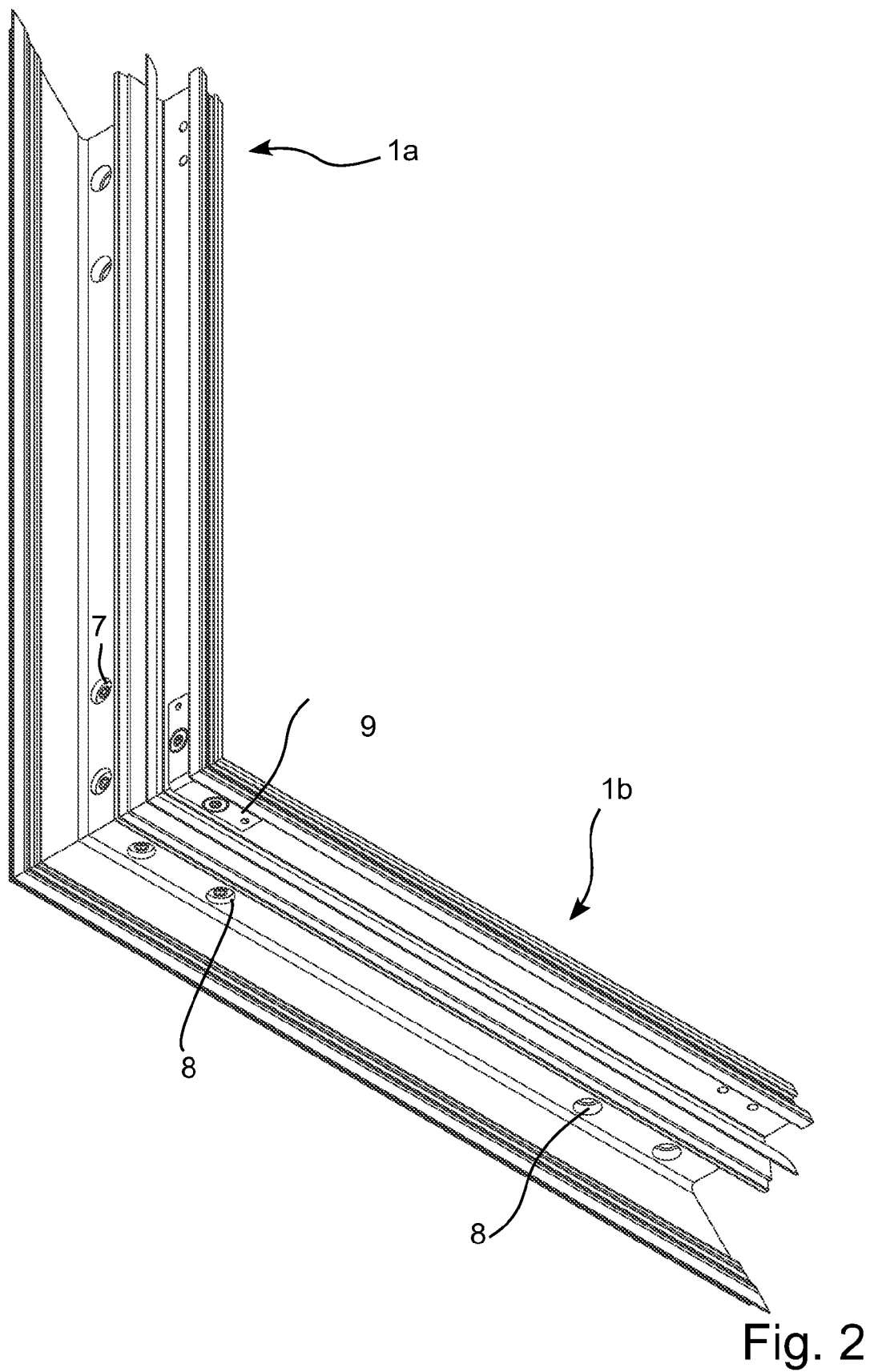
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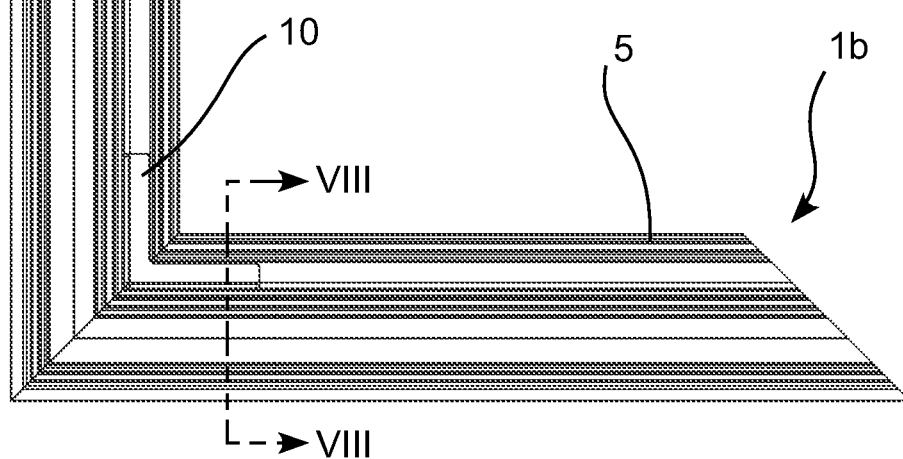
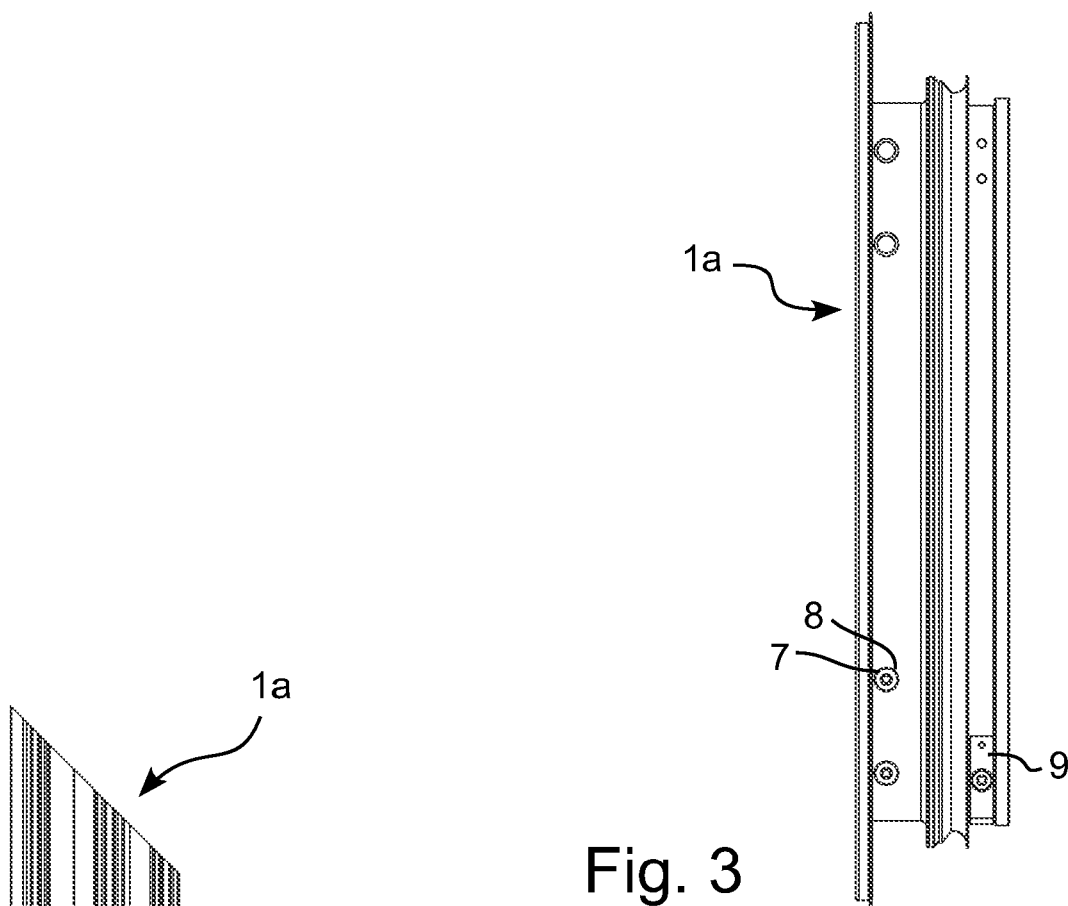
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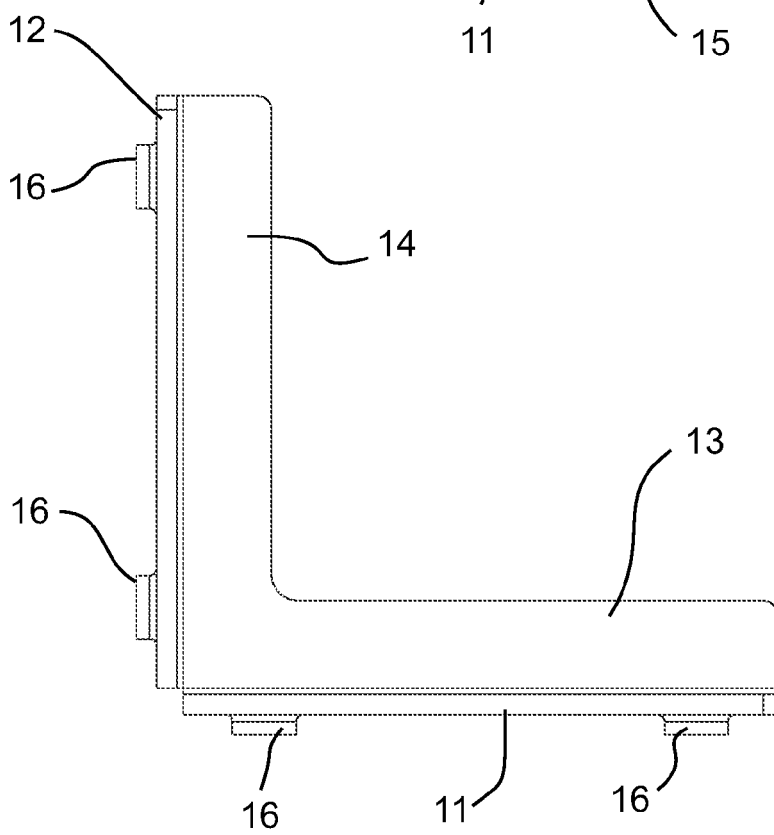
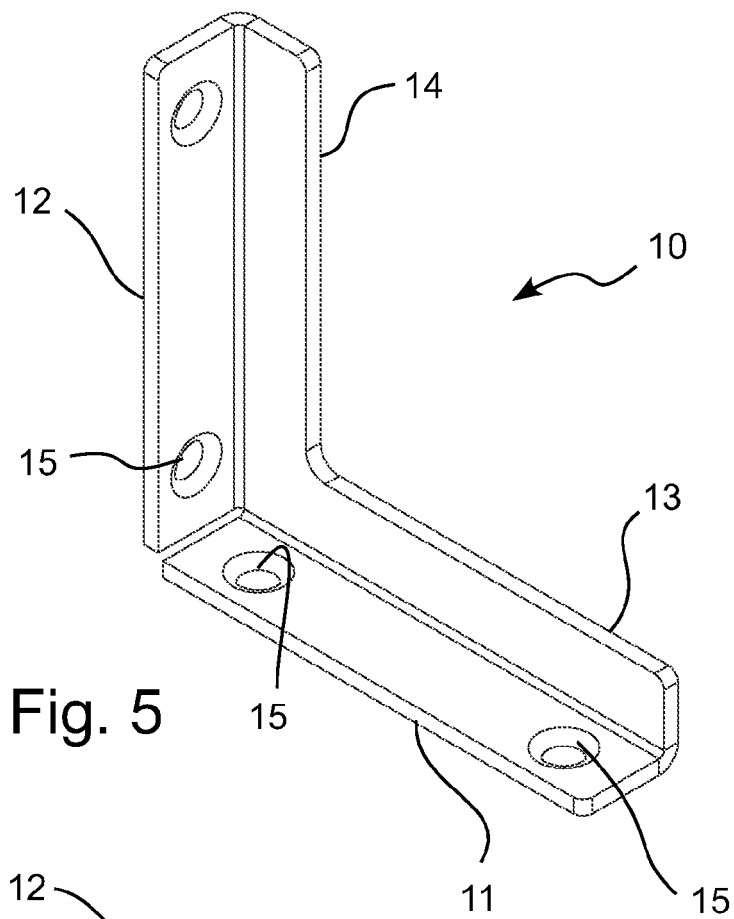
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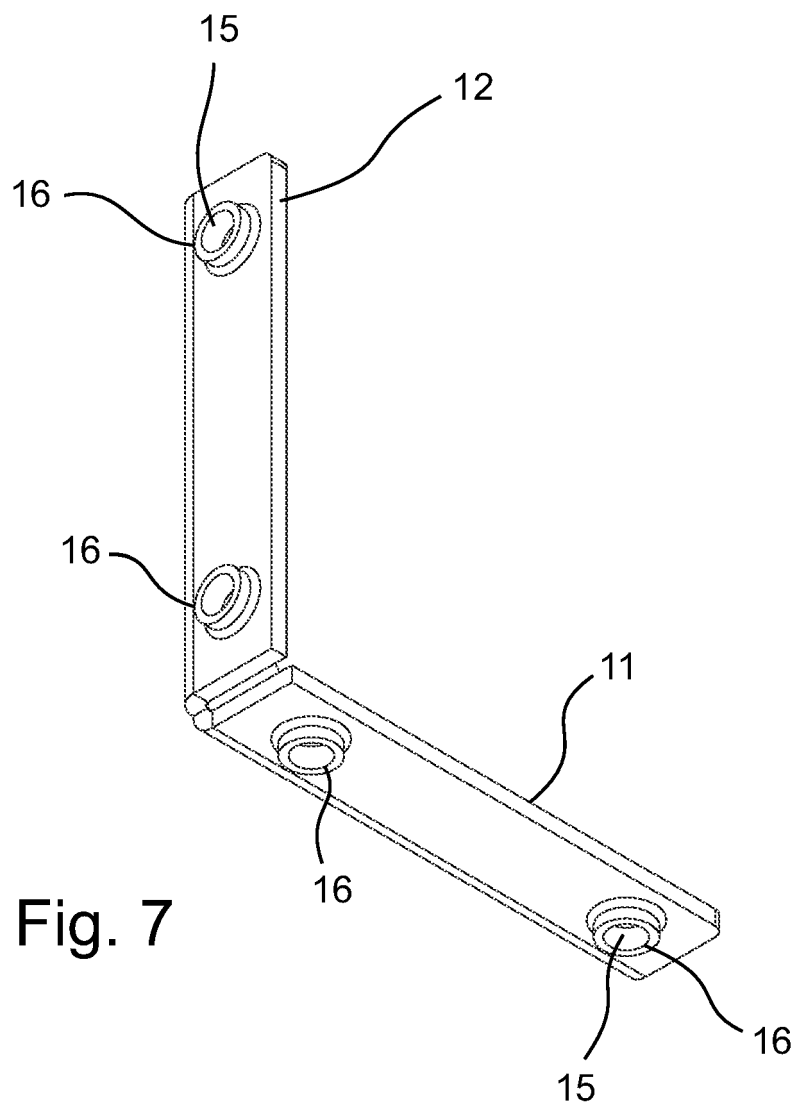
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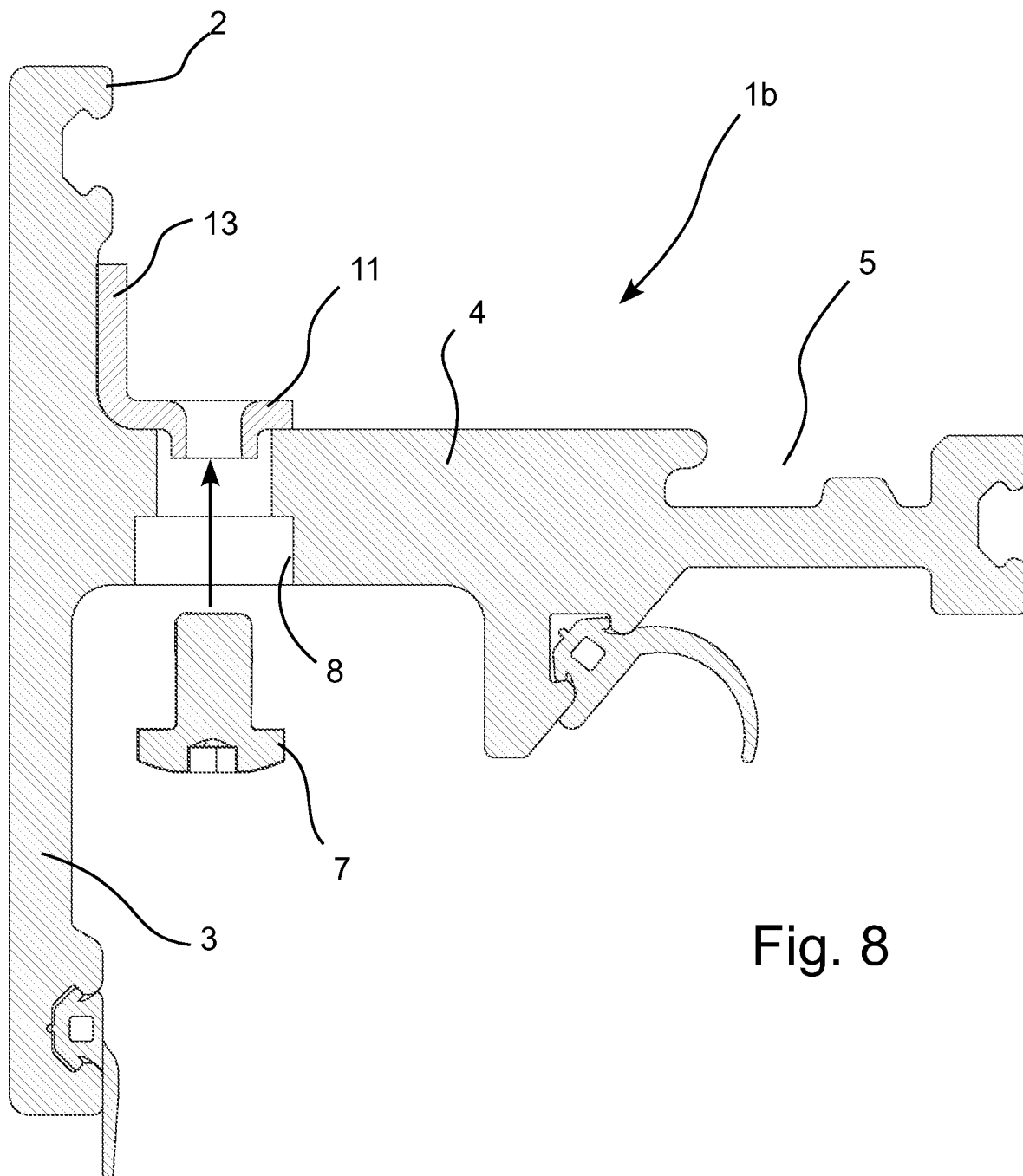


Fig. 8

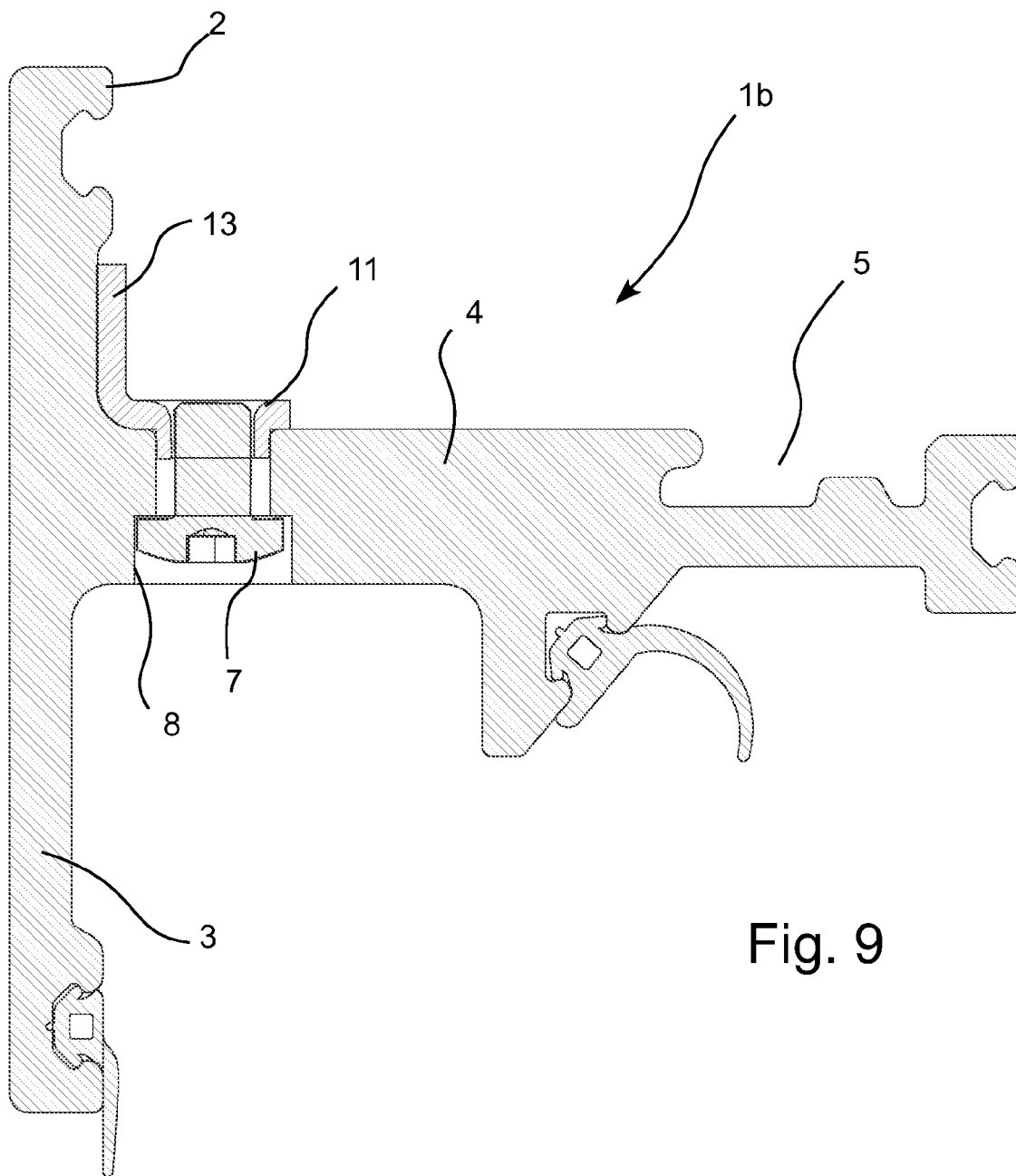


Fig. 9

REFERENCES CITED IN THE DESCRIPTION

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