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(71) Applicant: **Garner Aluminium Extrusions Limited**
Ormonde Drive, Denby Hall Business Park
Derby
Derbyshire DE5 8LE (GB)

(72) Inventor: **PARRY, Philip Dayton**
Derby
DE5 8LE (GB)

(74) Representative: **Foot, Paul Matthew James**
Withers & Rogers LLP
4 More London Riverside
London
Greater London SE1 2AU (GB)

(54) A METHOD

(57) A method of connecting an elongate first window frame section (106a) having a first longitudinal axis (112a) to an elongate connector section (110) having a second longitudinal axis (124) is disclosed. The first window frame section (106a) comprises a first female portion (115a) including a first wall (114) and the connector section (110) comprises a first male portion (117a) including a corresponding first undercut (116). The method comprises the steps of: translating the first male portion (117a) and the first female portion (115a) together in a transverse direction having a component transverse to both the first longitudinal axis (112a) and the second longitudinal axis (124); and positioning the first wall (114) until it engages the corresponding first undercut (116), wherein the first wall (114) and the first undercut (116) are shaped such that the first window frame section (106a) and the connector section (110) are interengaged.

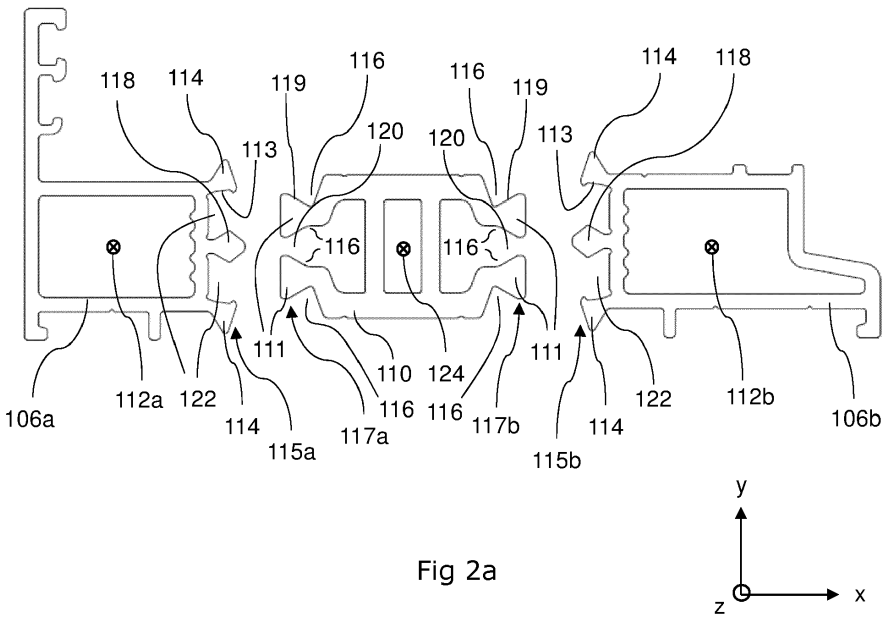

Fig 2a

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Description

FIELD

[0001] The present teachings relates to a method for assembling a window frame and to a kit of parts for a window frame assembly.

BACKGROUND

[0002] Typical fenestration units are assembled from a glazing unit comprising one or more panes of glass held around their periphery by frame members located along the borders of both faces of the glazing unit. In modern fenestration units, the frame members tend to be formed from plastics materials such as, for example, unplasticised polyvinyl chloride (uPVC) and/or metallic materials such as, for example, an aluminium alloy.

[0003] In units where the frame members are formed from a metallic material, it is typical for each frame member to comprise multiple interconnected sections. Commonly, these frame members are designed such that structural sections located adjacent a first face of the glazing unit are connected to structural sections located adjacent a second face of the glazing unit via two or more connector sections. It is preferable for the connector sections to be formed from a less thermally conductive material such as, for example, a plastics material. This allows the connector sections to act as thermal breaks between the structural sections adjacent a face of the glazing unit that may be external to a building and the structural sections adjacent a face of the glazing unit that may be internal to the building.

[0004] In order to connect a structural section to a connector section, it is common for the connector section to comprise a T-shaped protrusion and the structural section to comprise a correspondingly shaped recess for receiving the protrusion. The separate connector sections are connected to the structural sections in a parallel and transversely spaced arrangement. It is common for each connector section to comprise a slender body having a protrusion at each of its free ends such that each connector section has a substantially "dog bone" shaped cross-sectional profile. In such instances, the structural section typically comprises the same number of correspondingly shaped recesses for receiving the protrusions on one end of the connector sections.

[0005] Due to the shapes of the protrusion and the corresponding recess, the protrusion cannot be directly pressed into the recess along a direction that is transverse to the longitudinal axes of both sections. Instead, a longitudinal axis of the protrusion of one section is aligned with a longitudinal axis of the recess of the other section such that the sections lie end-to-end. Once aligned in end-to-end fashion, the protrusion is slid along the corresponding recess until the protrusion is fully received within the recess.

[0006] The prior art method for connecting a structural section to a connector section is problematic, especially when the sections are intended to be used for large fenestration units. This is because the workspace required to connect the sections together using the prior art method is required to have at least a length equal to the sum of the lengths of both the structural section and the connector section. For large fenestration units, for example having dimensions greater than two meters, the prior art method may be prohibitive in many workspaces.

[0007] The present teachings seek to overcome, or at least mitigate the problems of the prior art.

SUMMARY OF THE INVENTION

[0008] According to a first aspect of the present teachings, there is provided a method of connecting an elongate first window frame section having a first longitudinal axis to an elongate connector section having a second longitudinal axis, the first window frame section comprising a first female portion including a first wall and the connector section comprising a first male portion including a corresponding first undercut. The method comprises the steps of: translating the first male portion and the first female portion together in a transverse direction having a component transverse to both the first longitudinal axis and the second longitudinal axis; and positioning the first wall until it engages the corresponding first undercut, wherein the first wall and the first undercut are shaped such that the first window frame section and the connector section are interengaged.

[0009] Advantageously, this method allows a first window frame section to be securely assembled to a connector section without having to slide the walls of one section into recesses of another section from end faces of both sections. Therefore, the method allows for a quicker connection of two frame sections than the prior art. Further, the method allows the elongate sections to be assembled in a smaller assembly space than prior art methods, since an assembly space is only required to be as long as the length of the longest of the sections.

[0010] The first wall may be configured to be mechanically retained within the first undercut once positioned to engage the first undercut.

[0011] This ensures that the first wall permanently engages the first undercut when positioned, thus ensuring a permanent interengaging connection between the sections.

[0012] At least a portion of the first wall may be configured to plastically deform when positioned to engage the first undercut.

[0013] This provides a simple means for retaining the first wall in the first undercut once positioned to engage the first undercut.

[0014] The first window frame section may be a structural frame section and the connector section may be a thermal insulation section that is formed from a more thermally insulative material than the structural frame section.

[0015] This allows connector section to acts as a thermal break in a window frame assembly.

[0016] The first window frame section may be formed from an aluminium alloy and the connector section may be formed from a plastics material.

[0017] The first wall may comprise an engagement surface configured to abut an abutment surface of the first undercut when the first wall is positioned to engage the first undercut, wherein the abutment of the engagement surface and the abutment surface interengages the frame sections.

[0018] This provides a mechanism for interengaging the two frame sections together.

[0019] The first female portion may define a mouth having a first transverse dimension and the first male portion may have a maximum second transverse dimension, the maximum second transverse dimension being the same as or less than the first transverse dimension.

[0020] If both the male and female portions are substantially incompressible, this enables them to be translated together in a direction having a component transverse to both the first longitudinal axis and the second longitudinal axis.

[0021] Prior to the positioning step, the engagement surface may be at an angle of between 90 and 180 degrees to a plane normal to the transverse direction. The engagement surface may be at an angle of between 90 and 120 degrees to the plane. The engagement surface may be at an angle of between 92 and 102 degrees to the plane.

[0022] This allows the male and female portions to be connected together along the transverse direction.

[0023] After the positioning step, the engagement surface may be at an angle of between 0 and 90 degrees to a plane normal to the transverse direction. The engagement surface may be at an angle of between 60 and 90 degrees to the plane. The engagement surface may be at an angle of between 70 and 80 degrees to the plane.

[0024] This allows the first wall to interengage the first window frame section and the connector section.

[0025] The first wall may comprise a protuberance configured to deform a surface of the first undercut when said first wall engages the first undercut.

[0026] This provides a stronger and more secure connection between the first window frame section and the connector section.

[0027] A cross-sectional profile of the first female portion may be constant along the first longitudinal axis and a cross-sectional profile of the first male portion may be constant along the second longitudinal axis.

[0028] This provides a stronger connection between the sections, since both the walls and the undercuts are present along the whole of the longitudinal axes of both sections.

[0029] The method may further comprise the steps of: prior to the positioning step, inserting a first support protrusion located on the first female portion into a corresponding first opening located on the first male portion, wherein the first support protrusion and the first opening are shaped such that the first window frame section and the connector section are releasably connected.

[0030] The support protrusion helps to ensure that the two sections are in alignment before engaging the first wall. The support protrusion also helps to interengage the two sections together by limiting rotational movement of the window frame section with respect to the connector section.

[0031] The first support protrusion and the first opening may be shaped to act as a guiding mechanism, such that after fully inserting the first support protrusion into the first opening, the first wall is positionable into the first undercut.

[0032] This allows for a quicker and simpler connection between the two sections.

[0033] The first female portion may comprise two first walls and the first support protrusion may be located between the two first walls.

[0034] This allows for a stronger and symmetrical connection between the sections.

[0035] The method may further comprise the steps of: translating a second female portion of a second window frame section and a second male portion of the connector section together; and positioning a second wall located on the second female portion until it engages a corresponding second undercut located on the second male portion, wherein the second wall and the corresponding second undercut are shaped such that the second window frame section and the connector section are interengaged, wherein the second male portion is located at or near an opposite edge of the connector section to the first male portion.

[0036] This allows the connector section to acts as a break or a connector between a first and a second window frame section.

[0037] The method may further comprise the steps of: prior to positioning the second wall, inserting a second support protrusion located on the second female portion into a corresponding second opening located on the second male portion, wherein the second support protrusion and the second opening are shaped such that the connector section and the second window frame section are releasably connected.

[0038] According to a second aspect of the present teachings, there is provided a kit of parts for a window frame assembly comprising: an elongate first window frame section having a first longitudinal axis, the first window frame section comprising a first female portion including a cavity at least partially defined by a first wall, wherein the cavity comprises an aperture having a width perpendicular to the first longitudinal axis, wherein the first wall is moveable from a first position to a second position, and wherein the width of the aperture is greater in the first position relative to the second position; and an elongate connector section having a second longitudinal axis, the connector section comprising a first male portion having a maximum width perpendicular to the first

longitudinal axis less than or equal to the width of the aperture and including a first undercut, wherein the first male portion is shaped to at least partially conform to the first female portion when the first wall is in the second position and when the second longitudinal axis is parallel to the first longitudinal axis.

[0039] At least a portion of the first wall may be configured to plastically deform when moved from the first position to the second position.

[0040] The first window frame section may be a structural frame section and the connector section may be a thermal insulation section that is formed from a more thermally insulative material than the structural frame section. The first window frame section may be formed from an aluminium alloy and the connector section may be formed from a plastics material.

[0041] The first wall may comprise an engagement surface shaped to conform to an abutment surface comprised on the first undercut when the first wall is in the second position.

[0042] In the first position, the engagement surface may be at an angle of between 90 and 180 degrees to a plane parallel to the first longitudinal axis and passing through the first wall and the aperture. The engagement surface may be at an angle of between 90 and 120 degrees to the plane. The engagement surface may be at an angle of between 92 and 102 degrees to the plane.

[0043] In the second position, the engagement surface may be at an angle of between 0 and 90 degrees to a plane parallel to the first longitudinal axis and passing through the first wall and the aperture. The engagement surface may be at an angle of between 60 and 90 degrees to the plane. The engagement surface may be at an angle of between 70 and 80 degrees to the plane.

[0044] A cross-sectional profile of the first female portion may be constant along the first longitudinal axis and a cross-sectional profile of the first male portion may be constant along the second longitudinal axis.

[0045] The first female portion may further comprise a first support protrusion and the first male portion may further comprise a first opening, wherein the first support protrusion is shaped to at least partially conform to the first opening.

[0046] The kit of parts may further comprise an elongate second window frame section having a third longitudinal axis, the second window frame section comprising a second female portion including a cavity at least partially defined by a second wall, wherein the cavity comprises an aperture having a width perpendicular to the third longitudinal axis, wherein the second wall is moveable from a first position to a second position, and wherein the width of the aperture is greater in the first position relative to the second position, wherein the connector section may further comprise a second male portion including a second undercut, wherein the second male portion is shaped to at least partially conform to the second female portion when the second wall is in the second position and when the second longitudinal axis is parallel to the third longitudinal axis, and wherein the second male portion is located at or near an opposite edge of the connector section to the first male portion.

[0047] The second female portion may further comprise a second support protrusion and the second male portion may further comprise a second opening, wherein the second support protrusion is shaped to at least partially conform to the second opening.

[0048] A third aspect of the present teachings provides an elongate thermally insulating connector section for a window frame assembly, the connector section having a longitudinal axis, and comprising first and second male portions at a first side thereof and first and second male portions at a second side thereof, the male portions to be received in corresponding female portions of opposing first and second structural sections, wherein a first body extends between the first male portion on the first side and the first male portion on the second side, a second body extends between the second male portion on the first side and the second male portion on the second side and at least one cross-member connects the first body to the second body.

[0049] By connecting the four male portions of the connector section via the first and second bodies and the at least one cross-member, the connector section is provided as a single unitary structure. This is in contrast to the prior art in which, commonly, two or more discrete "dog bone" shaped connectors are used to connect two structural sections of a window frame assembly together. Advantageously, utilising a single unitary connector section may help to simplify the assembly of a window frame.

[0050] Moreover, the one or more cross-members may improve the thermal performance of the connector section by reducing thermal transfer via convection across the connector section from the first structural section to the second structural section or vice versa.

[0051] By providing the connector section with two male portions on the first side that are to be received in two corresponding female portions of a first structural section, and two male portions on the second side that are to be received in two corresponding female portions of a second structural section, the contact surface area between the connector section and each structural section is much larger relative to if the connector section only included one male portion on each side. As such, the grip strength between the connector section and the two structural sections is increased.

[0052] The first and second male portions on the first side may define a first opening therebetween. The first and second male portions on the second side may define a second opening therebetween. The first opening may be for receiving a protrusion of the first structural section. The second opening may be for receiving a protrusion of the second structural section.

[0053] Advantageously, the openings may act as part of a guiding mechanism, such that after fully inserting protrusions on the structural sections into the openings, the structural sections can be more easily interengaged

with the connector section. This allows for a quicker and simpler connection between the sections.

[0054] The at least one cross-member, the first body and the second body may at least partially define at least two voids between the first side and the second side.

[0055] Advantageously, the at least two voids in the connector section may improve the thermal performance of the connector section by reducing thermal transfer via convection across the connector section from the first structural section to the second structural section or vice versa.

BRIEF DESCRIPTION OF THE DRAWINGS

[0056] Embodiments are now disclosed by way of example only with reference to the drawings, in which:

Figure 1a is a plan view of a fenestration unit comprising a window frame assembly according to an embodiment;

Figure 1b is a cross-sectional view of the fenestration unit shown in figure 1a along section X-X shown in figure 1a;

Figure 2a is a cross-sectional view of window frame sections of a window frame assembly according to an embodiment;

Figure 2b is a magnified view of a portion of figure 2a;

Figure 3a is a cross-sectional view of a step of a window frame assembly method;

Figure 3b is a cross-sectional view of a step of the method illustrated in figure 3a; and

Figure 3c is a cross-sectional view of a step of the method illustrated in figures 3a and 3b.

DETAILED DESCRIPTION OF THE EMBODIMENT(S)

[0057] Figures 1a and 1b show a fenestration unit 100 comprising a window frame assembly 102 and a glazing unit 104. As shown in figure 1b, the glazing unit 104 comprises two panes of glass 108 spaced apart and lying parallel to each other. However, it will be appreciated that the glazing unit 104 may comprise one or more than two panes of glass 108. Alternatively, the glazing unit 104 could be replaced with a panel of wood, aluminium or other suitable material. It shall be appreciated that although the glazing unit 104 in this embodiment is a double glazing unit, alternative glazing units, for example opaque panels, for example for doors, may be used.

[0058] Fenestration units 100 of this type are typically used in external walls of domestic and commercial buildings. It is therefore necessary that the fenestration unit meets requirements for thermal insulation, sealing against water ingress, draughts etc.

[0059] The glazing unit 104 is supported by the window frame assembly 102, which is in contact with two opposite faces of the glazing unit 104 along each border of the glazing unit 104. The window frame assembly 102 comprises four window frame members 103, each being made up of a plurality, in this case three, window frame sections, these being an elongate first structural section 106a, an elongate second structural section 106b and an elongate connector section 110. Each structural section 106a, 106b abuts an opposite face of the glazing unit 104 such that movement of the glazing unit 104 is restricted along the x-direction and along the y-direction in figure 1b. The connector section 110 connects the first structural section 106a to the second structural section 106b and lies generally alongside but is spaced from an edge of the glazing unit 104.

[0060] It will be noted that in contrast to the prior art described above, the connector section 110 is a single unitary component instead of two or more discrete "dog bones". By utilising a single unitary component, this may aid assembly of the window frame assembly 102. In this embodiment, two cross-members 150 join the bodies 152 that create the thermal break of the connector 110 to achieve the unitary component. The number of cross members 150 may differ in other embodiments e.g. one may be provided or three or more. The cross members 150 may additionally improve the thermal performance of the connector section 110 by reducing thermal transfer via convection across the frame member 103.

[0061] In the embodiment illustrated in figure 1b, the second structural section 106b comprises a glazing bead 101; shown schematically in figure 1b. The glazing bead 101 may be formed as part of the second structural section 106b or may alternatively be releasably connected to the second structural section 106b.

[0062] Figure 2a shows the first and second structural sections 106a, 106b and the connector section 110 exclusively. Each of the sections 106a, 106b, 110 has a corresponding longitudinal axis 112a, 112b, 124, which are all shown as being parallel to each other and extending into the page in figure 2a; i.e. along the z-direction. Both the first and the second structural sections 106a, 106b comprise a female portion 115a, 115b along an edge of the structural sections 106a, 106b. In the particular embodiment, the connector section 110 comprises two male portions 117a, 117b, each located at an opposite edge of the connector section 110.

[0063] In the embodiment illustrated in figure 2a, the female portions 115a, 115b each comprise two walls 114, a protrusion 118 located between the two walls 114, and two cavities 122. In this embodiment each wall 114 is located along a corner of the respective structural section 106a, 106b and is movable from a first position (illustrated in figures 2a, 2b, 3a and 3b) to a second position (illustrated in figure 3c).

[0064] In the illustrated embodiment, each male portion 117a, 117b comprises two bosses 111, defining four

undercuts 116 and one opening 120. Each boss 111 has a leading edge (i.e. the edge of the boss 111 facing the cavity 122 in figure 2a) that it is wider relative to a trailing edge, and each undercut 116 and each opening 120 is shaped to define each boss 111.

[0065] In the illustrated embodiment, each protrusion 118 has a generally diamond-shaped cross-sectional profile and each opening 120 has a truncated bell-shaped cross-sectional profile. The width of the root of each protrusion 118, i.e. where each protrusion 118 joins the remainder of the respective structural section 106, is substantially equal to the width of the entrance of each opening 120 (where the width is defined as being aligned with the y-direction in figure 2a).

[0066] In other embodiments, the protrusion 118 and the corresponding opening 120 may have a different cross-sectional profile. For example, the protrusion 118 may have a rectangular, triangular or any other shaped cross-sectional profile, and the corresponding opening 120 may have a rectangular, triangular or any other shaped cross-sectional profile. If the protrusion is, for example rectangular, the bosses may in this case only have one undercut each to correspond with the walls 114.

[0067] In the illustrated embodiment, each male portion 117a, 117b is identical to each other, and each are symmetrical about a horizontal axis that is parallel to the x-axis in figure 2a. Likewise, in the particular embodiment, each female portion 115a, 115b is identical to each other, and each are symmetrical about a horizontal axis that is parallel to the x-axis in figure 2a.

[0068] However, in other embodiments, one or both of the male portions 117a, 117b and one or both of the female portions 115a, 115b may be asymmetrical about said horizontal axes. In some embodiments, each male portion 117a, 117b is not identical to the other male portion 117a, 117b, and each female portion 115a, 115b is not identical to the other female portion 115a, 115b.

[0069] Each wall 114 comprises an engagement surface 113 that is configured to abut an abutment surface 119 located on the undercuts 116 of the male portions 117a, 117b, when each wall 114 is in the second position; as will be discussed in more detail in the following.

[0070] Figure 2b shows a magnified view of the female portion 115 illustrated in figure 2a. As can be seen in figure 2b, each cavity 122 is at least partially defined by one of the walls 114. The entrance to each cavity 122 defines an aperture having a width 134 that is perpendicular to the longitudinal axis 112a, 112b of the respective structural section 106a, 106b and that is aligned generally in the y-direction in figure 2b. As illustrated in the figures, the width 134 of each aperture is greater when each wall 114 is in the first position (illustrated in figures 2a, 2b, 3a and 3b) than when each wall 114 is in the second position (illustrated in figure 3c). The maximum width of the boss 111 in the y-direction is less than or equal to the width 134 of the aperture in the y-direction when in the condition depicted in Figures 2a and 2b, in this embodiment. In this embodiment, this maximum width is at the leading edge of the boss 111, but this may not be the case in other embodiments.

[0071] In the embodiment illustrated in figure 2b, a protuberance 132 is formed on each wall 114. The protuberance 132 is configured to deform at least a portion of a corresponding abutment surface 119 (see figure 2a) defining one of the undercuts 116 when the wall 114 is positioned to engage said undercut 116; as will be discussed in more detail in the following. By deforming the surface of the undercut 116 via the protuberance 132, the wall 114 is capable of providing a stronger and more secure connection between the structural frame section 106 and the connector section 110.

[0072] In the illustrated embodiment, the protuberance 132 is located on a corner of the wall 114 between the engagement surface 113 and a second surface of the wall 114. However, in other embodiments, the protuberance 132 may be located elsewhere, such as, for example, along a middle portion of the engagement surface 113. In some embodiments, each wall 114 comprises a single protuberance 132 running along the length of the wall 114, i.e. parallel to the structural section's longitudinal axis 112. In other embodiments, each wall 114 comprises several discrete protuberances 132 spaced along the length of the wall 114.

[0073] Figures 3a-3c illustrate steps of a method for connecting window frame sections of a window frame assembly together. The reference numerals used in figure 2a apply to figures 3a-3c. However, for clarity, many of the reference numerals have been omitted in figures 3a-3c. Figures 3a-3c show a first structural section 106a, a connector section 110 and a second structural section 106b. Each section 106a, 106b, 110 has a longitudinal axis 112a, 112b, 124. Each longitudinal axis 112a, 112b, 124 is parallel to each other and is directed into the page; i.e. along the z-direction.

[0074] Figures 3a and 3b illustrate a first step of the method. In the first step, the first male portion 117a of the first structural section 106a and the first female portion 115a of the connector section 110 are translated together in a direction that has a component transverse to both the first structural section's longitudinal axis 112a and the connector section's longitudinal axis 124; i.e. along the x-direction. The two sections 106a, 110 are translated together in the transverse direction until each boss 111 on the male portion 117a abuts the corresponding cavity 122 in the female portion 115a, which prevents any further relative movement of the sections 106a, 110 towards each other in the transverse direction.

[0075] In the illustrated embodiment, in the first step of the method, the second male portion 117b of the second structural section 106b and the second female portion 115b of the connector section 110 are translated together with at least a component in the transverse direction simultaneously with the translation together of the first male portion 117a and the first female portion 115a. The two sections 106b, 110 are translated together in the transverse direction until each boss 111 on the male

portion 117b abuts the corresponding cavity 122 in the female portion 115b, which prevents any further relative movement of the sections 106b, 110 towards each other in the transverse direction. However, in other embodiments, the first male 117a and female 115a portions are translated together before or after the second male 117b and female 115b portions are translated together.

[0076] Prior to and during the first step, each wall 114 is in the first position. In the first position, each engagement surface 113 is at an angle α of between 90 and 180 degrees to a plane 130 normal to the transverse direction, i.e. a plane 130 parallel to the respective structural section's longitudinal axis 112a, 112b and aligned with the y-direction. Preferably, each engagement surface 113 is at an angle α of between 90 and 120 degrees to the plane 130. More preferably, each engagement surface 113 is at an angle α of between 92 and 102 degrees to the plane 130.

[0077] Each male portion 117 is shaped such that it can be received within the corresponding female portion 115 along the transverse direction when each wall 114 is in the first position. As can be seen in figure 3b, the bosses 111 are able to enter and be fully received within the corresponding cavities 122 when each wall 114 is in the first position.

[0078] In the illustrated embodiment, in the first step of the method, the protrusions 118 located on the respective female portions 115a, 115b are inserted into the corresponding openings 120 located on the respective male portion 117a, 117b. Each protrusion 118 and each corresponding opening 120 are shaped such that the respective structural section 106a, 106b and the connector section 110 are releasably connected, i.e. the connection is not permanent and is easily reversible.

[0079] As each structural section 106a, 106b is translated towards the connector section 110 along the transverse direction x, the tip of each protrusion 118 abuts the edges of the corresponding opening 120; as shown in figure 3a. As each structural section 106a, 106b is further translated towards the connector section 110 along the transverse direction x, each protrusion 118 causes its corresponding opening 120 to temporarily widen in a direction parallel to the plane 130 in order to accommodate the variable width of each protrusion's diamond-shaped profile. Once each protrusion 118 is fully received within each respective corresponding opening 120, as shown in figure 3b, each opening 120 relaxes back. Each structural section 106a, 106b is then releasably connected to the connector section 110. This may assist in handling the assembly in subsequent steps of the process.

[0080] In the illustrated embodiment, each protrusion 118 and each corresponding opening 120 acts as a guiding mechanism, such that after fully inserting each protrusion 118 into its corresponding opening 120, each wall 114 is positionable into the corresponding undercut 116; as discussed in more detail in the following. In some embodiments, the protrusions 118 and the openings 120 may also provide a supporting function by limiting relative rotational movement between each structural section 106a, 106b and the connector section 110.

[0081] Figure 3c illustrates a second step of the method. In the second step, each wall 114 located on the first female portion 115a is positioned until it engages the corresponding undercut 116 located on the first male portion 117a. This may be achieved, for example, by manually pressing the walls 114 until they engage the corresponding undercuts 116. Alternatively or additionally, a tool or machine may be used to position the walls 114 until they engage the corresponding undercuts 116. Such a machine may utilise rollers or the like to progressively deform the walls 114 as the assembly is fed through the machine in the Z direction.

[0082] Figure 3c illustrates the position of the walls 114 after they have engaged the corresponding undercuts 116. Each wall 114 and each corresponding undercut 116 is shaped such that the first structural section 106a and the connector section 110 are interengaged, i.e. the sections 106a, 110 are mutually engaged in order to provide a connection between the sections 106a, 110.

[0083] In the illustrated embodiment, in the second step of the method, each wall 114 located on the second female portion 115b is positioned until it engages the corresponding undercut 116 located on the second male portion 117b. Figure 3c illustrates the position of the walls 114 after they have engaged the corresponding undercuts 116. Each wall 114 and each corresponding undercut 116 is shaped such that the second structural section 106b and the connector section 110 are interengaged.

[0084] After the second method step, each wall 114 is in the second position. In the second position, each engagement surface 113 is at an angle β of between 0 and 90 degrees to the plane 130. Preferably, each engagement surface 113 is at an angle β of between 60 and 90 degrees to the plane 130. More preferably, each engagement surface 113 is at an angle β of between 70 and 80 degrees to the plane 130.

[0085] Each male portion 117 and corresponding female portion 115 are shaped such that relative movement between the structural sections 106 and the connector section 110 is prevented when each wall 114 is in the second position. As can be seen in figure 3c, the bosses 111 are enclosed within the corresponding cavities 122 when each wall 114 is in the second position, which prevents relative movement between the structural sections 106 and the connector section 110.

[0086] In this embodiment, each wall 114 is configured to be mechanically retained within the corresponding undercut 116 once positioned to engage said corresponding undercut 116. For example, at least a portion of each wall 114 may be configured to plastically deform when positioned to engage the corresponding undercut 116. In the embodiment illustrated in figures 3a-3c, a root of each wall 114, i.e. the portion of each wall that joins to the remainder of the respective structural section 106, is configured to plastically deform. This ensures that, after orientating each wall 114 about its root from the first po-

sition shown in figures 3a and 3b to the second position shown in figure 3c, each wall 114 is maintained in the second position. An aluminium alloy, as used in this embodiment for the structural sections 106a and 106b, is inherently capable of plastically deforming in this way.

[0087] In this embodiment, the connector section 110 is a thermal insulation section that is formed from a more thermally insulative material than either of the structural sections 106. Such a connector section 110 acts as a thermal break between the structural sections 106 connected to it, and inhibits heat conducting from one structural section 106a, which may be internal to a building, to a second structural section 106b, which may be external to a building. For example, one or both of the structural sections 106a, 106b may be formed from an aluminium alloy and the connector section 110 may be formed from a plastics material (e.g. polyamide). Due to their material properties, plastics materials are more thermally insulative than aluminium alloys.

[0088] In some embodiments, the cross-sectional profile of the female portion 115 is constant along the structural section's longitudinal axis 112 and the cross-sectional profile of the male portion 117 is constant along the connector section's longitudinal axis 124. Providing the structural section 106 and the connector section 110 with female 115 and male 117 portions respectively having constant cross-sectional profiles along their respective longitudinal axes 112, 124 helps to ensure the connection between the sections 106, 110 is strong and secure. This is because each wall 114 and each corresponding undercut 116 is present along the entire longitudinal length of the respective sections 106, 110.

[0089] In the foregoing disclosure, structural sections 106 comprising two walls 114 and connector sections 110 comprising four undercuts 116 have been disclosed. However, it will be appreciated that in some embodiments, the structural section 106 may comprise one or more than two walls 114 and the connector section 110 may comprise one, two, three or more than four corresponding undercuts 116.

[0090] In the foregoing disclosure, structural sections 106 comprising one protrusion 118 and connector sections 110 comprising one corresponding opening 120 have been disclosed. However, it will be appreciated that in some embodiments, the structural section 106 may comprise zero or more than one protrusion 118 and the connector section 110 may comprise zero or more than one corresponding opening 120.

[0091] In the foregoing disclosure, female portions 115 comprising two cavities 122 and male portions 117 comprising two bosses 111 have been disclosed. However, it will be appreciated that the female portion 115 and the corresponding male portion 117 may be of any shape, so long as the male portion 117 is shaped to at least partially conform to the female portion 115 when each wall 114 is in the second position and when the structural section's longitudinal axis 112 is parallel to the connector section's longitudinal axis 124.

Claims

1. A method of connecting an elongate first window frame section having a first longitudinal axis to an elongate connector section having a second longitudinal axis, the first window frame section comprising a first female portion including a first wall and the connector section comprising a first male portion including a corresponding first undercut, the method comprising the steps of:

   translating the first male portion and the first female portion together in a transverse direction having a component transverse to both the first longitudinal axis and the second longitudinal axis; and
   positioning the first wall until it engages the corresponding first undercut, wherein the first wall and the first undercut are shaped such that the first window frame section and the connector section are interengaged.

2. The method of claim 1, wherein the first wall is configured to be mechanically retained within the first undercut once positioned to engage the first undercut; optionally, wherein at least a portion of the first wall is configured to plastically deform when positioned to engage the first undercut.

3. The method of any preceding claim, wherein the first window frame section is a structural frame section and the connector section is a thermal insulation section that is formed from a more thermally insulative material than the structural frame section; optionally, wherein the first window frame section is formed from an aluminium alloy and the connector section is formed from a plastics material.

4. The method of any preceding claim, wherein the first wall comprises an engagement surface configured to abut an abutment surface of the first undercut when the first wall is positioned to engage the first undercut, wherein the abutment of the engagement surface and the abutment surface interengages the frame sections; and/or wherein the first female portion defines a mouth having a first transverse dimension and the first male portion has a maximum second transverse dimension, the maximum second transverse dimension is the same as or less than the first transverse dimension.

5. The method of claim 4, wherein prior to the positioning step, the engagement surface is at an angle of between 90 and 180 degrees to a plane normal to the transverse direction; and optionally, the engagement surface is at an angle of between 90 and 120 degrees to the plane; and optionally, the engagement surface is at an angle of between 92 and 102

degrees to the plane; and/or wherein after the positioning step, the engagement surface is at an angle of between 0 and 90 degrees to a plane normal to the transverse direction; and optionally, the engagement surface is at an angle of between 60 and 90 degrees to the plane; and optionally, the engagement surface is at an angle of between 70 and 80 degrees to the plane.

6. The method of any preceding claim, wherein a cross-sectional profile of the first female portion is constant along the first longitudinal axis and a cross-sectional profile of the first male portion is constant along the second longitudinal axis.

7. The method of any preceding claim, further comprising the steps of:

prior to the positioning step, inserting a first support protrusion located on the first female portion into a corresponding first opening located on the first male portion, wherein the first support protrusion and the first opening are shaped such that the first window frame section and the connector section are releasably connected; optionally,
wherein the first support protrusion and the first opening are shaped to act as a guiding mechanism, such that after fully inserting the first support protrusion into the first opening, the first wall is positionable into the first undercut; optionally, wherein the first female portion comprises two first walls and the first support protrusion is located between the two first walls.

8. The method of any preceding claim, further comprising the steps of:

translating a second female portion of a second window frame section and a second male portion of the connector section together; and
positioning a second wall located on the second female portion until it engages a corresponding second undercut located on the second male portion, wherein the second wall and the corresponding second undercut are shaped such that the second window frame section and the connector section are interengaged,
wherein the second male portion is located at or near an opposite edge of the connector section to the first male portion; optionally,
the method further comprising the steps of:
prior to positioning the second wall, inserting a second support protrusion located on the second female portion into a corresponding second opening located on the second male portion, wherein the second support protrusion and the second opening are shaped such that the connector section and the second window frame section are releasably connected.

9. A kit of parts for a window frame assembly comprising:

an elongate first window frame section having a first longitudinal axis, the first window frame section comprising a first female portion including a cavity at least partially defined by a first wall, wherein the cavity comprises an aperture having a width perpendicular to the first longitudinal axis, wherein the first wall is moveable from a first position to a second position, and wherein the width of the aperture is greater in the first position relative to the second position; and
an elongate connector section having a second longitudinal axis, the connector section comprising a first male portion having a maximum width perpendicular to the first longitudinal axis less than or equal to the width of the aperture and including a first undercut, wherein the first male portion is shaped to at least partially conform to the first female portion when the first wall is in the second position and when the second longitudinal axis is parallel to the first longitudinal axis.

10. The kit of parts of claim 9, wherein at least a portion of the first wall is configured to plastically deform when moved from the first position to the second position; and/or wherein the first window frame section is a structural frame section and the connector section is a thermal insulation section that is formed from a more thermally insulative material than the structural frame section, and optionally, wherein the first window frame section is formed from an aluminium alloy and the connector section is formed from a plastics material.

11. The kit of parts of any of claim 9 or claim 10, wherein the first wall comprises an engagement surface shaped to conform to an abutment surface comprised on the first undercut when the first wall is in the second position; optionally, wherein in the first position, the engagement surface is at an angle of between 90 and 180 degrees to a plane parallel to the first longitudinal axis and passing through the first wall and the aperture; and optionally, the engagement surface is at an angle of between 90 and 120 degrees to the plane; and optionally, the engagement surface is at an angle of between 92 and 102 degrees to the plane.

12. The kit of parts of claim 11, wherein in the second position, the engagement surface is at an angle of between 0 and 90 degrees to a plane parallel to the first longitudinal axis and passing through the first

wall and the aperture; and optionally, the engagement surface is at an angle of between 60 and 90 degrees to the plane; and optionally, the engagement surface is at an angle of between 70 and 80 degrees to the plane.

13. The kit of parts of any one of claims 9 to 12, wherein a cross-sectional profile of the first female portion is constant along the first longitudinal axis and a cross-sectional profile of the first male portion is constant along the second longitudinal axis; and/or wherein the first female portion further comprises a first support protrusion and the first male portion further comprises a first opening, and wherein the first support protrusion is shaped to at least partially conform to the first opening.

14. The kit of parts of any one of claims 9 to 13, further comprising an elongate second window frame section having a third longitudinal axis, the second window frame section comprising a second female portion including a cavity at least partially defined by a second wall, wherein the cavity comprises an aperture having a width perpendicular to the third longitudinal axis, wherein the second wall is moveable from a first position to a second position, and wherein the width of the aperture is greater in the first position relative to the second position,
wherein the connector section further comprises a second male portion including a second undercut, wherein the second male portion is shaped to at least partially conform to the second female portion when the second wall is in the second position and when the second longitudinal axis is parallel to the third longitudinal axis, and wherein the second male portion is located at or near an opposite edge of the connector section to the first male portion, and optionally, wherein the second female portion further comprises a second support protrusion and the second male portion further comprises a second opening, and wherein the second support protrusion is shaped to at least partially conform to the second opening.

15. An elongate thermally insulating connector section for a window frame assembly, the connector section having a longitudinal axis, and comprising first and second male portions at a first side thereof and first and second male portions at a second side thereof, the male portions to be received in corresponding female portions of opposing first and second structural sections, wherein a first body extends between the first male portion on the first side and the first male portion on the second side, a second body extends between the second male portion on the first side and the second male portion on the second side and at least one cross-member connects the first body to the second body.

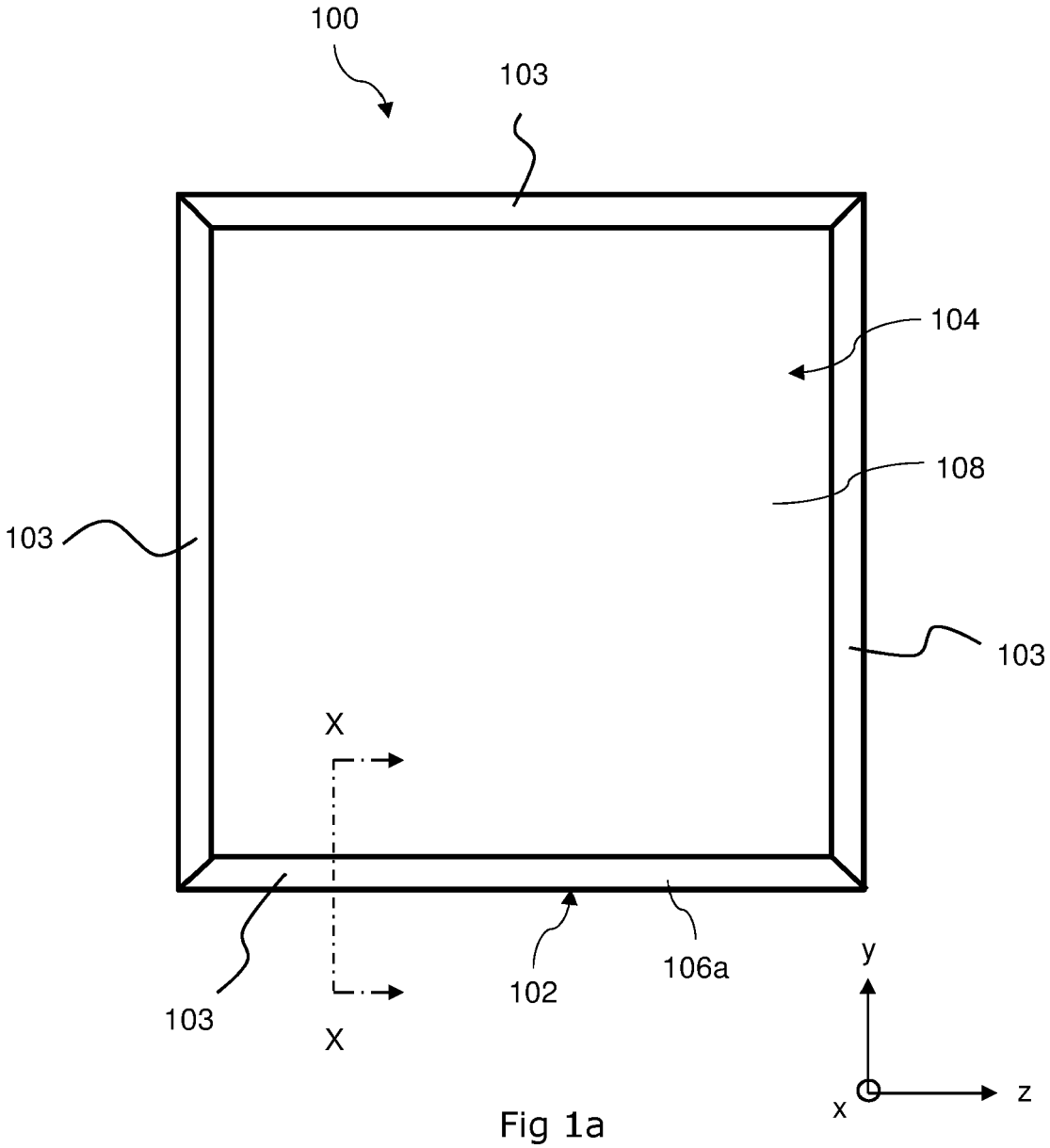

Fig 1a

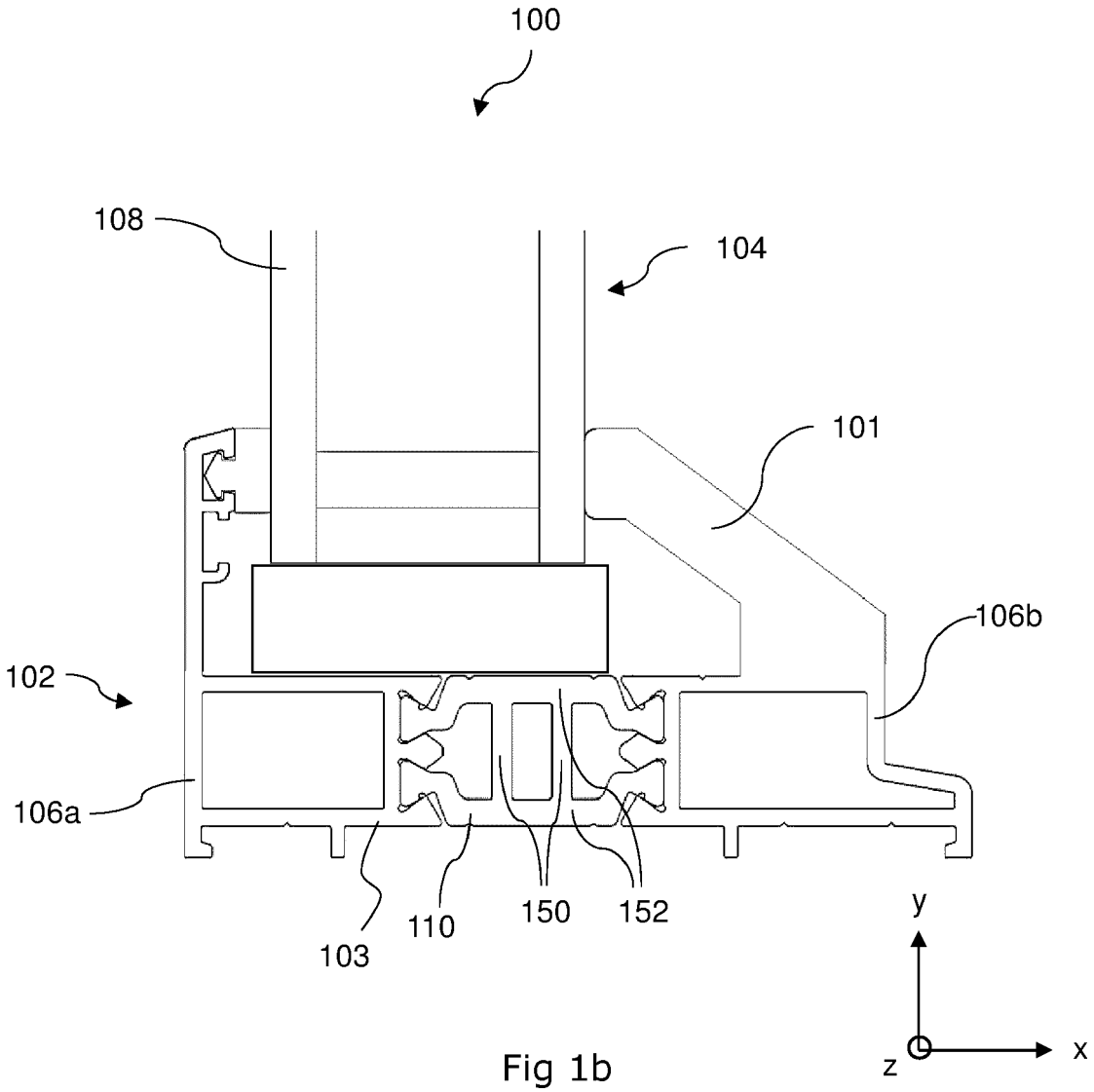

Fig 1b

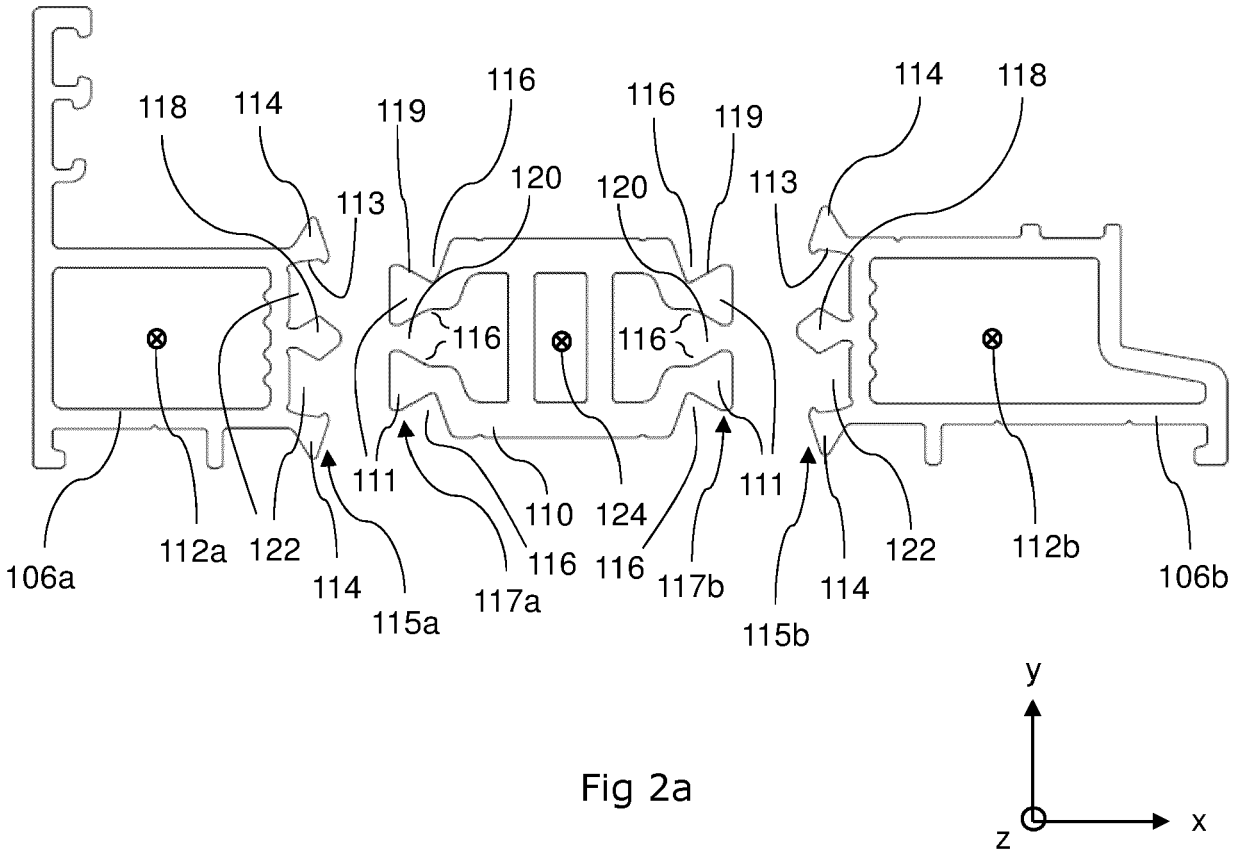
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Fig 2a

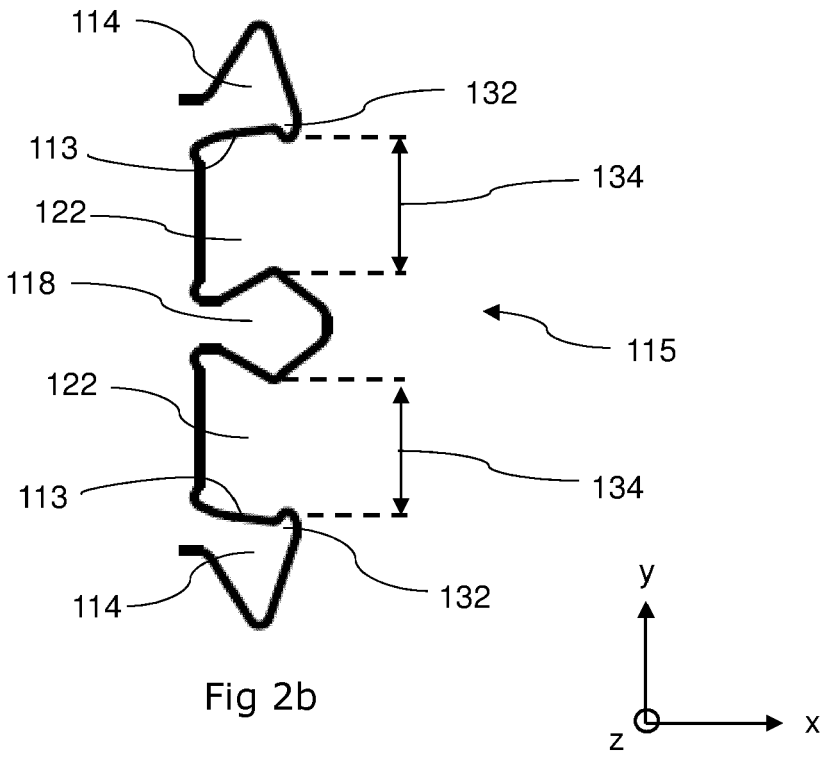
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Fig 2b

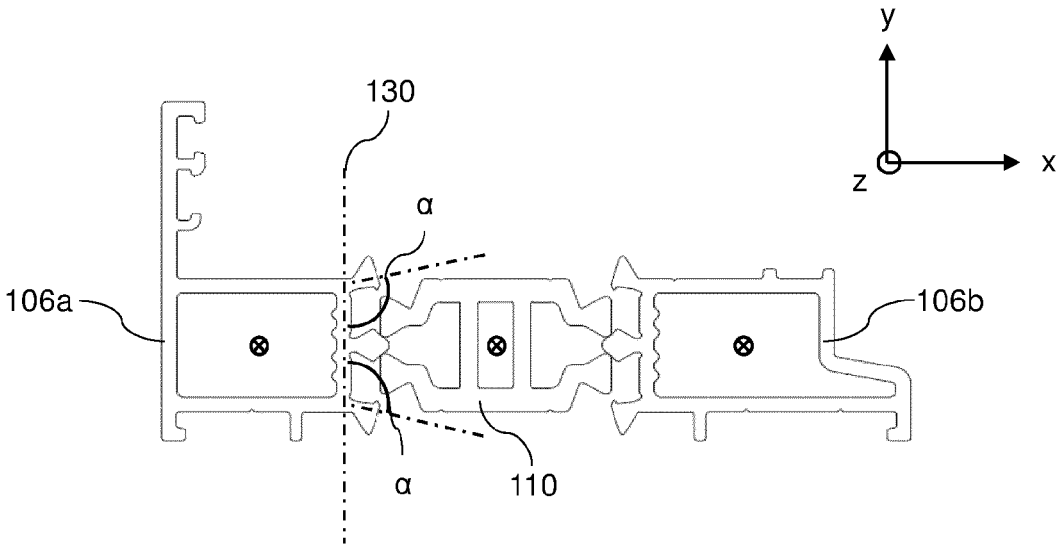

Fig 3a

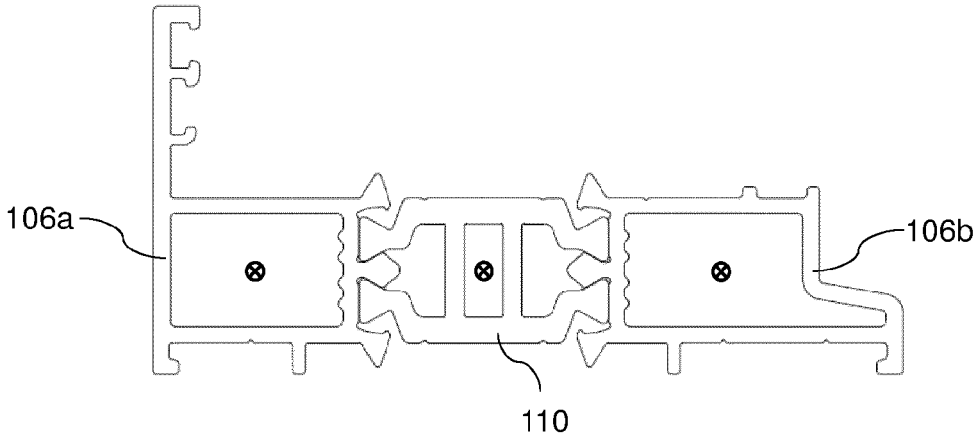

Fig 3b

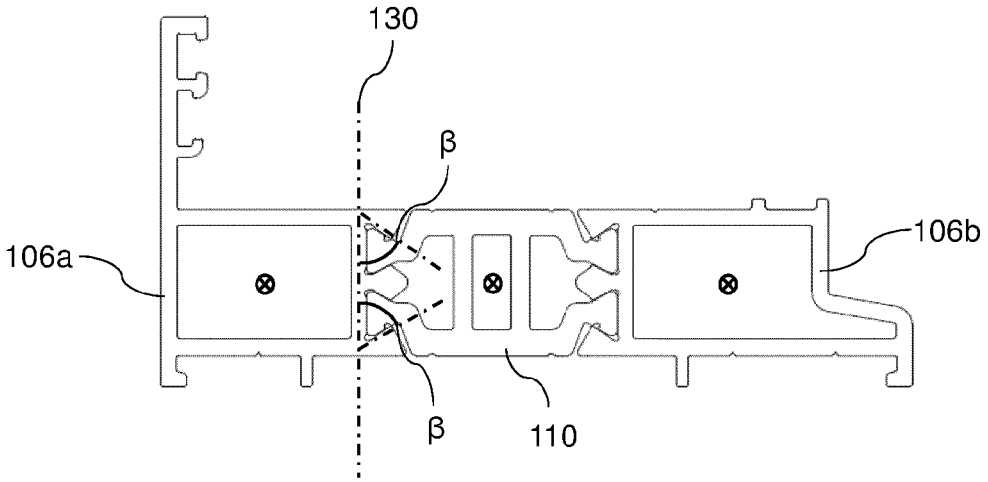

Fig 3c

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EUROPEAN SEARCH REPORT

Application Number
EP 21 15 3856

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	DE 22 21 179 A1 (WUTOESCHINGEN ALUMINIUM) 15 November 1973 (1973-11-15) * page 4, paragraph 4; claim 1; figures *	1-15	INV. E06B3/273 E06B3/263
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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	25 February 2021	Kis, Pál

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25-02-2021

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DE 2221179 A1	15-11-1973	NONE	
BE 668070 A	01-12-1965	NONE	

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