



(11)

EP 3 623 562 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.03.2020 Bulletin 2020/12

(51) Int Cl.:
E06B 3/964 ^(2006.01)
E06B 3/968 ^(2006.01)
E06B 3/54 ^(2006.01)
E06B 3/98 ^(2006.01)
E06B 3/263 ^(2006.01)

(21) Application number: **19196397.4**

(22) Date of filing: **10.09.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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

(72) Inventor: **Parry, Philip**
Derby, Derbyshire DE5 8LE (GB)

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

(30) Priority: **11.09.2018 GB 201814737**

(54) **FRAME ASSEMBLY**

(57) A first aspect of the invention provides a beadless frame assembly for a fenestration unit, the frame assembly comprises a plurality of metallic frame members, preferably aluminium, and a plurality of connectors. Each frame member comprises a pair of bevelled edges configured to interface with a respective bevelled edge of a neighbouring frame member so as to form a mitre joint. The plurality of connectors are configured to secure

neighbouring frame members at each of the respective of mitre joints. Each of the frame members further comprise a groove for receiving a panel of the fenestration unit, therefore enabling a panel to be secured within the frame assembly without requiring a bead. The level of security provided by the frame assembly is therefore improved.

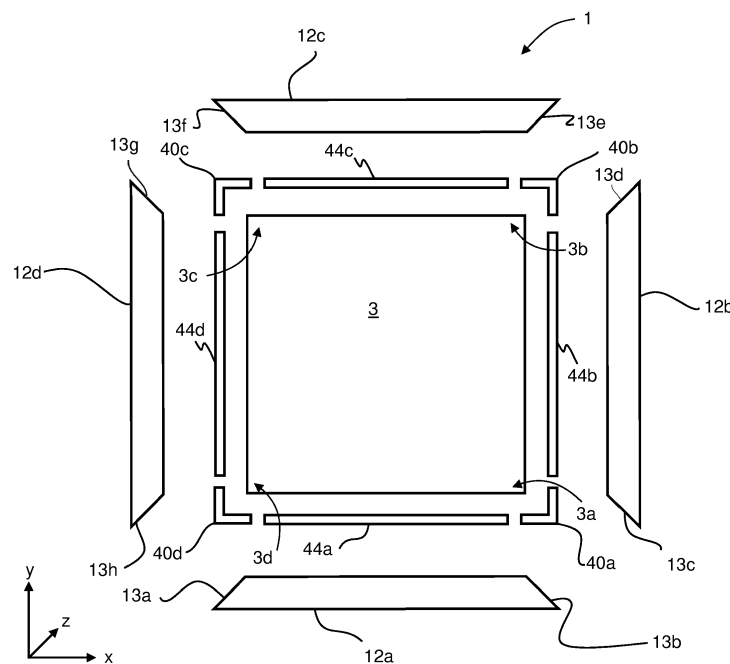


FIG. 5

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a beadless frame assembly for a fenestration unit, a fenestration unit comprising said beadless frame assembly, a kit of parts for assembling said fenestration unit and a method of assembling the same.

BACKGROUND OF THE INVENTION

[0002] Modern fenestration units typically comprise a frame assembly, into which a panel, such as a glass pane, or a sealed double glazing unit, is inserted in a direction generally normal to the plane of the panel. Typically, such frame assemblies are pre-assembled prior to the panel being inserted. A bead is then secured to the frame assembly after the panel has been inserted into the frame assembly, for securing said panel within the frame assembly.

[0003] However, such beads are easily removable with the appropriate knowledge and tools and are often accessible from a building's exterior. Therefore, fenestration units featuring this design are often vulnerable to home intrusion as the bead, and subsequently the panel secured within the frame assembly, can be easily removed without breaking the glass or other panel material, thereby allowing access into the building in which the fenestration unit is installed. More recently, window beads have been moved onto the interior side of the fenestration unit to help address this issue. However, with the correct know-how, it is still possible to externally access and dislodge the bead in these designs, thereby enabling access into the building.

[0004] Furthermore, domestic frame assemblies are typically made from uPVC. uPVC is a lower strength material and can therefore be more easily drilled or broken to enable access to the bead.

[0005] Therefore, the aim of the present invention is to provide a way of alleviating at least some of the aforementioned issues.

SUMMARY OF THE INVENTION

[0006] According to a first aspect of the invention, there is provided a beadless frame assembly for a fenestration unit, the frame assembly comprising a plurality of frame members, each frame member comprising a pair of bevelled edges configured to interface with a respective bevelled edge of a neighbouring frame member so as to form a mitre joint; and a plurality of connectors configured to secure neighbouring frame members at each of the respective of mitre joints, wherein each of the frame members comprise a groove for receiving a panel of the fenestration unit, and wherein the frame assembly is a metallic frame assembly.

[0007] The provision of a plurality of frame members,

each having a groove for receiving a panel of the fenestration unit, enables the panel to be installed into the frame assembly without requiring a bead, thereby improving the security provided by the frame assembly once the fenestration unit has been installed. The provision of metallic frame members further improves the security provided by the frame assembly.

[0008] The frame assembly may comprise frame members comprising an internal profile section and an external profile section and a thermal break sandwiched between the internal profile section and the external profile section.

[0009] Advantageously this enables the frame assembly to have enhanced security and greater insulation properties to enable its use in building structures such as dwellings and offices.

[0010] The internal and external profile sections may comprise a body portion and an upstanding projection, the upstanding projections defining the groove.

[0011] An opening to receive the connectors may be provided in the body portion of one or both of the internal and/or external profile sections.

[0012] The body portions have a suitable space to provide a void for the connector, and, if connectors are provided in both sections, the load may be substantially evenly shared across the mitre joint

[0013] The frame assembly may comprise a plurality of corner spacers configured to be received within the groove of each frame member at each of the respective mitre joints.

[0014] The provision of a plurality of corner spacers provides the advantage of ensuring correct positioning of the panel in 2 axes (height/width) of the frame assembly.

[0015] The plurality of corner spacers may be substantially L-shaped.

[0016] This provision allows each spacer to be more easily located at each of the mitre joints thereby reducing installation times. Furthermore, such spacers do not require cutting to shape in order to fit within the groove at the respective mitre joint. This further reduces installation times and also improves ease of installation.

[0017] The plurality of corner spacers may each comprise at least one corner gasket comprising a resilient material, preferably a rubber-like material, and most preferably EDPM.

[0018] This provision provides the advantage of improved sealing.

[0019] The plurality of corner spacers may each comprise a groove configured to receive a corner of the panel of the fenestration unit.

[0020] The provision of a groove provides the further advantage of ensuring correct positioning of the panel along a further axis (depth) of the frame assembly. Furthermore, this provision also provides a more uniform stress around the circumference of the panel which enables a more uniform, and therefore better, seal to be achieved around the panel once the fenestration unit has

been completed.

[0021] Each connector may comprise first and second fasteners configured to secure respective neighbouring frame members to the connector.

[0022] This provision reduces the number of parts and allows for fastener installation.

[0023] The plurality of frame members may each define a hollow profile having at least one opening at a respective bevelled edge of each frame member, each opening being configured to receive one of the plurality of connectors; and each of the plurality of connectors may comprise a first arm configured to extend within a hollow profile defined by a first frame member, and a second arm configured to extend within a hollow profile defined by a second frame member.

[0024] This provision allows for easier location of the connectors at the mitre joint, and subsequently reduces the likelihood of fastener misalignment.

[0025] Each fastener may be a threaded fastener. Preferably each fastener may be a self-tapping threaded fastener. Each fastener may comprise a frusto-conical leading end.

[0026] This provision enables the fasteners to secure neighbouring frame members without requiring any further fastening elements, thereby reducing the number of parts and allowing for fastener installation.

[0027] At least one mount may be located at an external surface of the frame assembly, the at least one mount being configured to releasably secure the beadless frame assembly within a casing.

[0028] This provision allows for easier replacement of the panel once the fenestration unit has been installed without requiring the entire fenestration unit to be removed.

[0029] The plurality of frame members may comprise at least four modular frame members, and the plurality of connectors may comprise at least four connectors.

[0030] This provision enables the frame assembly to be manufactured as series of modular sections and therefore improves ease and cost of manufacturing.

[0031] The metallic frame assembly may comprise aluminium.

[0032] This provision provides the advantage of improved durability.

[0033] For example, where the frame assembly comprises an internal profile section and an external profile section these may be formed substantially entirely of aluminium (which term encompasses aluminium alloys). These profile sections provide the majority of the structural strength of the frame members.

[0034] However if a thermal break is present this is manufactured from a non-metallic material with a lower thermal such as plastics material - e.g. polyamide. The thermal break is typically non-structural.

[0035] According to a second aspect of the invention, there is provided a kit of parts for assembling a fenestration unit, the kit of parts comprising a beadless frame assembly according to the first aspect of the invention,

and a panel configured to be received within the beadless frame assembly.

[0036] According to a third aspect of the invention, there is provided a fenestration unit comprising a panel and the beadless frame assembly according to the first aspect of the present invention.

[0037] According to a fourth aspect of the invention, there is provided a method of assembling a fenestration unit comprising the steps of providing a plurality of metallic frame members, each frame member comprising a pair of bevelled edges and a groove for receiving a panel of the fenestration unit; locating a first frame member about a panel, such that the panel is received within the groove of a first frame member; abutting a second frame member with the first frame member such that the panel is received within the groove of the second frame, and such that at least one bevelled edge of the first frame member and at least one bevelled edge of the second frame member interface to form a mitre joint; and securing a connector at the mitre joint so as to secure the first and second frame members.

[0038] The plurality of metallic frame members may comprise at least three metallic frame members, and the method may further comprise the steps of abutting a portion of the frame members such that at least one bevelled edge of each frame member interfaces to form a mitre joint; and securing a respective connector at the mitre joint so as to secure the frame members thereby forming the first frame member, wherein the steps of abutting and securing the first frame member take place prior to locating the first frame member about the panel.

[0039] This provision reduces the number of joints required to complete the fenestration unit once the panel is in place. This provides the advantage of reducing installation times and also reduces the likelihood of damage to the panel during installation.

[0040] The plurality of metallic frame members may comprise at least four modular metallic frame members, and the method may further comprise the steps of abutting three of the modular metallic frame members such that at least one bevelled edge of each frame member interfaces to form a respective mitre joint; and securing a respective connector at each of the mitre joints so as to secure the frame members thereby forming the first frame member, wherein the steps of abutting and securing the first frame member take place prior to locating the first frame member about the panel, and wherein the step of locating the first frame member about the panel comprises sliding the panel into the respective grooves of the three modular metallic frame members which make up the first frame member. This provision enables the panel to be easily received within the frame members prior to the final frame member being attached, thereby allowing for easier assembly of the fenestration unit. Furthermore, this provision means that only two joints require securing once the panel is in place. This provides the advantage of reducing installation times and also reduces the likelihood of damage to the panel during in-

stallation.

[0041] The method may further comprise the steps of providing at least one gasket, and locating said at least one gasket about each of the plurality of metallic frame members.

[0042] The step of locating said at least one gasket about each of the plurality of metallic frame members may take place after the first frame member and second frame member have been secured.

[0043] A fifth aspect of the present invention provides a frame member for constructing a beadless frame assembly, the frame member comprising bevelled edges configured to interface with a respective bevelled edge of a neighbouring frame member so as to form a mitre joint; and wherein each of the frame members comprises an internal profile section and an external profile section and a thermal break sandwiched between the internal profile section and the external profile section.

[0044] The frame member may be configured to receive at least one connector to secure the frame member to a neighbouring frame member.

[0045] The connector(s) may be received in one or both of the internal and external profile sections.

[0046] The internal and external profile sections may comprise a body portion and an upstanding projection, the upstanding projections defining the groove.

[0047] An opening to receive the connectors may be provided in the body portion of one or both of the internal and/or external profile sections.

[0048] The body portions have a suitable space to provide a void for the connector, and, if connectors are provided in both sections, the load may be substantially evenly shared across the mitre joint.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049]

Figure 1 is a front view of a fenestration unit having a beadless frame assembly according to an embodiment of the present invention;

Figure 2 is a cross-sectional view of a frame member of the beadless frame assembly according to the embodiment illustrated in Figure 1;

Figure 3 is an isometric view of part of a mitre joint of the beadless frame assembly according to the embodiment illustrated in Figures 1 and 2;

Figure 4 is an isometric view of the mitre joint of Figure 3 in a partially assembled state;

Figure 5 is an exploded front view of the fenestration unit according to the embodiment illustrated in Figure 1;

Figure 5A is a simplified cross sectional view of the

beadless frame assembly on the plane A-A of Figure 1, proximate a corner thereof;

Figure 5B is a further cross-sectional view of the frame member of the beadless frame assembly on the plane B-B of Figure 1 at a mid-point of the frame member;

Figure 5C is a schematic cross-sectional view of the frame member illustrated in Figure 5B showing the gasket in both a compressed and an uncompressed state;

Figure 6 is a front view of the fenestration unit according to the embodiment illustrated in Figure 1, and a casing for housing the fenestration unit;

Figures 7A-E illustrate a method of assembling a fenestration unit according to an embodiment of the present invention;

Figures 8A-C illustrate an alternative method of assembling a fenestration unit according to an embodiment of the present invention; and

Figures 9A-D illustrate a further alternative method of assembling a fenestration unit according to an embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENT(S)

[0050] Figure 1 shows a fenestration unit generally indicated at 1, having a frame assembly 2 made up of a plurality of frame members 12a-d. The fenestration unit 1 of this embodiment is suitable for a window, door or other type of fenestration, such as a vent or cladding panel. The frame assembly 2 is configured to receive and support a pane or panel 3, such as a pane of glass, a double or triple glazed sealed unit, or a panel of wood, aluminium or other suitable material. The frame assembly of the present invention is a beadless frame assembly meaning that the panel 3 is secured within the frame assembly without the use of a bead. This is achieved by providing the frame members 12a-d with a groove, or channel - i.e. the frame members have a 'U'-shaped cross-sectional profile to receive the pane or panel 3 securely as discussed in more detail below.

[0051] Each frame member 12 comprises a pair of angled or bevelled edges 13. The bevelled edges 13 of each frame member 12 are configured to interface with a corresponding bevelled edge 13 of a neighbouring frame member 12 so as to form a mitre joint 10. In the embodiment illustrated in Figure 1, the frame assembly 2 is made up of four modular frame members 12a-d, with each frame member 12a-d comprising a respective pair of bevelled edges 13a-h. The bevelled edges 13a-h are each configured to interface with a respective bevelled edge 13 of a neighbouring frame member 12 to form four

mitre joints 10a-d, one at each corner 4a-d of the frame assembly 2. A first mitre joint 10a is formed at the interface between the bevelled edge 13b of the first frame member 12a and the bevelled edge 13c of the second frame member 12b. A second mitre joint 10b is formed at the interface between the bevelled edge 13d of the second frame member 12b and the bevelled edge 13e of the third frame member 12c. A third mitre joint 10c is formed at the interface between the bevelled edge 13f of the third frame member 12c and the bevelled edge 13g of the fourth frame member 12d, and a fourth mitre joint 10d is formed at the interface between the bevelled edge 13h of the fourth frame member 12d and the bevelled edge 13a of the first frame member 12a.

[0052] However, it shall be appreciated that in other embodiments the frame assembly may comprise a pair of corresponding L-shaped frame members in elevation, may comprise a U-shaped frame member in elevation and a corresponding frame member configured to interface with the bevelled edges of the U-shaped frame member, or may comprise any other suitable configuration of frame members. It shall be appreciated that in such embodiments, the frame assembly may comprise fewer than four mitre joints. For example, one embodiment may comprise two mitre joints. In other embodiments comprising more than four frame members, it shall be appreciated that the frame assembly may comprise more than four mitre joints.

[0053] The frame assembly 2 of the present invention is a metallic frame assembly, i.e. a frame assembly 2 having frame members 12 that are at least in part metallic. A metallic frame assembly as described here may include features or components of some non-metallic or composite material, such as plastics material or wood. However, the majority of the structural strength is provided by the metallic parts.

[0054] Typically, the frame assembly is an aluminium frame assembly, i.e. a frame assembly 2 having frame members 12 comprising at least part aluminium. The frame members 12a-d of this embodiment comprise a 6063T6 aluminium alloy. However, it shall be appreciated that any other suitable material may be used. In one alternative, the frame members are of some other suitable material, such as some other 6063 series aluminium alloy, or a 6060 series aluminium alloy.

[0055] The frame members 12a-d of this embodiment are typically manufactured by extrusion. However, it shall be appreciated that other suitable manufacturing methods may be used.

[0056] Figure 2 shows a cross-sectional view of one of the frame members 12a illustrated in Figure 1. Whilst only the first frame member 12a is illustrated in Figure 2, it shall be appreciated that frame members 12b-d are substantially the same configuration, and therefore, for reasons of conciseness and brevity, only frame member 12a shall be described herein. Like components of frame members 12b-d shall be denoted by like reference numerals.

[0057] The frame member 12a comprises an internal profile section 5a, an external profile section 6a and a thermal break 7a sandwiched therebetween comprising a low thermal conductivity material such as a plastics or foam. However, it shall be appreciated that other suitable thermal breaks may be used, or alternatively, the thermal break may be omitted. The internal 5a and external 6a profile sections are metallic profile sections, typically comprising aluminium, although it shall be appreciated that any other suitable metal, or metallic material, may be used. As noted above, these profile sections 5a and 6a are typically manufactured by extrusion of aluminium alloys and have a relatively high thermal conductivity, whereas the foam or plastics material has a relatively low thermal conductivity to enhance the overall thermal insulation properties of the frame member.

[0058] The internal 5a and external 6a profile sections each comprise a respective body portion 30a, 32a and an upstanding projection 34a, 36a extending upwardly therefrom. In this embodiment it can be seen that these are unitarily or monolithically formed, e.g. by the extrusion process, which enhances the strength thereof. A groove 38a is defined between the respective upstanding projections 34a, 36a, which is configured to receive the panel 3 of the fenestration unit 1, thereby enabling the panel 3 to be secured within the frame assembly 2 without requiring a bead. The method of assembly shall be described in greater detail at a later stage within this application.

[0059] A mitre joint 10a of the internal profile 6a frame assembly 2 is shown in Figure 3. Whilst only the first mitre joint 10a is illustrated in Figure 3, it shall be appreciated that mitre joints 10b-d are substantially the same configuration, and therefore, for reasons of conciseness and brevity, only the first mitre joint 10a shall be described herein. Like components of mitre joints 10b-d shall be denoted by like reference numerals.

[0060] When the mitre joint 10a is in the assembled state, as shown in Figure 3, the frame members 12a, 12b abut to form a corner 4a of the frame assembly 2. When the first and second frame members 12a, 12b are abutted, the bevelled edge 13b of first frame member 12a and the corresponding bevelled edge 13c of the second frame member 12b interface with one another thereby forming the mitre joint 10a. In this embodiment, as indicated at a, b, the bevelled edges 13b, 13c are both angled at 45°, i.e. the angle is 45° and the angle b is 45°. In alternative embodiments, the bevelled edges 13b, 13c may have some other angle. In such embodiments, the first and second frame members 12a, 12b may be of a different width to one another, so that the bevelled edge 13b of the first frame member 12a may require a different angle to the bevelled edge 13c of the second frame member 12b. In this embodiment the frame members 12a, 12b form a 90° corner 4a. However, in alternative embodiments, the frame assembly may have corners of some other angle, e.g. between 60° and 120°. In such embodiments, the bevelled edges are of equal angles.

In alternative embodiments where the frame has a corner or corners of some non-90° angle, and where the first and second frame members are of different widths to one another, the bevelled edges may be of different angles to one another.

[0061] Each of the respective frame members 12 are secured at each of the respective mitre joints 10 via a respective connector. Typically, in embodiments which comprise four modular frame members, such as the embodiment illustrated in Figures 1 and 2, eight connectors are provided, two at each mitre joint with one connector securing a neighbouring pair of internal profile sections 5 and the other securing a neighbouring pair of external profile sections 6. However, it shall be appreciated that in other embodiments, a single connector may be provided at each mitre joint 10, or alternatively, three or more connectors may be provided at each mitre joint. Furthermore, in embodiments comprising "U" or "L" shaped frame members, in which there are fewer than four mitre joints, fewer than four connectors may be provided.

[0062] A connector 16 according to one embodiment of the present invention is illustrated in Figure 4. Whilst the connector 16 is described in relation to mitre joint 10a, it shall be appreciated that the frame members 12 at each of the other respective mitre joints 10b-d are joined in substantially the same way as is described below for mitre joint 10a. However, it shall also be appreciated that in other embodiments, the connector may comprise a screw connector, an adhesive, or may be any other suitable connector type. Furthermore, in such embodiments, it shall be appreciated that the hollow profiles and respective openings at each of the bevelled edges may be omitted.

[0063] The connector 16 of this embodiment is formed by injection moulding, and is of glass filled nylon. In an alternative embodiment the connector is of some other material suitable for injection moulding. In alternative embodiments the connector is die-cast, and is of some other suitable material, such as a zinc based material.

[0064] The connector 16 locates the frame members 12a, 12b in relation to one another, and is substantially L-shaped. The connector 16 has a first arm 20a and a second arm 20b which meet to form a corner 20c. In this embodiment, the frame members 12a, 12b form a 90° corner 4a. However, in embodiments where the frame assembly 2 has corners of some other angle, the connector arms meet at a corresponding angle.

[0065] The connector 16 comprises first and second fasteners 18a, 18b. The fasteners 18a, 18b are configured to secure the respective first and second frame members 12a, 12b to the connector 16.

[0066] Each frame member 12a, 12b defines a hollow profile 22a, 22b. Each frame member 12a, 12b further comprises a pair of openings 23b, 23c located at a respective bevelled edge 13b, 13c of the first and second frame members 12a, 12b, which enable external access to the hollow profile 22a, 22b of the each frame member 12a, 12b. In the embodiment illustrated in Figure 4, the

openings 23b, 23c are provided at the respective body portions 30a, 30b of the first and second frame members 12a, 12b.

[0067] The first arm 20a of the connector 16 is configured to extend within the first member profile 22a, via the opening 23b. When the first arm 20a extends within the first frame member profile 22a, the first fastener 18a engages the first frame member 12a. The second arm 20b of the connector 16 is configured to extend within the second frame member profile 22b, via the opening 23c. When the second arm 20b extends within the second frame member profile 22b the second fastener 18b engages the second frame member 12b.

[0068] The engagement of the fasteners 18a, 18b with the respective frame members 12a, 12b secures the frame members 12a, 12b to the connector 16, creating a secure joint 10.

[0069] The fasteners 18a, 18b of this embodiment are threaded fasteners. In this embodiment, the fasteners 18a, 18b are self-tapping grub screws. In an alternative embodiment, some other suitable type of fastener is provided. For example, some other type of threaded fastener is provided. The leading end of each grub screw 18a, 18b in this embodiment is at least partially conical, or frusto-conical. The conical shape of the leading end aids self-tapping of each grub screw 18a, 18b with the respective frame members 12a, 12b. It should be noted that in embodiments where the fasteners are self-tapping, the frame members are of a metallic material that is less hard than the material of the fasteners, so that a thread can be formed in the frame members by the fasteners.

[0070] Each profile 22a, 22b further defines at least two projections 24 (four as depicted) extending from the profile 22a, 22b to engage the respective fastener 18a, 18b. The projections 24 engage the fasteners 18a, 18b at discrete, separate engagement points (not shown), where each engagement point is distinct from the next. The projections 24 are arranged about the fasteners 18a, 18b such that the engagement points provide balanced support, e.g. such that the engagement points are evenly arranged about a periphery of each fastener 18a, 18b. Advantageously, this arrangement provides stability to the engagement between a fastener 18a, 18b and the frame members 12a, 12b whilst reducing the amount of material used in the profile 22a, 22b. Providing an engagement point rather than a solid block or a face of a profile wall or the like for fastener engagement can also improve ease of engagement, in particular where the fastener is a self-tapping screw, due to the reduced amount of material used.

[0071] In this embodiment, engagement of the projections 24 and the fastener 18a, 18b at the engagement points cover less than 25% of the total circumference of each fastener 18a, 18b. In alternative embodiments, the engagement points cover less than 50% of the total periphery of each fastener, or less than 35%.

[0072] Each connector further 16 defines an access aperture 26. Each access aperture 26 is configured to

provide access to a respective fastener 18a, 18b for a tool, for example an Allen key or a screwdriver (not shown) which is configured for engagement with fasteners 18a and 18b respectively.

[0073] As the fasteners of this embodiment are engaged with an Allen key, or other suitable means, and subsequently screwed in a first direction, the self-tapping grub screws 18a, 18b of this embodiment create a thread within the respective hollow profiles 22a, 22b of the first and second frame members 12a, 12b thereby securing the frame members 12a, 12b to the connector 16 at the mitre joint 10a.

[0074] A further access aperture 28 is provided in each frame member 12a, 12b such that when each frame member 12a, 12b is in the assembled state as shown in Figure 3, the access apertures 26, 28 of the connector 16 and the frame members 12a, 12b are aligned with one another. This arrangement allows the first frame member 12a to be located, and potentially secured, to the connector 16, then the second frame member 12b to be located and secured to the connector 16, as access is provided to the fastener 18b via the access aperture 28 of the first frame member 12b, and the access aperture 26 of the first connector arm 20a. Alternatively, the second frame member 12b can be located and potentially secured to the connector 16 prior to location of the first frame member 12a.

[0075] Figure 4 is a cut-away view showing only the external profile sections 6a, 6b of the first and second frame members 12a, 12b. Although not shown in Figure 4, it shall be appreciated that further openings are provided at the respective body portions 32a, 32b of the first and second frame members 12a, 12b. The first arm of a further connector is configured to extend within the first member profile 22a, via the further opening to further engage the first frame member 12a. The second arm of the further connector is configured to extend within the second frame member profile 22b, via the further opening to further engages the second frame member 12b.

[0076] It shall also be appreciated that in other embodiments, any number of openings and respective connectors may be provided for securing the first and second frame members 12a, 12b. In one such embodiment, the first and second frame members 12a, 12b may comprise a single opening such that the first and second frame members 12a, 12b are secured at the mitre joint 10a by a single connector. Alternatively, additional openings may be provided. Furthermore, it shall be appreciated that in other alternatives, the openings may be located at substantially any cross-sectional location of the frame members, and are therefore not limited to being housed in the respective body portions of the internal and external profile sections.

[0077] An exploded view of the assembled frame assembly 2 is shown in Figure 5. A plurality of corner spacers 40a-d are located in each of the respective corners 3a-d of the panel 3. The corner spacers 40a-d are configured to be received within the respective grooves 38a-

d of each frame member 12a-d at each of the respective mitre joints 10a-d. The corner spacers 40 are typically L-shaped and further comprise a groove 42a-d configured to receive a respective corner 3a of the panel 3, as illustrated in Figure 5A. However, it shall be appreciated that the corner spacers may alternatively be any suitable shape, or in an alternative embodiment, may be omitted.

[0078] The corner spacers 40 ensure the correct positioning of the panel 3 in both the X (width-wise) and Y (height-wise) axes. Furthermore, grooves 42a-d also ensure correct positioning of the panel in the Z (depth-wise) axis.

[0079] The plurality of corner spacers 40a-d typically comprise at least one corner gasket. Typically, the plurality of corner spacers comprise an internal gasket configured to abut and seal against an interior side of the panel 3 and an external gasket configured to abut and seal against an exterior side of the panel 3. The corner gasket may be integrally formed as a part of each corner spacer 40a-d or may be provided as a separate component. Each corner gasket is typically made up of a resilient material to provide a sealing effect about the panel 3 at each corner 4a-d of the frame assembly 2. Typically, the corner gaskets comprise a rubber-like material, in particular EDPM, although it shall be appreciated that any other suitable material may be used. Typically, the corner gaskets are made from a different, more resilient material, to that of rest of the corner spacers 40a-d.

[0080] A plurality of gaskets 44a-d are also located within the respective grooves 38a-d of each frame member 12a-d as is illustrated in Figure 5B. The gaskets 44a-d span along the groove 38a-d of each frame member 12a-d between the respective corner spacers 40a-d. Typically, each groove 38a-d houses a pair of gaskets 43a-d, 45a-d as shown in Figure 5B. An internal gasket 43a is located between the panel 3 and the upstanding projection 36a of the internal profile section 5a of the first frame member 12a, and an external gasket 45a is located between the panel 3 and the upstanding projection 38a of the external profile section 6a of the first frame member 12a. However, it shall be appreciated that a single gasket may be provided at each of the respective frame members or, in a further alternative, the gaskets may be omitted.

[0081] The internal 43 and external 45 gaskets are typically sized to be larger than the space provided between the panel 3 and the frame member 12. As the respective internal 43 and external gaskets 45 are located within the groove 38, between the panel 3 and a respective upstanding portion 36, 38, the gaskets become compressed, as shown in Figure 5C, thereby achieving an effective seal between the frame member 12 and the panel 3. Typically the gaskets 43 and 45 are inserted into the gap between the panel and the upstanding projections 36 and 38 after the frame members have been assembled and secured around the panel. To facilitate this, the gaskets 43 and 45 have a generally wedge shaped leading profile, as shown in 45a'. Further, in this embod-

iment, the gaskets have a ridge, as shown in 45a", positioned on one face, such that when correctly inserted this ridge is seated under an undercut of the respective up-standing projection 36 or 38. This allows the fitter to have physical feedback on when the gasket is inserted to the correct position, and also inhibits the removal of the gasket either under the action of forces generated by its own resilience under compression, or an external force.

[0082] The plurality of gaskets 44a-d are typically made up of a resilient material configured to provide a sealing effect about the panel 3. In particular, the plurality of gaskets 44a-d comprise a rubber-like material, in particular EDPM, although it shall be appreciated that any other suitable material may be used. Furthermore, the gaskets 44a-d may be made from the same, or different, material to the corner spacers 40a-d.

[0083] Frame assemblies according to the prior art typically comprise a single gasket that is inserted around the circumference of the frame assembly and is "doubled up" at the corner regions. At the corner regions the gasket is therefore typically under greater amounts of compression loading than the gasket at other regions of the frame assembly. Whilst this creates a good seal at the corner, this can also lead to reduced compressive loads being placed on the gasket in other regions of the frame assembly, thereby providing regions of poorer sealing. The provision of gaskets pre-formed as part of the corner spacers provides a more uniform stress loading around the circumference of the panel which enables a more uniform, and therefore better, sealing to be achieved around the panel once the fenestration unit has been completed. It also avoids the difficulty of fitting the gaskets to the corners.

[0084] In certain configurations, the frame assembly 2 further comprises at least one mount, illustrated in Figure 6. In Figure 6, the mount of the frame assembly 2 comprises a plurality of packers 46, located on an exterior surface 48 of the frame assembly 2. The packers 46 are configured to releasably secure the frame assembly 2 within a casing 50, configured to house the fenestration unit 1.

[0085] In the embodiment illustrated in Figure 6, the packers 46 are provided as a plurality of clips, which clip into corresponding receptacles (not shown) located within the casing 50. However, in an alternative embodiment, the packers, or packer, may be provided in any other suitable form. In another embodiment, the mount may be provided in the form of a hinge such that the fenestration unit 1 is pivotable relative to the casing 50.

[0086] This provision enables the panel 3 of the fenestration unit 1 to be replaced without requiring replacement of the entire fenestration unit 1 and casing 50. Once the respective packers 46 have been released, or the frame assembly 2 has been decoupled from the hinge, the frame assembly 2 can be partially dismantled, for example via de-coupling one of the frame members 12 from a respective connector 16, to facilitate removal of the panel 3. Once the panel 3 has been replaced, the

frame member 12 can be re-attached via re-coupling the frame member 12 to the respective connector 16 before re-securing the frame assembly 2 into the casing 50. Therefore, this provision allows for easier replacement of the fenestration unit post-installation.

[0087] A method of assembling a fenestration unit according to an embodiment of the present invention shall now be described with reference to Figures 7A-E.

[0088] In a first step illustrated in Figure 7A, the corner spacers 40a-d are applied at the respective corners 3a-d of the panel 3. Once the corner spacers 40a-d have been applied, the first frame member 12a is located about the panel 3, as shown in Figure 7B, such that the panel 3 is received within the groove 38a of the first frame member 12a. The first arm 20a of the connector 16 is then applied to the hollow profile 22a of the first frame member 12a, via the opening 23b. A further connector is also applied to the hollow profile 22a of the first frame member 12a, via a further opening such that a pair of connectors are located at the bevelled edge 13b of the first frame member 12a, one in the opening 23b provided at the body portion 30a of the first frame member 12a, and another at the opening provided at the body portion 32a of the first frame member 12a. The second frame member 12b is then located about the panel 3, as illustrated in Figure 7C, via pushing the frame member 12b onto the panel 3 such that the panel 3 is received within the groove 38b of the second frame member 12b, and sliding the second frame member 12b down the panel 3 such that the second arm 20b of the connector 16 is located within the hollow profile 22b of the second frame member 12b via the opening 23c provided at the body portion 30b, and the second arm of the further connector is located within the hollow profile 22b of the second frame member 12b via the further opening, provided at the body portion 32b. As the second frame member 12b is located about the panel 3, the second frame member 12b abuts the first frame member 12a such that the bevelled edge 13c of the second frame member 12b interfaces with the bevelled edge 13b of the first frame member 12a to form the mitre joint 10a. The connectors 16 can then be secured at the mitre joint 10a via engaging an Allen key, or other suitable tool, with the respective fastener 18a, 18b via access apertures 26, 28 so as to secure the first and second frame members 12a, 12b. This process can then be repeated to locate and secure the fourth frame member 12d and then the third frame member 12c about the panel 3 to complete the assembly of the fenestration unit, as shown in Figures 7D and 7E.

[0089] The frame members and connectors can be assembled in an alternative order, depending on preference. Furthermore, it shall be appreciated that fewer than two, or more than two connectors may be provided and secured at the respective mitre joints 10a-d. Furthermore, in an alternative embodiment, each of the frame members 12a-d may be located about the panel 3 prior to the step of securing a connector at each of the respective mitre joints 10a-d. Although the method is described

using the connector 16, as described in Figure 4, it shall be appreciated that any other type of suitable connector, such as a screw connector, may be used. In such embodiments, the openings and hollow profiles may be omitted. It should be noted that in embodiments featuring the connectors 16, as illustrated in Figure 4, connectors are applied to the hollow profiles of the second and fourth frame members 12b, 12d, located at bevelled edges 13d and 13g respectively, prior to the third frame member 12c being located and secured to complete the frame assembly 2. However, in embodiments featuring other connectors, the connectors may be applied in any order and at any suitable stage, for example after respective frame members 12 have been abutted to form a mitre joint.

[0090] Once each of the frame members 12a-d have been secured at each of the respective mitre joints 10a-d, internal 43 and external 45 gaskets are applied to each of the frame members 12a-d to complete the fenestration unit 1. However, it shall be appreciated that in some embodiments the plurality of gaskets may be pre-applied within each of the frame members 12a-d prior to assembly, for example, the plurality of gaskets may be pre-formed within the grooves 38a-d of each frame member 12a-d. Furthermore, in another embodiment, the plurality of gaskets 44 and/or corner spacers 40a-d may be omitted.

[0091] An alternative method of assembling a fenestration unit is illustrated in Figures 8A-B.

[0092] In a first step of this alternative method, first and second connectors are applied to the hollow profile 22a of the first frame member 12a, as has been described previously. Further connectors are also applied to the hollow profile of the fourth frame member 12d at respective openings located at the bevelled edge 13g in substantially the same way as has previously been described.

[0093] The first frame member 12a is then abutted with the second frame member 12b and the fourth frame member 12b is abutted with the third frame member 12c such that the bevelled edge 13b of the first frame member 12a interfaces with the bevelled edge 13c of the second frame member 12b to form the mitre joint 10a, and the bevelled edge 13g of the fourth frame member 12d interfaces with the bevelled edge 13f of the third frame member 12c to form the mitre joint 10c. As the first frame member 12a is abutted with the second frame member 12b, the second arms of the respective connectors are located within the hollow profile 22b of the second frame member 12b. Similarly, as the fourth frame member 12d is abutted with the third frame member 12c, the second arms of the respective connectors are located within the hollow profile of the third frame member 12c. The connectors are then secured at the respective mitre joints 10a, 10c in the same way as has been previously described so as to secure the first and second 12a, 12b and third and fourth 12c, 12d frame members respectively thereby providing a pair of corresponding L-shaped

members 50, 52, as shown in Figure 8B.

[0094] In the method described in Figure 8, the corner spacers 40a-d can be applied to the panel 3 in substantially the same way as has been described in Figure 7. Alternatively, corner spacers 40a and 40c may instead be located within the groove 38 formed at the mitre joints 10a, 10c of the respective L-shaped members 50, 52.

[0095] Further connectors are then applied to the hollow profiles of the first and second frame members 12a, 12b located at bevelled edges 13a and 13d respectively. The first and second L-shaped members 50, 52 are then substantially simultaneously located about the panel 3 such that the panel 3 is received within the groove 38 of the first and second 12a, 12b and third and fourth frame members 12c, 12d. As the L-shaped members 50, 52 are located about the panel, the second and third frame members 12b, 12c and the first and fourth frame member 12a, 12d subsequently abut with each other such that the bevelled edge 13a of the first frame member 12a interfaces with the bevelled edge 13h of the fourth frame member 12d to form the mitre joint 10d and the bevelled edge 13d of the second frame member 12b interfaces with the bevelled edge 13e of the third frame member 12c to form the mitre joint 10b. The connectors are then be secured at the respective mitre joints 10b, 10d in the same way as has been previously described to secure the corresponding L-shaped members 50, 52 thereby completing the assembly of the fenestration unit.

[0096] It shall be noted that the frame members and connectors may be assembled in an alternative order, depending on preference.

[0097] The plurality of gaskets may then be applied in substantially the same way as has been described previously, although it shall also be appreciated that this step may be omitted.

[0098] Yet a further alternative method of assembling a fenestration unit is illustrated in Figure 9.

[0099] In a first step of this alternative method, first and second connectors are applied to the hollow profile of the second frame member 12b at respective openings located at the bevelled edge 13d in substantially the same way as has been described previously. Further connectors are also applied to the hollow profile of the fourth frame member 12d at respective openings located at the bevelled edge 13g in substantially the same way as has previously been described.

[0100] The second, third and fourth frame members 12b, 12c, 12d are then abutted with each other, as shown in Figure 9B, such that the bevelled edge 13d of the second frame member 12b interfaces with the bevelled edge 13e of the third frame member 12c to form the mitre joint 10b, and the bevelled edge 13g of the fourth frame member 12d interfaces with the bevelled edge 13f of the third frame member 12c to form the mitre joint 10c. As the frame members 12 are abutted, the second arms of the respective connectors become located within the respective hollow profiles of the third frame member 12c located at the bevelled edges 13e and 13f respectively. The con-

nectors are then be secured at the respective mitre joints 10b, 10c in the same way as has been previously described so as to secure the second, third and fourth frame members 12b, 12c, 12d thereby forming a U-shaped member 54.

[0101] Once the U-shaped member 54 has been provided, the corner spacers 40a-d can be applied to the panel 3 in substantially the same way as has been described in Figure 7. Alternatively, corner spacers 40b and 40c may instead be located within the groove 38 formed at each mitre joint 10b, 10c of the U-shaped member 54. The U-shaped member 54 is then located about the panel 3 via sliding the panel 38 into the respective grooves 38b-d of the second, third and fourth frame members 12b, 12c, 12d, which make up the U-shaped member 54.

[0102] Further connectors are then applied to the hollow profile 22a of the first frame member 12a, located at bevelled edges 13a and 13b respectively.

[0103] The first frame member 12a is then located about the panel 3, as illustrated in Figure 9D, such that the panel 3 is received within the groove 38a of the first frame member 12a. As the first frame member 12a is applied, and the second arms of the further connectors become located within the hollow profiles of the second frame member 12b, located at the bevelled edge 13c, and the fourth frame member, located at the bevelled edge 13h. As the first frame member 12a is located about the panel 3, first frame member 12a abuts the second and fourth frame members 12b, 12d such that the bevelled edge 13a of the first frame member 12b interfaces with the bevelled edge 13h of the fourth frame member 12d and the bevelled edge 13b of the first frame member 12a interfaces with the bevelled edge 13c of the second frame member 12b to form mitre joints 10a and 10d respectively. The connectors can then be secured at the mitre joints 10a, 10d via engaging an Allen key, or other suitable tool, with the respective fastener 18a, 18b of each connector, via access apertures 26, 28, thereby completing the assembly of the fenestration unit.

[0104] The plurality of gaskets may then be applied in substantially the same way as has been described previously, although it shall also be appreciated that this step may be omitted.

[0105] It shall be noted that the frame members and connectors may be assembled in an alternative order, depending on preference.

[0106] Both alternative methods described in Figures 8 and 9 reduce the number of joints required to complete the fenestration unit once the panel is in place. This provides the advantageous effect of reducing installation times, since it is often more difficult to assemble a joint once the panel is in place. This also reduces the likelihood of damage to the panel during installation.

[0107] Furthermore, by enabling the panel to be slid into position, the method described in Figure 9 has the further advantage of enabling the frame members to be more easily located about the panel, thereby allowing for easier and faster assembly of the fenestration unit.

[0108] Whichever method is employed, it will be appreciated that mounting the pane or panel within a groove defined by fixed upstanding projections enhances the security of the frame assembly, whilst allowing for fast and simple assembly compared with known approaches that utilise a removable bead.

[0109] It should be noted that although the methods illustrated in Figures 7-9 are described as using the connectors 16 as described in Figure 4, it shall be appreciated that any other suitable connector type may be used. For example, in methods using a screw connector, the connectors may be instead be applied after the respective frame members have been abutted.

[0110] Where the word 'or' appears this is to be construed to mean 'and/or' such that items referred to are not necessarily mutually exclusive and may be used in any appropriate combination.

[0111] Although the invention has been described above with reference to one or more preferred embodiments, it will be appreciated that various changes or modifications may be made without departing from the scope of the invention as defined in the appended claims.

Claims

1. A beadless frame assembly for a fenestration unit, the frame assembly comprising:
 - a plurality of frame members, each frame member comprising a pair of bevelled edges configured to interface with a respective bevelled edge of a neighbouring frame member so as to form a mitre joint; and
 - a plurality of connectors configured to secure neighbouring frame members at each of the respective of mitre joints, wherein each of the frame members comprise a groove for receiving a panel of the fenestration unit, and wherein the frame assembly is a metallic frame assembly.
2. The beadless frame assembly of claim 1 wherein each of the frame members comprises an internal profile section and an external profile section and a thermal break sandwiched between the internal profile section and the external profile section.
3. The beadless frame assembly of claim 2 wherein the internal and external profile sections comprise a body portion and an upstanding projection, the upstanding projections defining the groove.
4. The beadless frame assembly according to any preceding claim, wherein the frame assembly further comprises a plurality of corner spacers configured to be received within the groove of each frame member at each of the respective mitre joints, optionally wherein the plurality of corner spacers are substan-

tially L-shaped, optionally wherein the plurality of corner spacers each comprise at least one corner gasket comprising a resilient material, preferably a rubber-like material, and most preferably EDPM.

- 5
10
15
20
25
5. The beadless frame assembly according to claim 4, wherein the plurality of corner spacers each comprise a groove configured to receive a corner of the panel of the fenestration unit.

6. A beadless frame assembly according to any preceding claim, wherein each connector comprises first and second fasteners configured to secure respective neighbouring frame members to the connector.

7. The beadless frame assembly according to any preceding claim, wherein the plurality of frame members each define a hollow profile having at least one opening at a respective bevelled edge of each frame member, each opening being configured to receive one of the plurality of connectors; and wherein each of the plurality of connectors comprises a first arm configured to extend within a hollow profile defined by a first frame member, and a second arm configured to extend within a hollow profile defined by a second frame member.

8. The beadless frame assembly according to claim 6 or 7, wherein each fastener is a threaded fastener, preferably wherein each fastener is a self-tapping threaded fastener, and/or wherein each fastener comprises a frusto-conical leading end.

9. The beadless frame assembly according to any preceding claim, further comprising at least one mount located at an external surface of the frame assembly, the at least one mount being configured to releasably secure the beadless frame assembly within a casing.

10. A kit of parts for assembling a fenestration unit, the kit of parts comprising:

a beadless frame assembly according to any preceding claim; and
a panel configured to be received within the beadless frame assembly.

11. A fenestration unit comprising a panel and the beadless frame assembly according to any preceding claim.

12. A method of assembling a fenestration unit comprising the steps of:

a) providing a plurality of metallic frame members, each frame member comprising a pair of bevelled edges and a groove for receiving a pan-

el of the fenestration unit;

b) locating a first frame member about a panel, such that the panel is received within the groove of a first frame member;

c) abutting a second frame member with the first frame member such that the panel is received within the groove of the second frame, and such that at least one bevelled edge of the first frame member and at least one bevelled edge of the second frame member interface to form a mitre joint; and

d) securing a connector at the mitre joint so as to secure the first and second frame members.

13. The method according to claim 12, wherein the plurality of metallic frame members comprise at least three metallic frame members, the method further comprising the steps of:

abutting a portion of the frame members such that at least one bevelled edge of each frame member interfaces to form a mitre joint; and securing a respective connector at the mitre joint so as to secure the frame members thereby forming the first frame member, wherein the steps of abutting and securing the first frame member take place prior to locating the first frame member about the panel.

14. The method according to claim 12 or claim 13 further comprising the steps of:

providing at least one gasket; and locating said at least one gasket about each of the plurality of metallic frame members; optionally wherein the step of locating said at least one gasket about each of the plurality of metallic frame members takes place after the first frame member and second frame member have been secured.

15. A frame member for constructing a beadless frame assembly, the frame member comprising bevelled edges configured to interface with a respective bevelled edge of a neighbouring frame member so as to form a mitre joint; and wherein each of the frame members comprises an internal profile section and an external profile section and a thermal break sandwiched between the internal profile section and the external profile section.

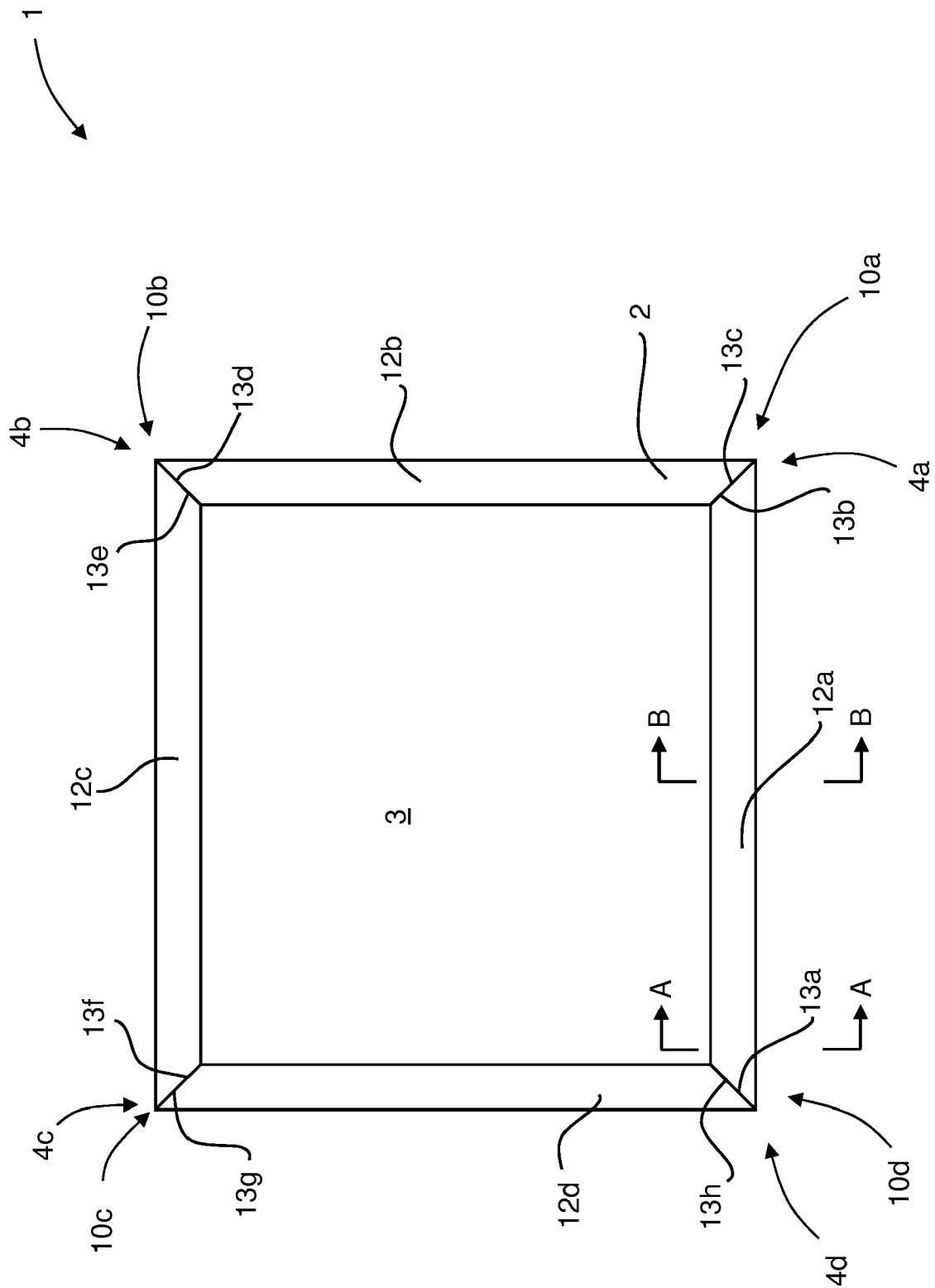


FIG. 1

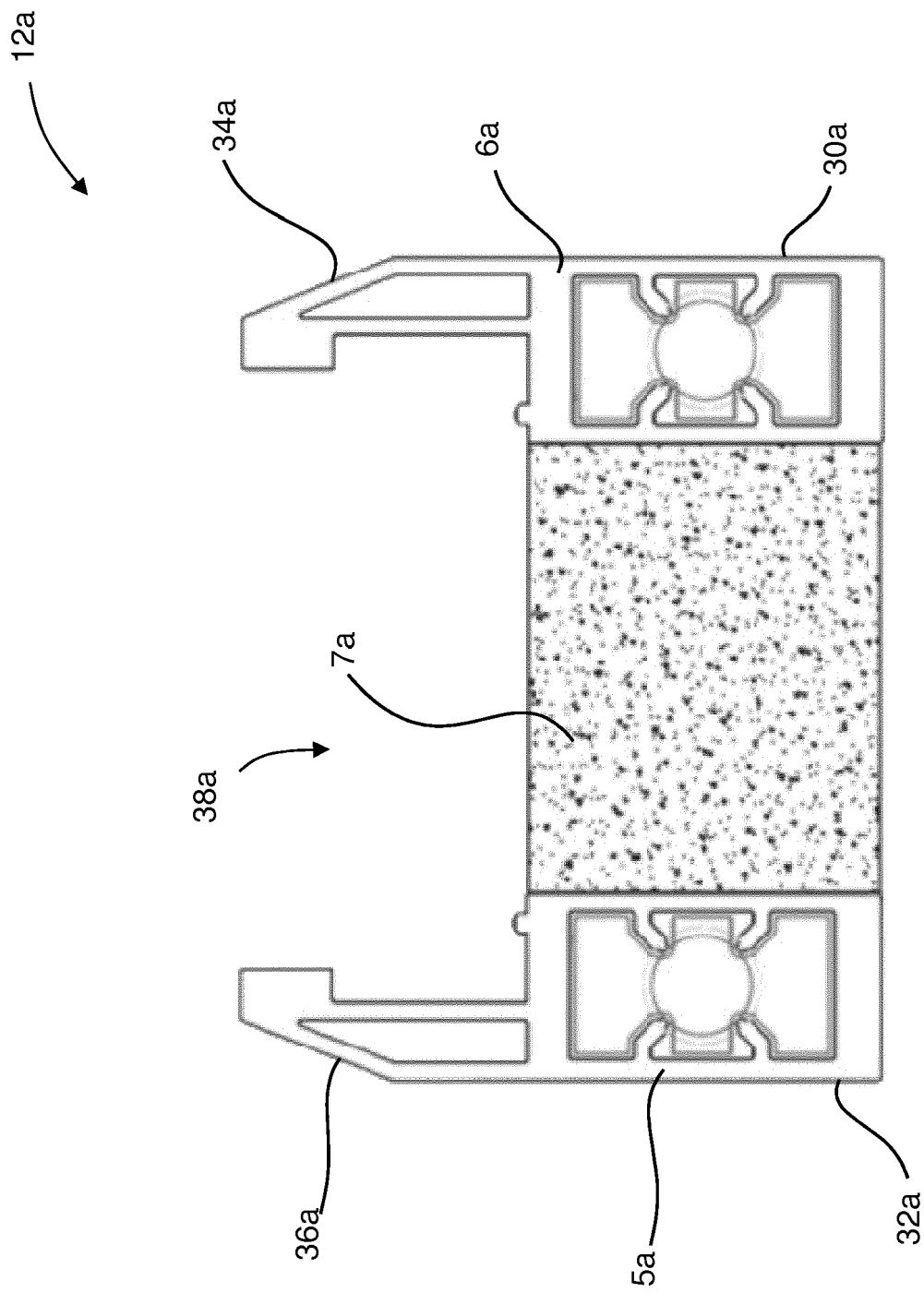


FIG. 2

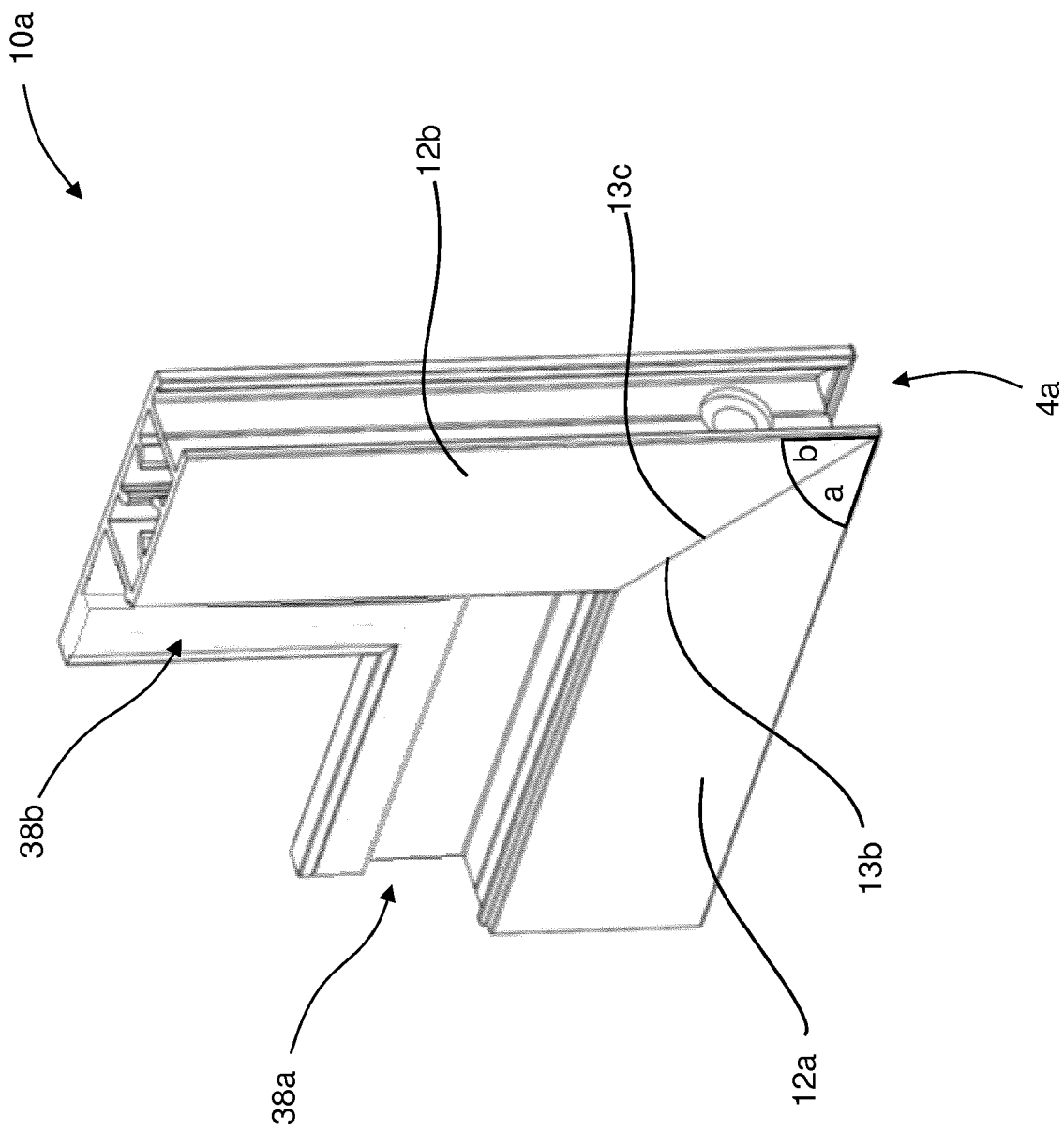


FIG. 3

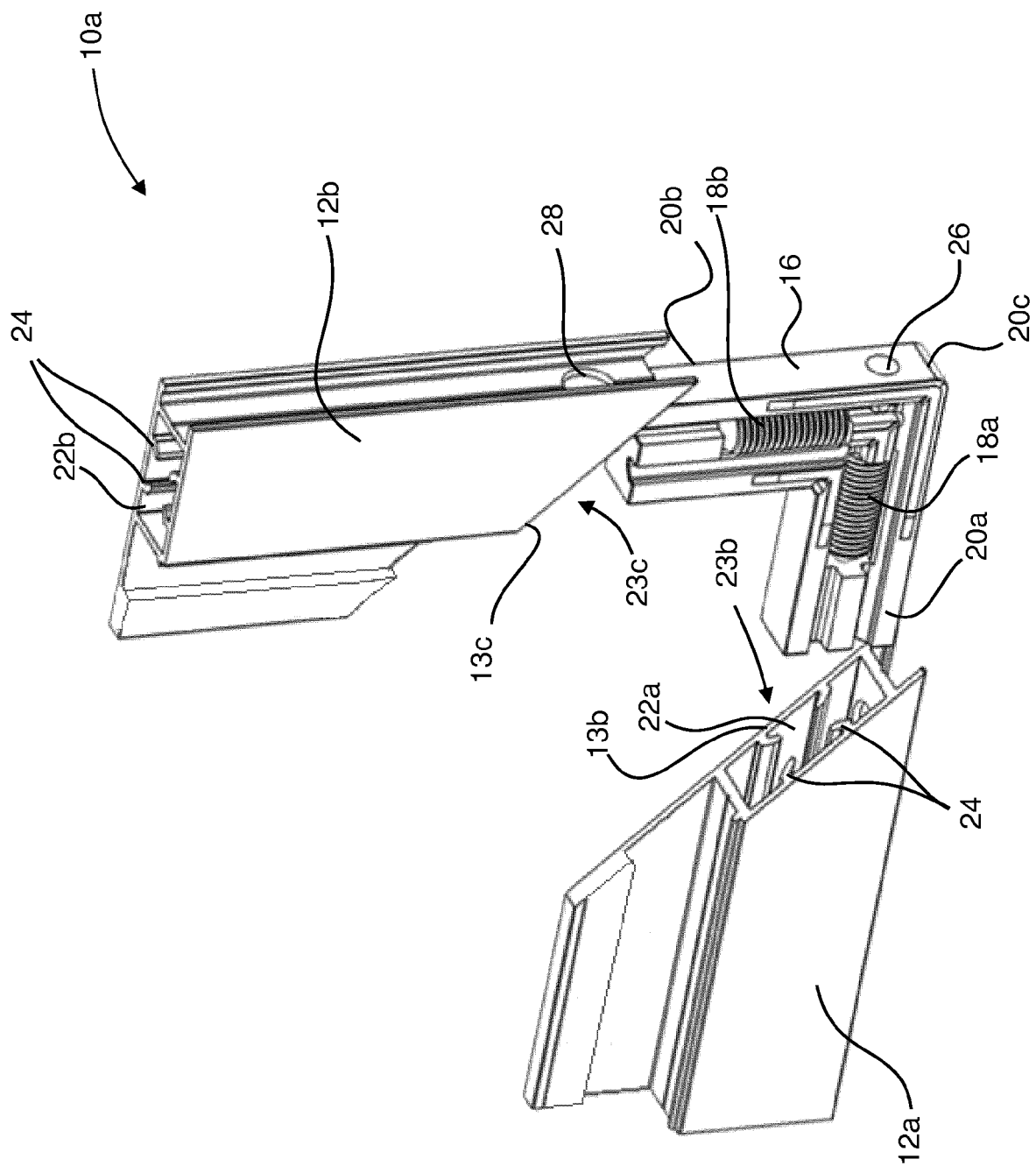


FIG. 4

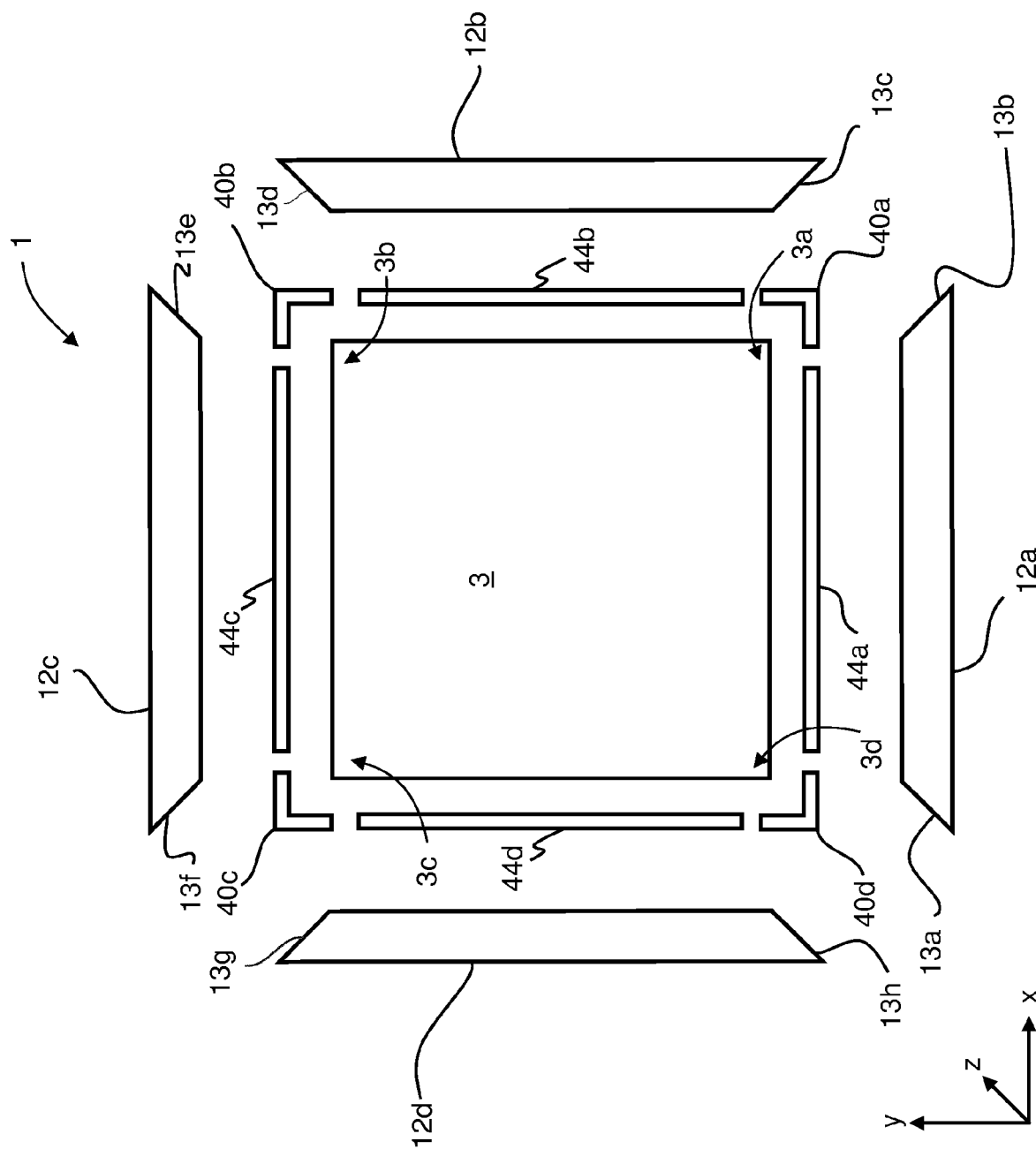


FIG. 5

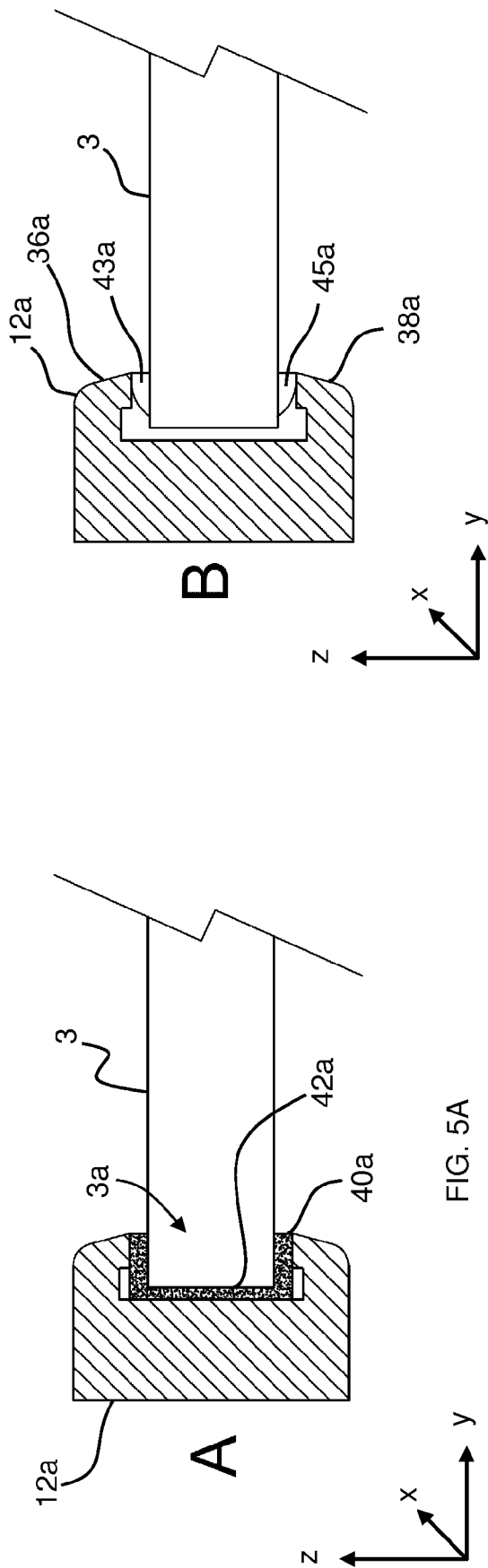


FIG. 5B

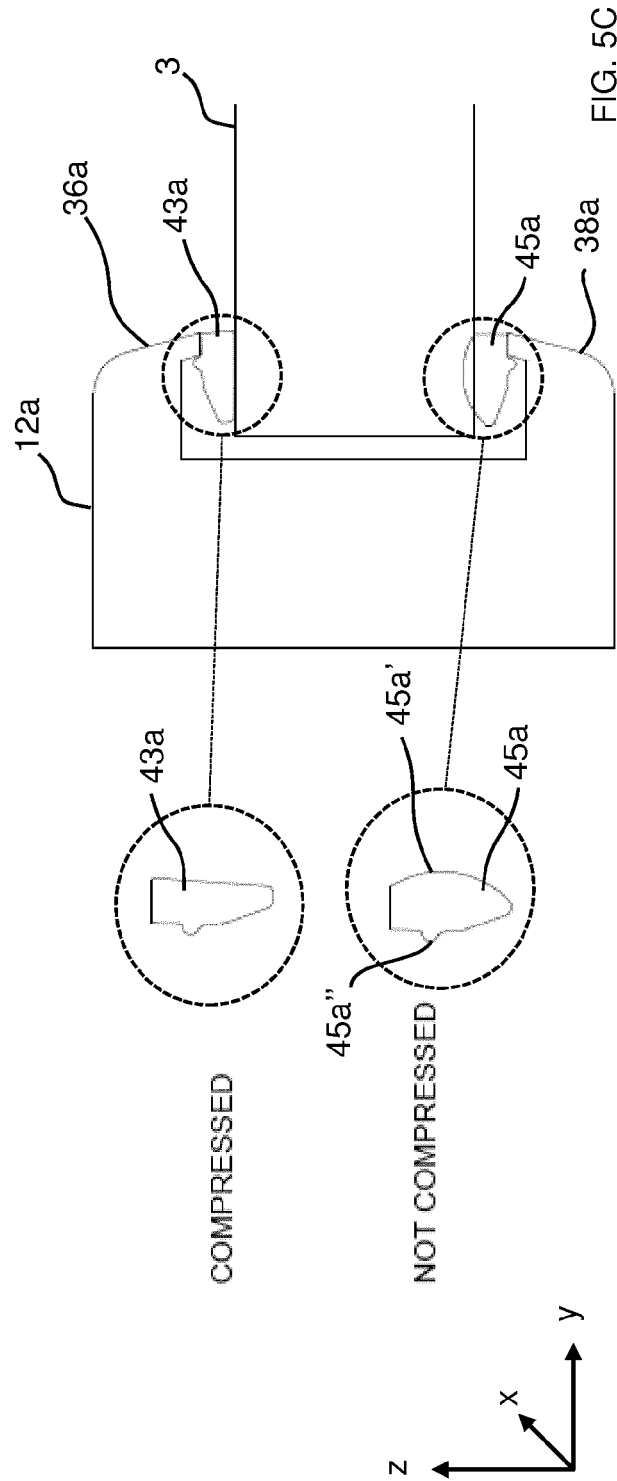


FIG. 5C

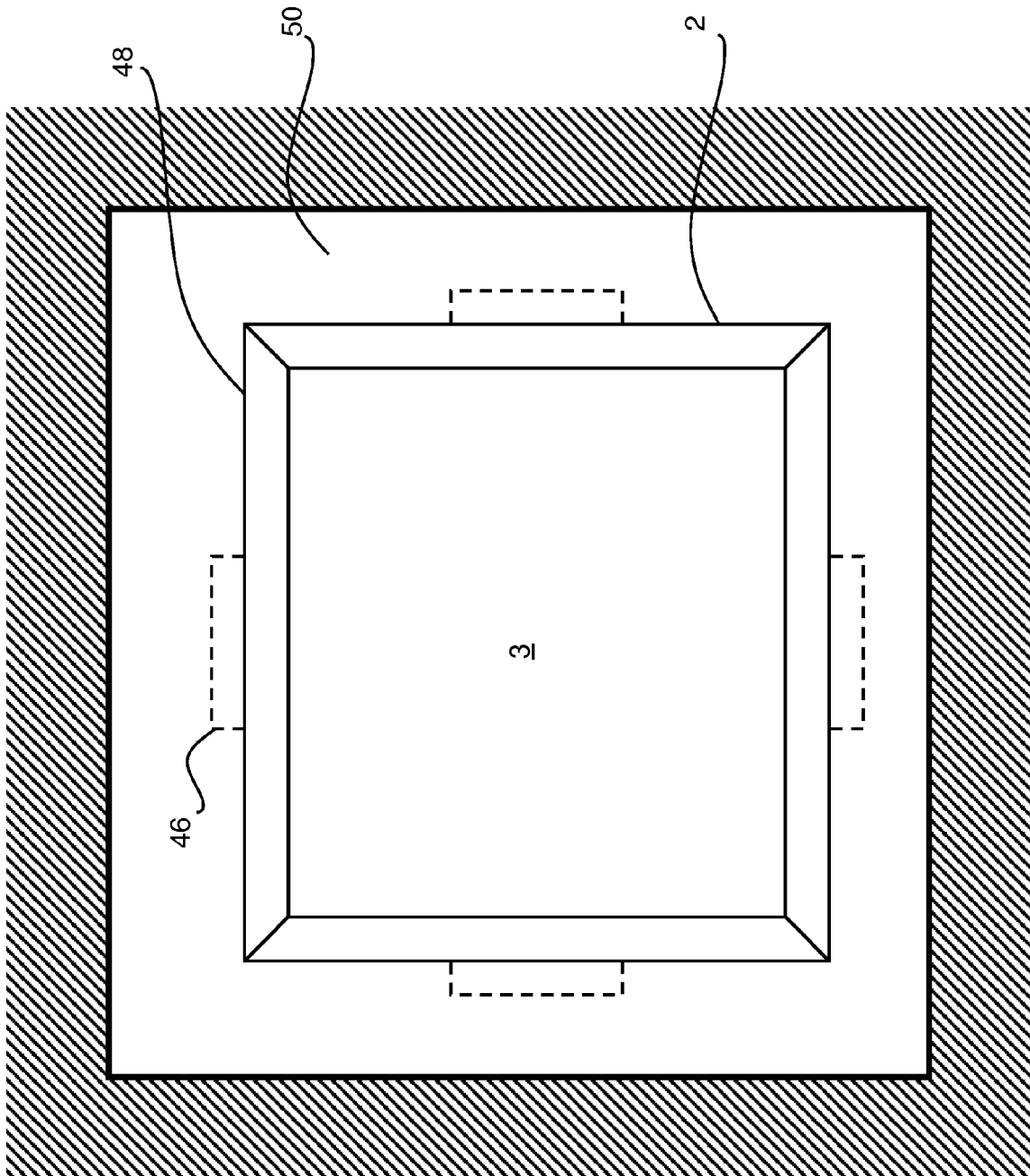


FIG. 6

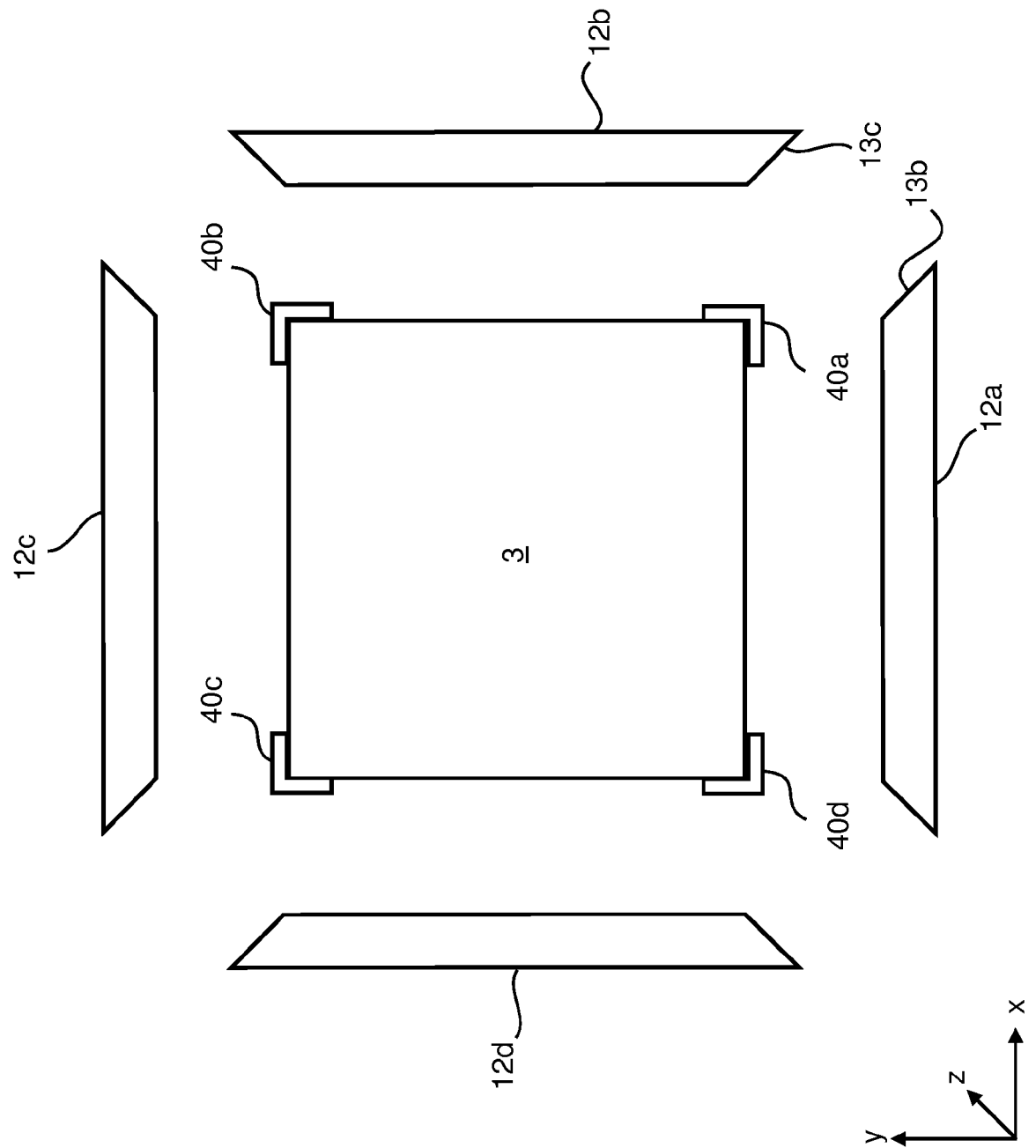


FIG. 7A

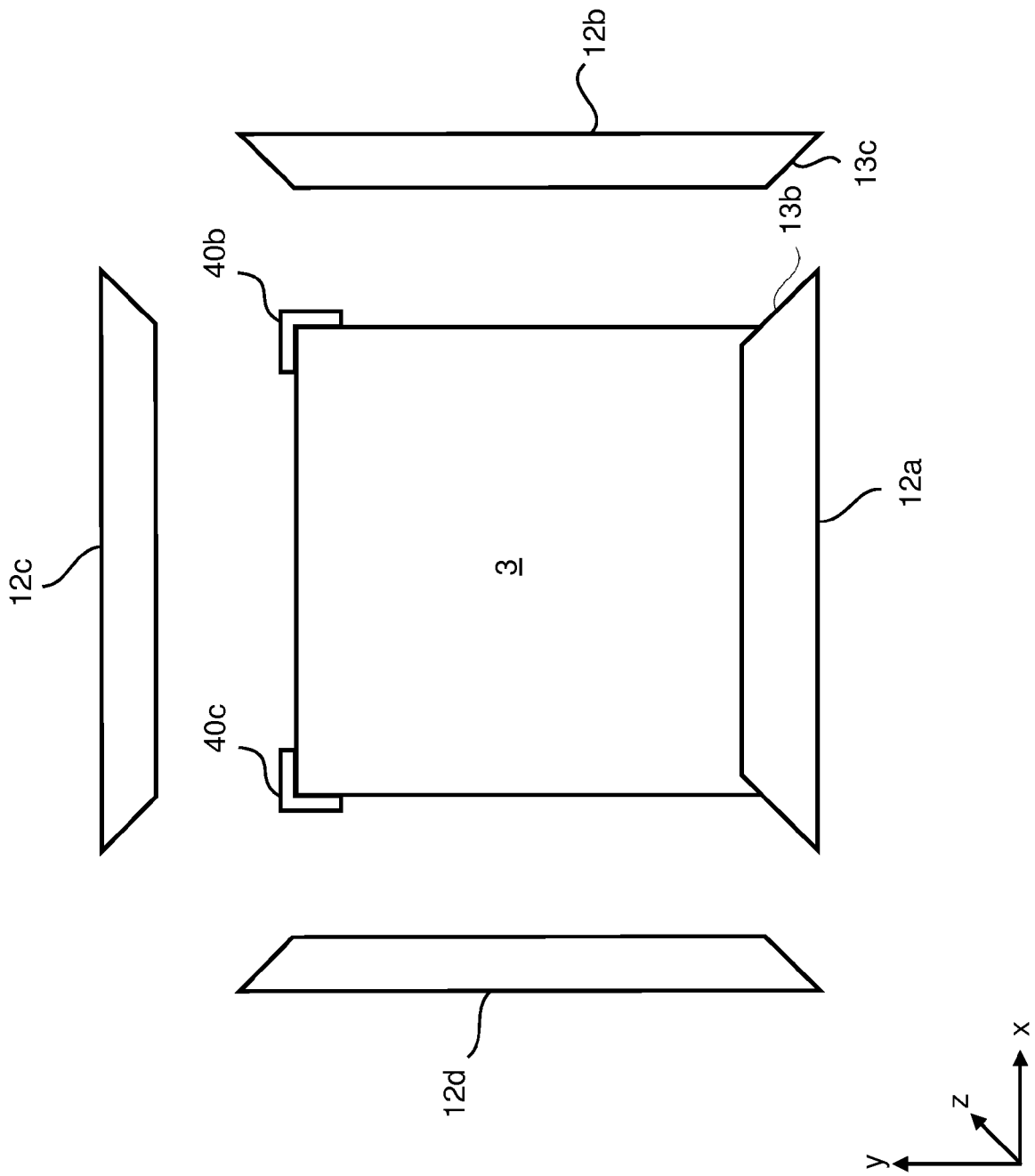


FIG. 7B

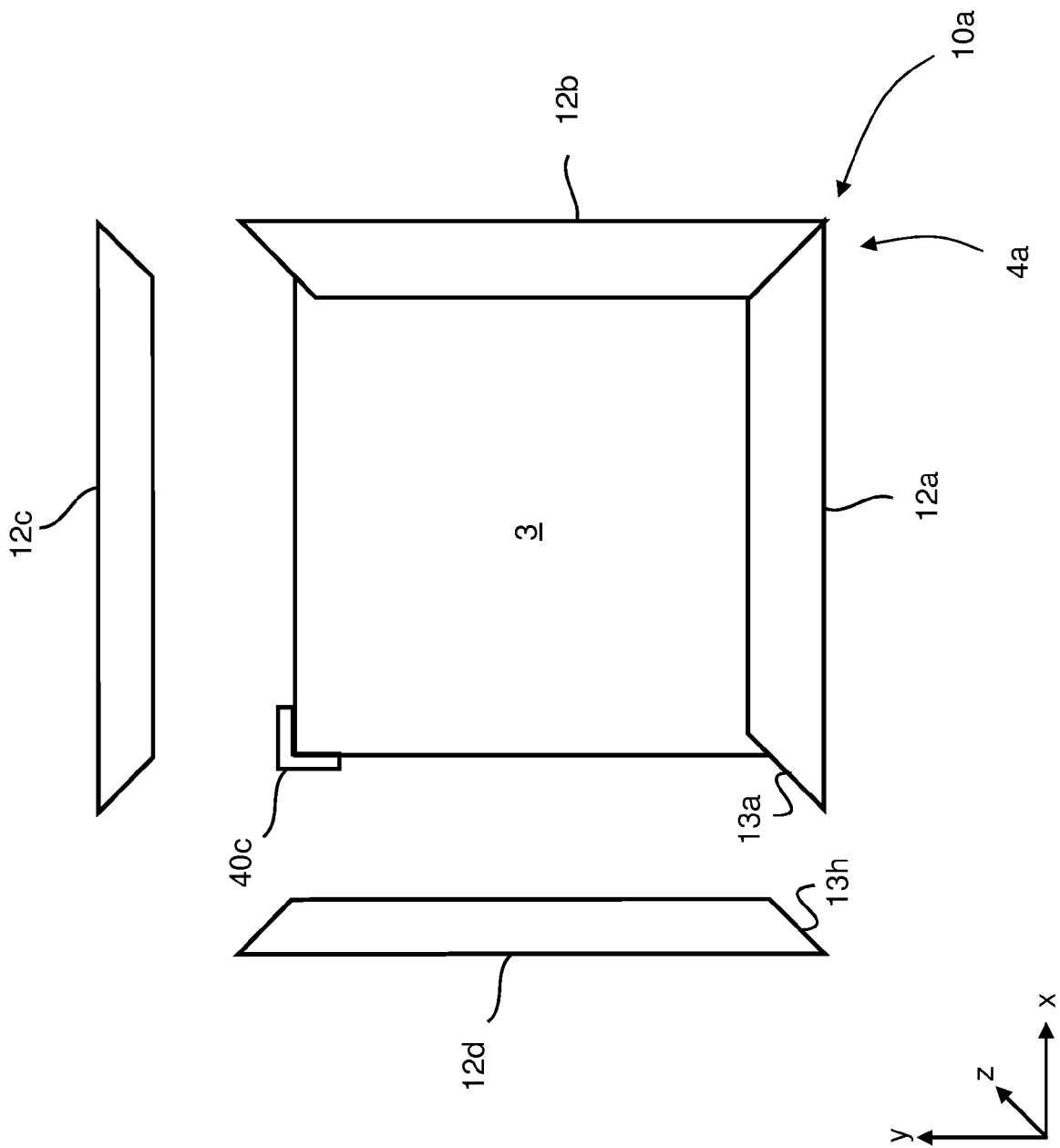


FIG. 7C

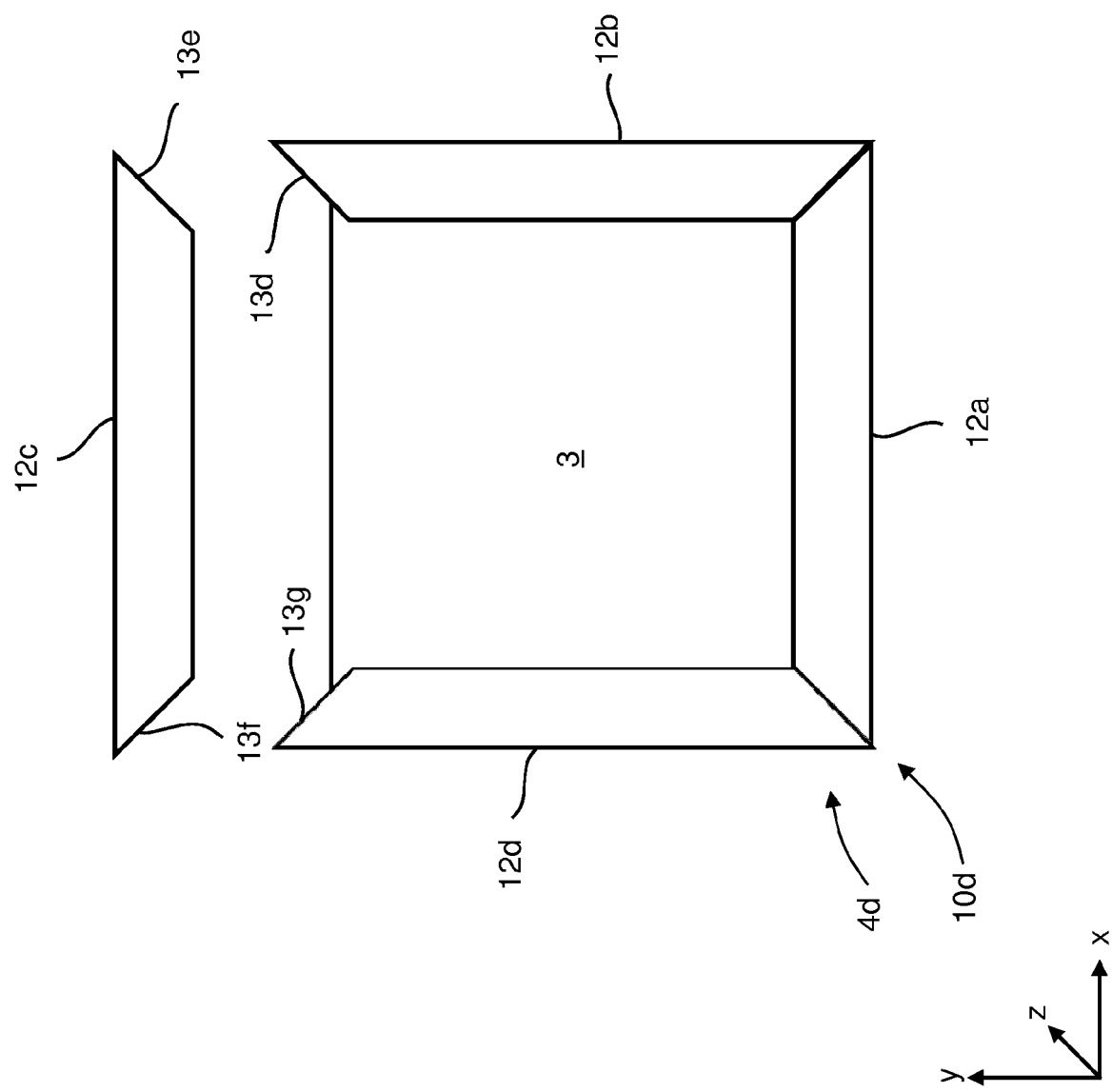


FIG. 7D

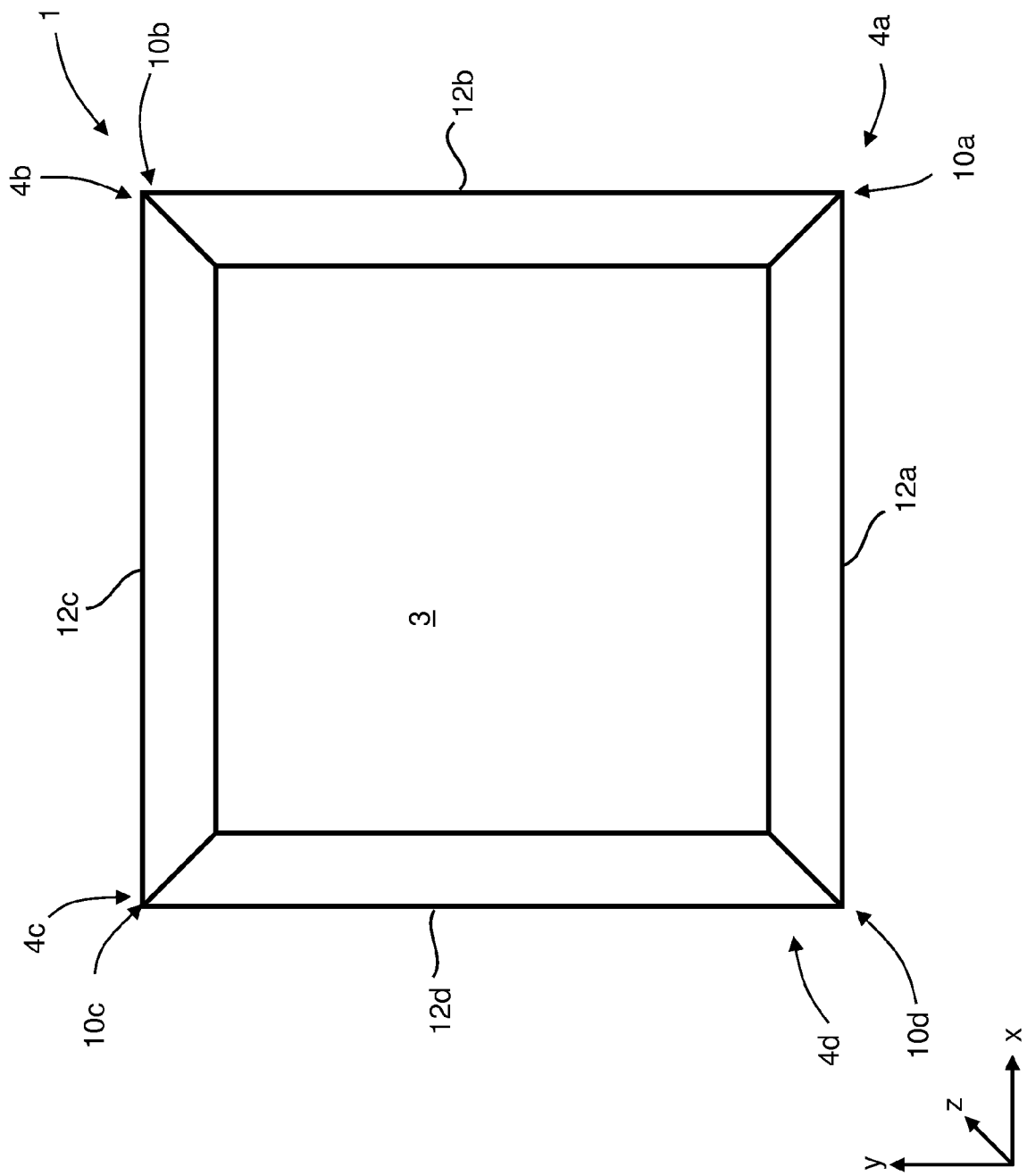


FIG. 7E

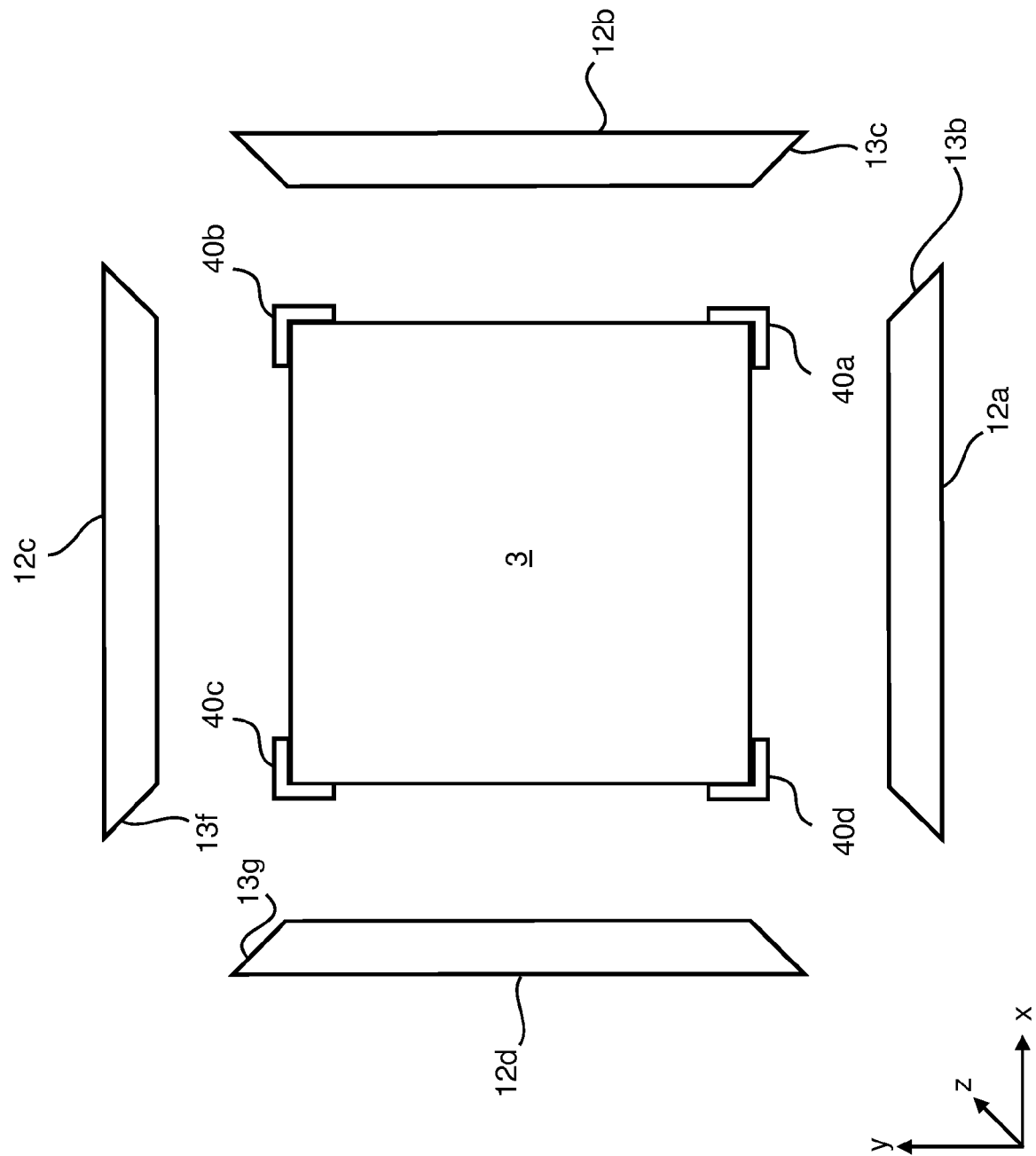


FIG. 8A

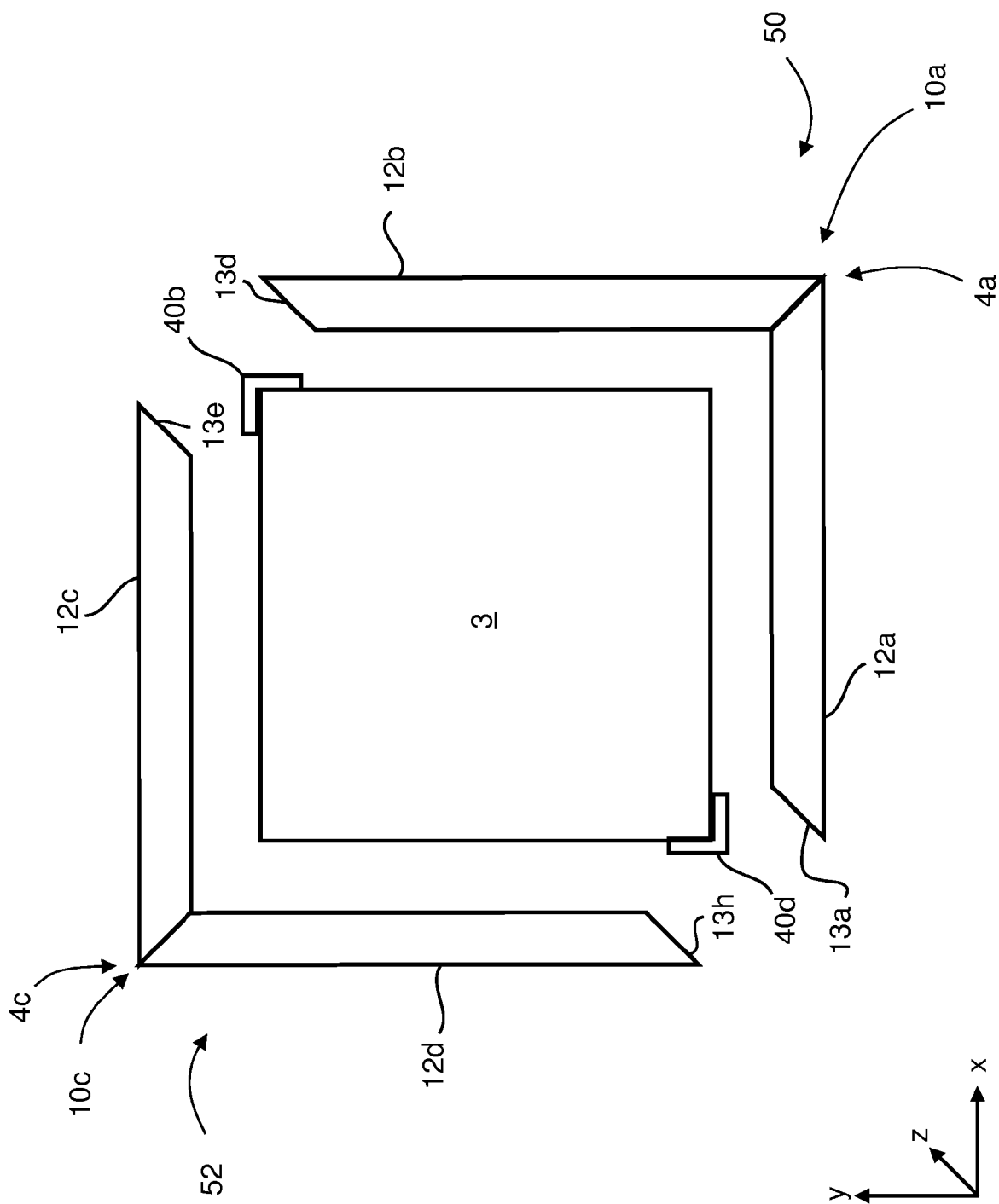


FIG. 8B

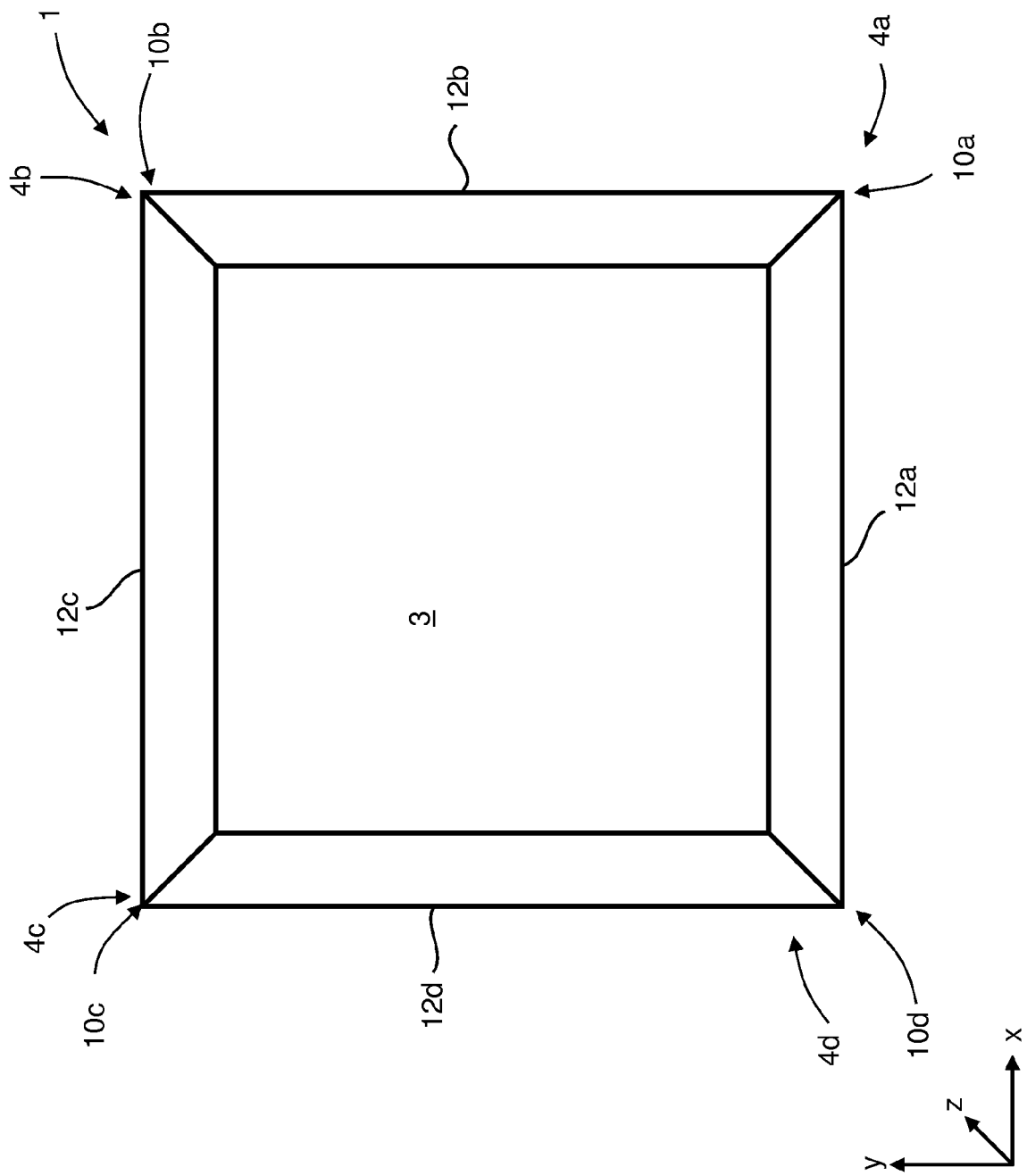


FIG. 8C

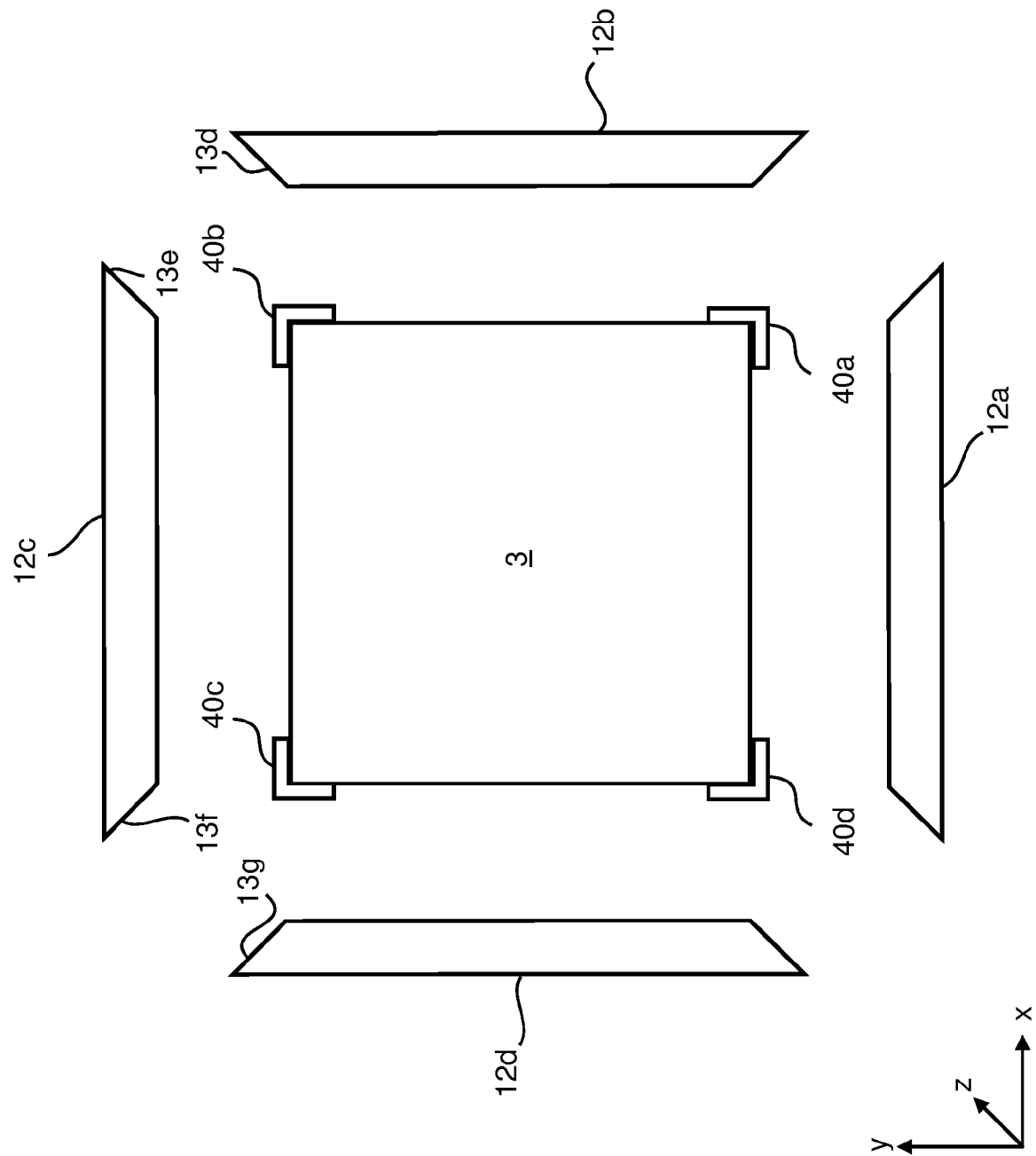


FIG. 9A

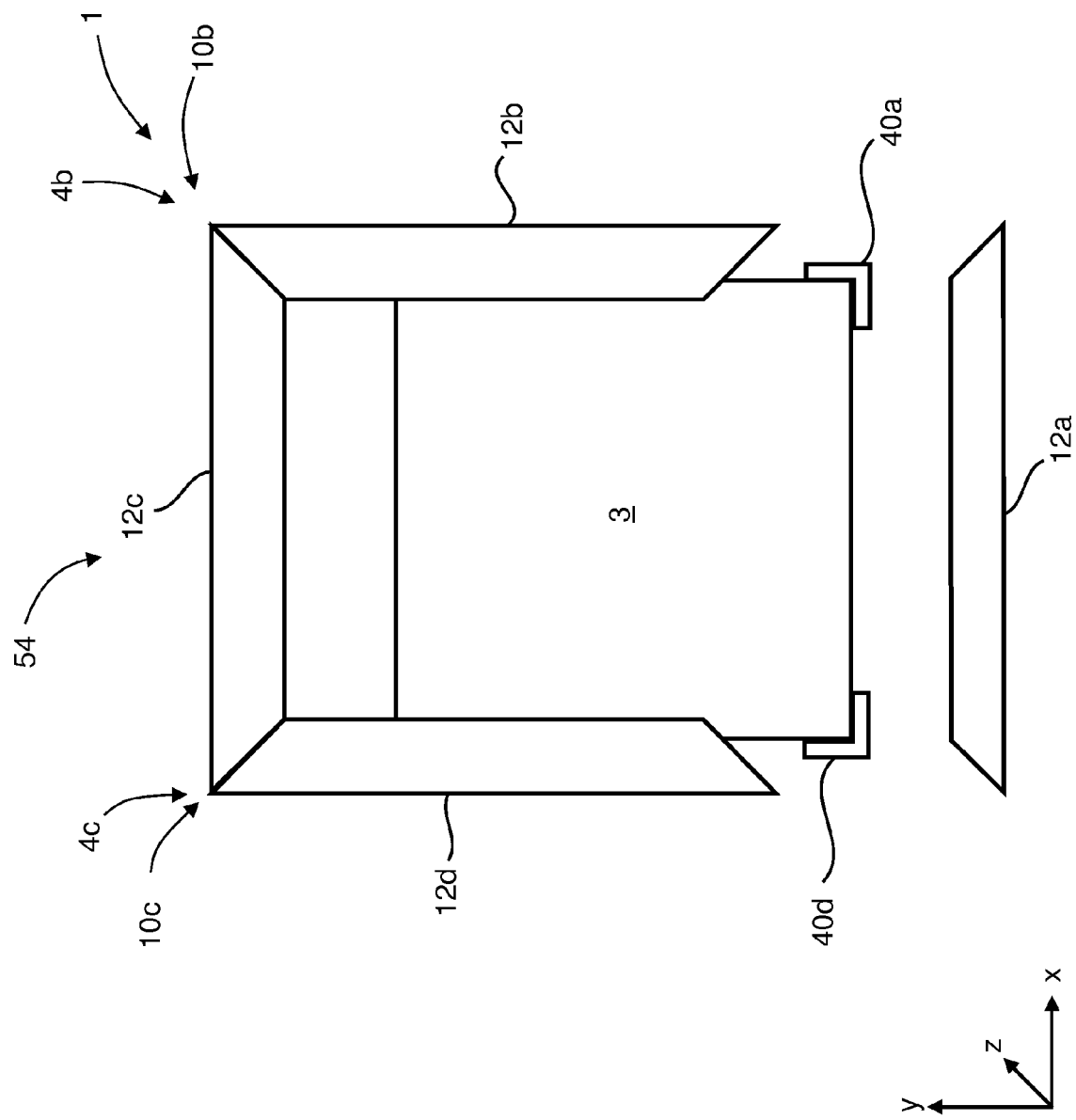


FIG. 9B

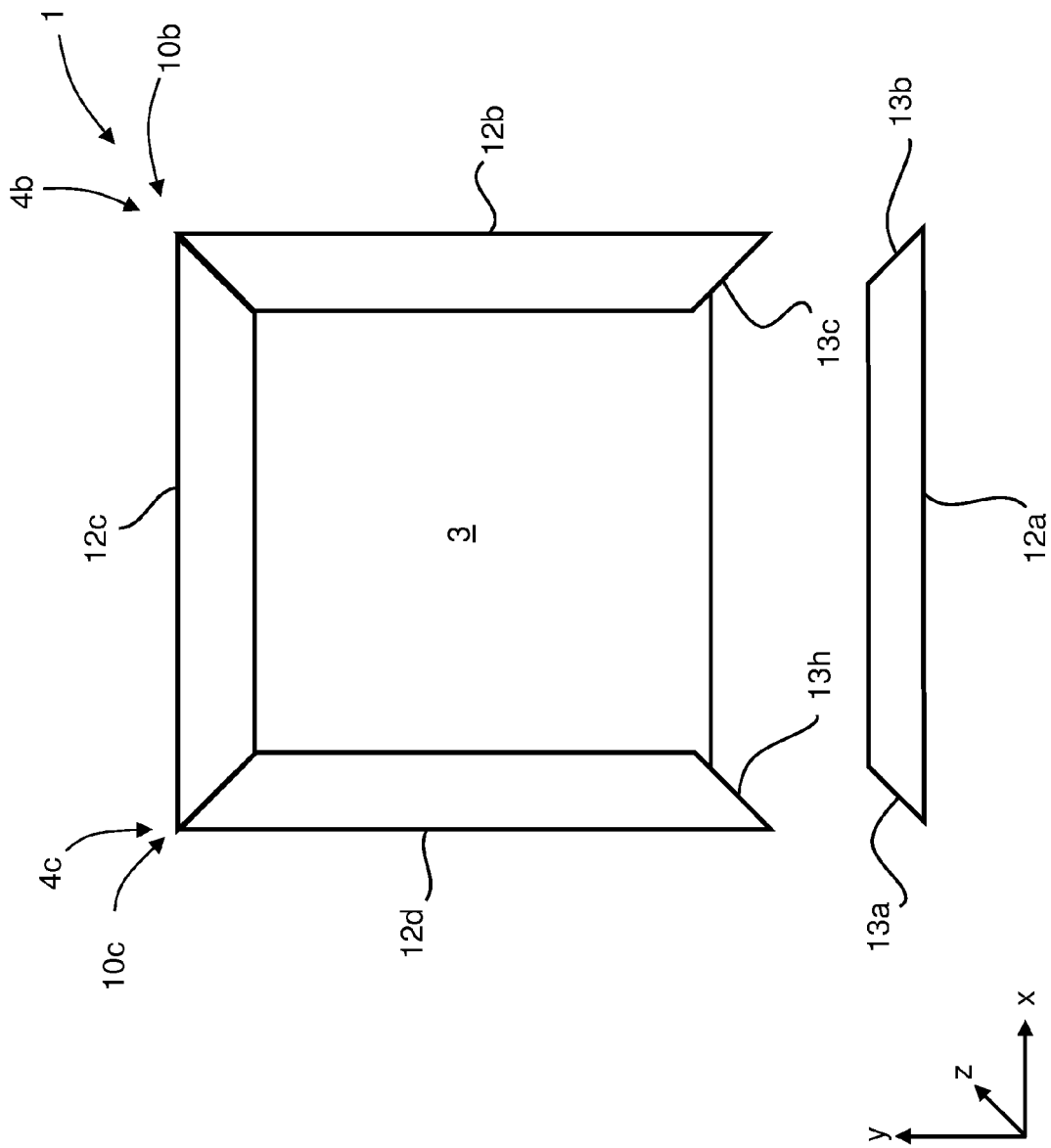


FIG. 9C

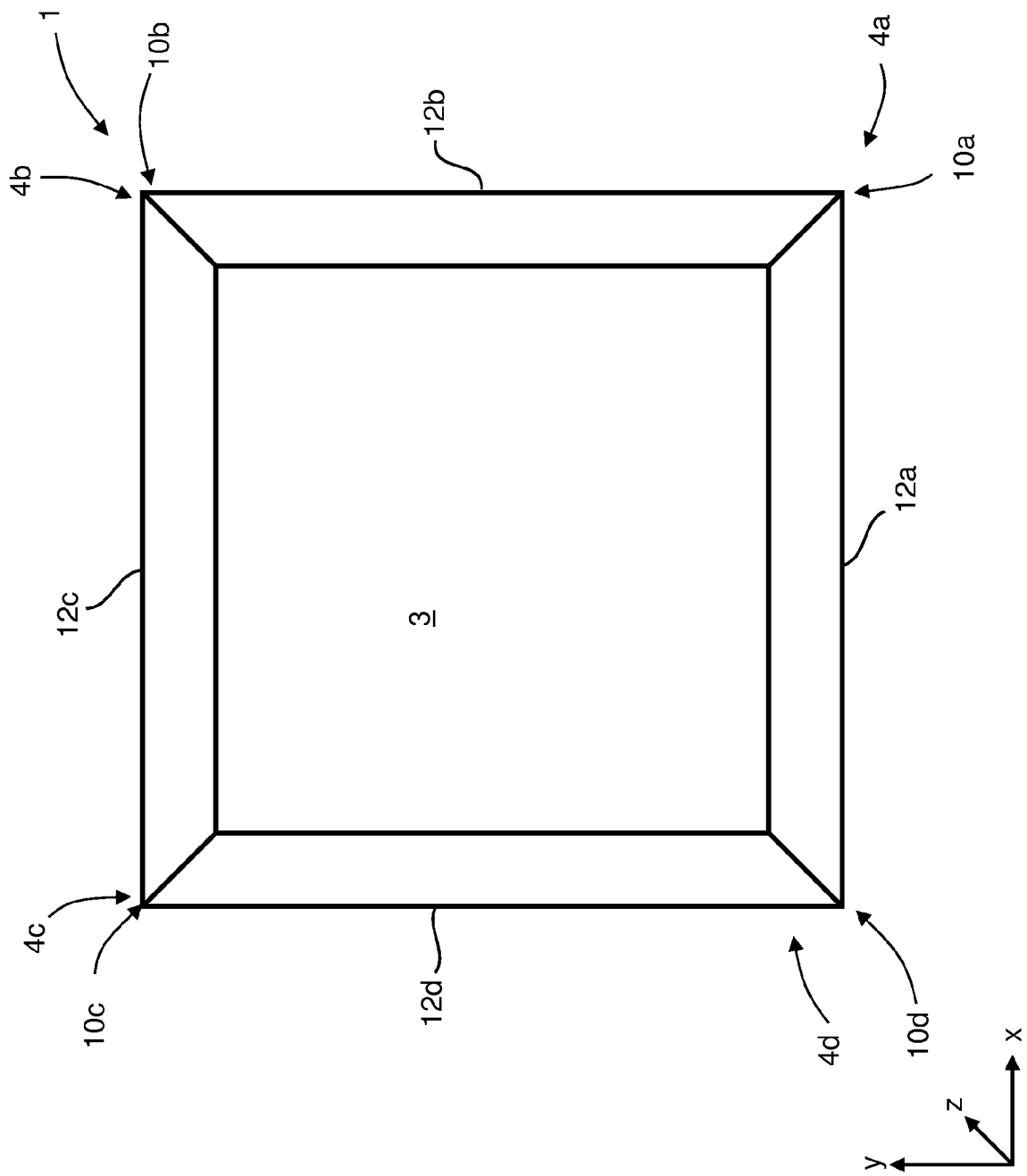


FIG. 9D



EUROPEAN SEARCH REPORT

Application Number
EP 19 19 6397

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2 816 632 A (NARDULLI MICHAEL J) 17 December 1957 (1957-12-17)	1,4-14	INV. E06B3/964
A	* figures 1,3,5 * -----	2,3,15	E06B3/98 E06B3/968 E06B3/263
X	US 2 809 728 A (OLSON HAROLD G) 15 October 1957 (1957-10-15)	1,4,5,7, 9-14	E06B3/263
A	* figures 1,2 * -----	2,3,6,8, 15	ADD. E06B3/54
X	DE 15 34 784 A1 (WINDOW PRODUCTS CORP) 26 June 1969 (1969-06-26)	1-5,9-15	
A	* figure 1 * -----	6-8	
			TECHNICAL FIELDS SEARCHED (IPC)
			E06B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 6 February 2020	Examiner Jülich, Saskia
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
EPO FORM 1503 03.02 (P04C01)

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

EP 19 19 6397

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-02-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2816632	A	17-12-1957	NONE
US 2809728	A	15-10-1957	NONE
DE 1534784	A1	26-06-1969	NONE