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(54) **RESTRAINT BRACKET**

(57) The present invention relates to a gable restraint bracket for receiving a masonry block and a timber member comprising a timber engaging portion and a masonry engaging portion upstanding from a base plate configured to engage the upper surface of a brick (masonry block) in a course of bricks forming a wall head, the timber

engaging portion upstanding from a surface of the base plate and the masonry engaging portion upstanding from another surface of the base plate. The invention also relates to a roofing system comprising a gable restraint bracket according to the invention.

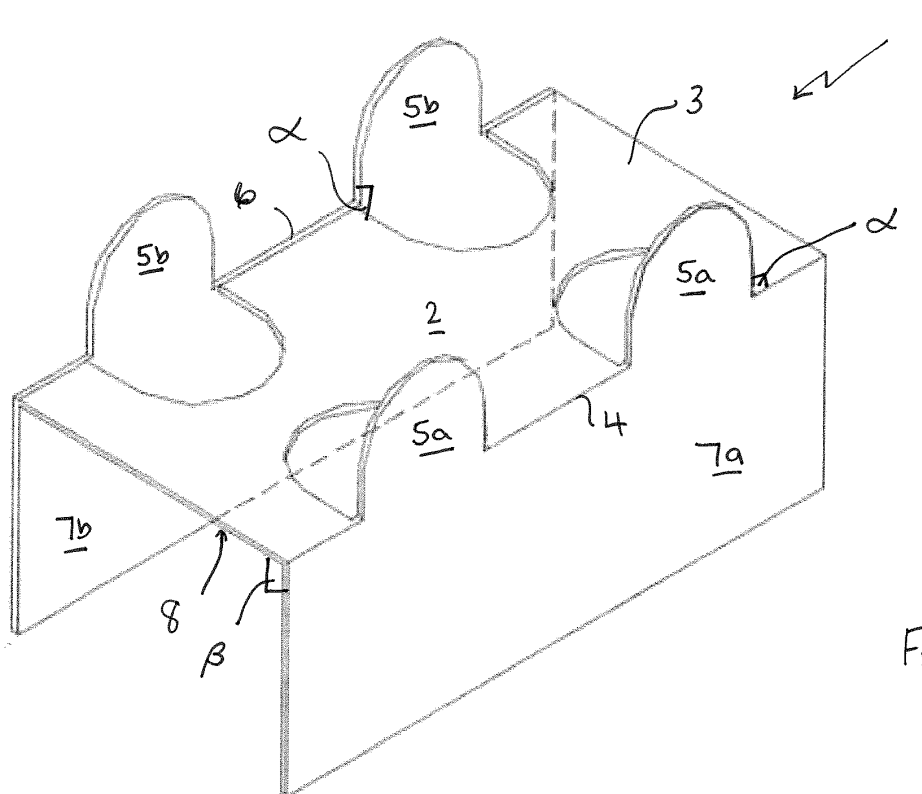


Figure 1

Description

[0001] This present invention relates to a restraint bracket for a gable panel in a building or other construction, in particular, but not exclusively, to a gable restraint bracket for receiving a masonry block and a timber member comprising timber and masonry engaging portions. The present invention further relates to a roofing system comprising a gable restraint bracket.

BACKGROUND

[0002] The gable end of a building or construction is typically constructed of bricks and/or masonry blocks. A brick gable end is heavy and time consuming to construct. The construction of the brick gable end itself can be hazardous due to the propensity of the gable end to fall away from the roofing trusses until the gable end is tied into the inner blockwork of the building or construction.

[0003] It is becoming increasingly common for house builders to switch from masonry gable to timber gables which in turn speeds up the build and removes a lot of potential safety issues involved in constructing masonry gables. With a timber gable, the inner skin of the building is built-up as normal to truss level in masonry with a timber gable comprising a timber-framed gable end panel then sitting above the uppermost masonry level.

[0004] An issue arises in securely connecting the timber gable to the masonry wall as this connection needs to take wind forces in compression and tension to transfer them from the wall into the roof and from the timber gable into the masonry.

[0005] In order to attach a gable end panel to the uppermost course of brickwork (the wall head) and/or a wall plate and/or truss plate located on the wall head, it is typical for the builder to use conventional restraint straps which have been twisted into position. Such straps place loads on the surrounding timbers and trusses which are not desirable.

[0006] The present invention provides at least an alternative to restraint brackets of the prior art.

BRIEF SUMMARY OF THE DISCLOSURE

[0007] In accordance with the present invention there is provided a restraint bracket and a roofing system according to the appended claims.

[0008] According to an aspect, the present invention provides a restraint bracket for receiving a masonry block and a timber member comprising a timber engaging portion and a masonry engaging portion upstanding from a base plate configured to engage the upper surface of a brick (masonry block) in a course of bricks forming a wall head, the timber engaging portion upstanding from a surface of the base plate and the masonry engaging portion upstanding from another surface of the base plate.

[0009] In certain embodiments, the restraint bracket is a gable restraint bracket.

[0010] In certain embodiments the timber engaging portion is configured (adapted, arranged) to receive a wall plate or a truss plate. In this way, the timber engaging portion can receive a timber truss plate or a timber wall plate when the bracket is located at the top of a course of brickwork, a wall head for example. A gable panel can then be attached (nailed, screwed) onto the truss plate or wall plate held within the bracket.

[0011] In certain embodiments the timber engaging portion is configured (adapted, arranged) to receive a gable panel. More specifically, the timber engaging portion is configured (adapted, arranged) to receive a frame member of a gable panel.

[0012] In certain embodiments, the timber engaging portion is upstanding from a surface of the base plate and the masonry engaging portion is upstanding from an opposite surface of the base plate.

[0013] In certain embodiments, the timber engaging portion extends in a first direction substantially perpendicular to the surface of the base plate.

[0014] In certain embodiments, the masonry engaging portion extends in a second direction substantially perpendicular to the surface of the base plate.

[0015] In certain embodiments the plane including the timber engaging portion and the plane including the masonry engaging portion are substantially parallel. More specifically, the plane including the timber engaging portion and the plane including the masonry engaging portion are one and the same.

[0016] In certain embodiments, the first and second directions are opposite one another. More specifically, the plane including the vector describing the first direction and the vector describing the second direction are in the same plane and directionally opposite.

[0017] In certain embodiments, the timber engaging portion is upstanding from an edge of the base plate. More specifically, the timber engaging portion is upstanding substantially perpendicular to the surface of the base plate.

[0018] In certain embodiments, a further timber engaging portion is upstanding from an edge of the base plate. More specifically, the further timber engaging portion is upstanding substantially perpendicular to the surface of the base plate. Yet more specifically, the further timber engaging portion is upstanding from an edge of the base plate opposite the edge of the base plate from which the timber engaging portion is upstanding.

[0019] In certain embodiments, the timber engaging portion and the further timber engaging portion are resiliently biased towards one another and/or the centre of the base plate. In this way, a wall plate, truss plate or gable panel frame member will need to be pushed (i.e. snapped) into place between the timber engaging portions and the portions will grip the outer surface of the timber.

[0020] In certain embodiments the resilient bias is provided by the material of the, and/or the further timber engaging portions.

[0021] In certain embodiments, the, and/or the further timber engaging portion(s) comprises one or more tabs (lugs).

[0022] In certain embodiments, the, and/or the further timber engaging portion(s) comprise a plurality of tab (lugs).

[0023] In certain embodiments, the, and/or the further timber engaging portion(s) each comprise two tabs (lugs).

[0024] In certain embodiments, each of the, and/or the further plurality of timber engaging tabs are spaced part from one another along an edge of the base plate.

[0025] In certain embodiments, the, and/or the further timber engaging portion(s) are initially integral with the base plate and are stamped (pushed) out of the plane of the base plate in forming the restraint bracket.

[0026] In certain embodiments, the, and/or the further timber engaging portion(s) have a curved uppermost edge.

[0027] In certain embodiments, the, and/or the further timber engaging portion(s) are substantially planar.

[0028] In certain embodiments, the angle between the surface of the base plate and the surface or the, and/or the further timber engaging portion(s) are substantially planar is less than or equal to 90 degrees.

[0029] In certain embodiments, the, and/or the further timber engaging portion(s) comprise one or more fastener apertures. More specifically the fastener apertures are configured (adapted, arranged) to receive a screw, nail or the like.

[0030] In certain embodiments, the masonry engaging portion is upstanding from an edge of the base plate. More specifically, the masonry engaging portion is upstanding substantially perpendicular to the surface of the base plate.

[0031] In certain embodiments, a further masonry engaging portion is upstanding from an edge of the base plate. More specifically, the further masonry engaging portion is upstanding substantially perpendicular to the surface of the base plate. Yet more specifically, the further masonry engaging portion is upstanding from an edge of the base plate opposite the edge of the base plate from which the masonry engaging portion is upstanding.

[0032] In certain embodiments, the, and/or the further masonry engaging portion(s) may be resiliently biased towards one another and/or the centre of the base plate. In this way, a masonry block (brick, block) will need to be pushed (i.e. snapped) into place between the masonry engaging portions and the portions will grip the outer surface of the masonry block (brick, block).

[0033] In certain embodiments the resilient bias is provided by the material of the, and/or the further masonry engaging portions.

[0034] In certain embodiments, the, and/or the further masonry engaging portion(s) comprises one or more tabs (lugs). Alternatively, the, and/or the further masonry engaging portion(s) comprises plates.

[0035] In certain embodiments, the, and/or the further plurality of masonry engaging tabs are spaced part from one another along an edge of the base plate.

[0036] In certain embodiments, the, and/or the further masonry engaging portion(s) are initially integral with the base plate and are stamped (pushed) out of the plane of the base plate in forming the restraint bracket.

[0037] In certain embodiments, the, and/or the further masonry engaging portion(s) are substantially planar.

[0038] In certain embodiments, the angle between the surface of the base plate and the surface or the, and/or the further masonry engaging portion(s) are substantially planar is less than or equal to 90 degrees.

[0039] In certain embodiments, the, and/or the further masonry engaging portion(s) are integrally formed and are folded out of the plane of the base plate.

[0040] In certain embodiments, the masonry engaging portion and the further masonry engaging portion form a pair of masonry engaging portions. More specifically, the pair of masonry engaging portions co-operate to receive a masonry block between them and against a surface of the base plate.

[0041] In certain embodiments, the pair of masonry engaging portions co-operate with one another and with the base plate to form a recess configured (adapted, arranged) to receive a masonry block, brick or the like. In this way, the bracket can be located over a masonry block, brick or the like such that the base plate contacts the top of the block and the timber engaging portion(s) are upstanding from the opposite surface of the base plate.

[0042] In certain embodiments, the timber engaging portion and the further timber engaging portion form a pair of timber engaging portions. More specifically, the pair of timber engaging portions co-operate to receive a wall plate, truss plate or gable panel frame member between them and against a surface of the base plate.

[0043] In certain embodiments, the pair of timber engaging portions co-operate with one another and with the base plate to form a recess configured (adapted, arranged) to receive a wall plate, truss plate or a gable panel frame member.

[0044] In certain embodiments the bracket is formed of galvanised steel.

[0045] According to a further aspect of the invention there is provided a roofing system comprising a restraint bracket according to an aspect of the present invention and a gable end panel.

[0046] In certain embodiments, the restraint bracket is configured (adapted, arranged) to receive a wall plate, truss plate or gable end panel frame member. More specifically, the wall plate, truss plate or gable end panel frame member are located on the base plate and in abutment with the timber engaging portion.

[0047] In certain embodiments, the wall plate, truss plate or gable end panel frame member are located on the base plate and in abutment with and between the timber engaging portion and the further timber engaging

portion.

[0048] In certain embodiments, the restraint bracket is configured (adapted, arranged) to receive a masonry block, brick or the like. More specifically, the masonry block (brick) is located on the base plate and in abutment with the masonry engaging portion.

[0049] In certain embodiments, the masonry block (brick) is located on the base plate and in abutment with and between the masonry engaging portion and the further masonry engaging portion.

[0050] In certain embodiments, the masonry engaging portion and the further masonry engaging portion (if present), extend from a top edge of the masonry block (brick) away from the top surface of the block (brick).

[0051] In certain embodiments, the base plate abuts the top of the masonry block (brick). In this way, the bracket is located over the top of a masonry block. Thus, the bracket is firmly supported on the uppermost course of brickwork/blockwork and is located to receive a wall plate, truss plate or a gable end panel frame member of the roofing system.

[0052] In certain embodiments the gable end panel comprises a frame of timber members onto which a panel board is attached to the outermost side of the frame. A timber framed gable end panel is lighter than a brick gable end as well as being easier, faster and safer to construct.

[0053] The restraint bracket of the present invention facilitates simple, fast and secure attachment of a gable end panel frame member to a course of blockwork and/or a wall plate or truss plate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0054] Embodiments of the invention are further described hereinafter with reference to the accompanying drawings, in which:

Figure 1 is a schematic representation of a gable restraint bracket according to an embodiment of the present invention;

Figure 2 is a schematic representation of a gable restraint bracket according to Figure 1 prior to the folding of the timber engaging portion and the further timber engaging portion out of the plane of the base plate;

Figure 3 is a side plan view of the gable restraint bracket of Figure 1 in position between a masonry block and a wall plate;

Figure 4 is a end plan view of the gable restraint bracket of Figure 1 in position between a masonry block and a wall plate;

Figure 5 is a schematic representation of a gable restraint bracket according to an embodiment of the invention in position in a gable end wall and roofing

system;

Figure 6 is a schematic representation of a gable restraint bracket according to an embodiment of the invention in position in an alternative gable end wall and roofing system;

Figure 7 is a schematic representation of a roofing system comprising a gable restraint bracket according to an embodiment of the invention;

Figure 8 is an end plan view of the roofing system of Figure 7;

Figure 9 is a schematic representation of a gable restraint bracket according to an embodiment of the present invention; and

Figure 10 is a schematic representation of a gable restraint bracket according to a yet further embodiment of the present invention.

DETAILED DESCRIPTION

[0055] Like reference numerals are used to depict like features throughout.

[0056] Figure 1 shows a schematic representation of a gable restraint bracket according to an embodiment of the present invention. The restraint bracket is formed of galvanised steel from a single piece blank.

[0057] The restraint bracket 1 has two planar tabs 5a upstanding from a surface 2 of a planar base plate 3 at an angle α of approximately 90 degrees. The tabs 5a extend from edge 4 of the base plate so as to be substantially perpendicular to the base plate 3. The tabs 5a are spaced apart from one another along edge 4. The tabs 5a are formed when the material of the tabs is pressed out of the material of the base plate 3.

[0058] A further timber engaging portion is provided by two planar tabs 5b upstanding from a planar base plate 3 at an angle α of approximately 90 degrees. The tabs 5b extend from edge 6 of the base plate so as to be substantially perpendicular to the base plate 3. The tabs 5b are spaced apart from one another along edge 6. The tabs 5b are formed when the material of the tabs is pressed out of the material of the base plate 3.

[0059] The tabs 5a and 5b form a pair of timber engaging portions. A wall plate, truss plate or gable end panel timber frame member (not shown) can be located between the pair of timber engaging portions.

[0060] The restraint bracket 1 has a planar masonry engaging tab 7a upstanding from an opposite surface 8 of the planar base plate 3 at an angle β of approximately 90 degrees. The tab 7a extends from edge 4 of the base plate so as to be substantially perpendicular to the base plate 3. The tab 7a is formed when the material of the tab is bent out of the plane of the material of the base plate 3.

[0061] A further masonry engaging portion is provided by a planar tab 7b upstanding from a planar base plate 3 at an angle β of approximately 90 degrees. The tab 7b extends from edge 6 of the base plate so as to be substantially perpendicular to the base plate 3. The tab 7b is formed when the material of the tab is bent out of the plane of the material of the base plate 3.

[0062] The tabs 7a and 7b form a pair of masonry engaging portions. A masonry block or a brick (not shown) can be located between the pair of masonry engaging portions.

[0063] In use, the restraint bracket 1 is configured to receive a masonry block between tabs 7a and 7b and a timber member (a wall plate, truss plate or gable end panel timber frame member) between tabs 5a and 5b. In this way the gable restraint bracket 1 straddles the masonry to provide restraint connection in a horizontal direction transferring wind loads onto the gable wall into the timber gable, masonry wall and/or roof diaphragm.

[0064] Figure 2 shows the gable restraint bracket 1 prior to the folding of the tabs 5a and 5b out of the plane of the base plate 3. Each tab 5a, 5b comprises a pair of fastener apertures 15 into which nails, screws or the like are driven when a timber member is positioned between the tabs 5a, 5b when in the positions depicted in Figure 1.

[0065] Figure 3 shows the gable restraint bracket 1 having a wall plate 11 positioned in the recess between the timber engaging tabs 5a and the further timber engaging tabs 5b. The tabs 5a, 5b may initially have an angle α of less than 90 degrees, for example an over-bend, where α is 87 degrees, such that when the timber wall plate 11 is located between tabs 5a and 5b, the tabs 5a, 5b are initially urged outwardly away from one another to receive the timber member 11 but the resilient bias provided by the material of the tabs 5a, 5b urges them back onto the surface of the timber member 11 so as to grip the member 11 between them.

[0066] Figure 3 also shows masonry tab 7b depending from edge 4 of the base plate 3. A corresponding tab 7a (not shown) depends from the opposite edge (6) of the base plate 3 such that a masonry block can be received between the masonry engaging tabs 7a, 7b.

[0067] In Figure 4 the timber engaging tabs 5a, 5b are configured to receive a timber frame member 116 of a gable end panel 14. The gable end panel 14 has a timber frame member 116 and a gable panel board 13 attached to the outermost surface of the timber frame member 116. The timber frame member 116 and the gable panel board 13 are, together, received and retained between the pair of timber engaging portions, tabs 5a, 5b. The surface 8 of base plate 3 of the bracket 1 is located on the wall head 17 which, in the depicted arrangement is the uppermost face of masonry block 9. A pair of masonry engaging tabs 7a, 7b depend from the edges 4, 6 of the base plate 3 and extend along the outer faces 19a, 19b of the masonry block 9. In this way, any lateral load applied to the gable panel board 13, for example by wind, is transferred into tabs 7a, 7b which restrain the move-

ment of the board 13.

[0068] In the partial roofing system 300 of Figure 5a, gable restraint bracket 1 is located on the uppermost masonry block 9 of a wall having multiple courses of masonry blocks, three of which 9, 9a, 9b are depicted. Timber wall plate 41 is retained by the timber engaging tabs of the restraint bracket 1. The timber frame member 11 of gable end panel 14 is then nailed (or screwed) into the wall plate 41 so that the gable end panel 14, comprising a gable panel board 13, is held in place by the restraint bracket 1. The gable end panel board 13 is tied into the outer brickwork 43 by wall ties 21. A restraint strap 23 is twisted or folded and fixed to the side of a vertical stud of the gable end panel 14 whilst also extending horizontally along a truss brace 29. The truss brace 29 acts to support roof trusses 31 and is fixed to a solid timber block 39 which abuts the outer face of tab 5a. A holding down strap 37 is hooked over the upper face of the timber gable panel frame member 11 and extends down the face of the masonry blocks 9, 9a, 9b. Breather membranes 25 are located against the panel board 13 and the truss wall plate 27 to prevent the ingress of moisture into the roofing system 300. Insulation 33 and cavity insulation 35 provide thermal protection for the building interior.

[0069] In this way, the timber engaging tabs 5a, 5b can receive a timber truss plate or a timber wall plate when the bracket is located at the top of a course of brickwork, a wall head for example. A gable panel can then be attached (nailed, screwed) onto the truss plate or wall plate held within the bracket.

[0070] In the depicted arrangement of Figure 5, the masonry wall 9, 9a, 9b stops at wall plate 41 level, the wall plate 41 will sit in the gable restraint bracket 1 with the timber gable end panel 14 then fixed on top of the wall plate 41.

[0071] In the further embodiment of a partial roofing system 400 depicted in Figure 6, the features are similar to the embodiment of Figure 5 with the exception that the masonry course extends above the level of the truss wall plate 27. Additional masonry blocks 9c and 9d extend the masonry blockwork above the level of the insulation 33. In fact, masonry block 9 is cut to form block 9c in order to accommodate horizontal restraint strap 129 between blocks 9 and 9c.

[0072] Extending the masonry blockwork is intended to reduce or prevent thermal bridging.

[0073] The restraint bracket 1 receives the wall plate 41 between timber engaging tabs 5a, 5b. Nails 45 through fastener apertures 15 (Figure 2) secure the tabs 5a, 5b to the wall plate 41. The gable end frame member 116 is then secured by nails or screws to the wall plate 41. The board 13 of the gable end panel 14 is secured to brickwork 43 by wall ties 21. The roofing structure 400 is braced against the wind pushing (direction of arrow "A") or pulling (direction of arrow "B") the gable end by, amongst other features, the restraint bracket 1, the wall ties 21, the holding down strap 37 and the horizontal restraint strap 129.

[0074] In this embodiment the masonry generally denoted by reference numeral 9 is continued above truss wall plate 27 level, then there is a timber wall plate 41 sitting in the gable restraint bracket 1 with the timber member 116 of the gable panel 14 then fixed on top of the wall plate 41. It will be understood that in further embodiments (not shown) the wall plate 41 is not present and the timber member 116 of the gable panel 14 sits directly in the gable restraint bracket 1 between timber engaging tabs 5a, 5b.

[0075] Figure 7 is an alternative partial view of the roofing system 400 depicted in Figure 6. A full height wall 47 of which only three courses of bricks is shown, has a wall head 17 topped by a truss wall plate 27. Trusses 31, only three of which are shown, rest against and are attached to the truss wall plate 27. Masonry blocks 9c, 9d form part of the masonry layers of the gable end of the roofing system 400. Gable end panel 14 can be seen at the end of the structure (shown only in part). Figure 8 provides an end plan view of the roofing system 400 of Figures 6 and 7. Six gable restraint brackets 1 are positioned on the uppermost masonry course 9 and receive the timber frame member 11 of the gable end panel 14.

[0076] It will be understood that the gable restraint bracket 1 can have a number of variations and modification without departing from the scope of the invention. For example, in the embodiment depicted in Figure 9 the gable restraint bracket 100 has two timber engaging tabs 105b spaced apart from one another along edge 106 of base plate 103. Two masonry engaging tabs 107a, 107b depend from an opposite side of base plate 103. Edge 104 has no timber engaging member.

[0077] In the gable restraint bracket 200 of Figure 10, the pair of timber engaging tabs 205a and 205b comprise two hemispherical planar tabs upstanding from the base plate 203. A pair of masonry engaging plates 207a, 207b depend from the edges 204, 206 of the base plate 203.

[0078] Further alternative embodiments (not shown) may comprise tabs 205b and 207a or tabs 205a and 207b of Figure 10 or Tabs 5b and 7a or tabs 5a and 7b of Figure 9.

[0079] Throughout the description and claims of this specification, the words "comprise" and "contain" and variations of them mean "including but not limited to", and they are not intended to (and do not) exclude other moieties, additives, components, integers or steps. Throughout the description and claims of this specification, the singular encompasses the plural unless the context otherwise requires. In particular, where the indefinite article is used, the specification is to be understood as contemplating plurality as well as singularity, unless the context requires otherwise.

[0080] Features, integers, characteristics, compounds, chemical moieties or groups described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith. All of the features

disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive. The invention is not restricted to the details of any foregoing embodiments. The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A gable restraint bracket for receiving a masonry block and a timber member comprising a timber engaging portion and a masonry engaging portion upstanding from a base plate configured to engage the upper surface of a brick (masonry block) in a course of bricks forming a wall head, the timber engaging portion upstanding from a surface of the base plate and the masonry engaging portion upstanding from another surface of the base plate.
2. A restraint bracket according to claim 1, wherein the timber engaging portion is configured (adapted, arranged) to receive a wall plate or a truss plate or a frame member of a gable panel.
3. A restraint bracket according to claim 1 or claim 2, wherein the timber engaging portion extends in a first direction substantially perpendicular to the surface of the base plate and the masonry engaging portion extends in a second direction substantially perpendicular to the surface of the base plate, wherein the first and second directions are opposite one another.
4. A restraint bracket according to any one of the preceding claims, wherein the timber engaging portion is upstanding from an edge of the base plate and is substantially perpendicular to the surface of the base plate.
5. A restraint bracket according to any one of the preceding claims, wherein a further timber engaging portion is upstanding from an edge of the base plate opposite the edge of the base plate from which the timber engaging portion is upstanding and is substantially perpendicular to the surface of the base plate.
6. A restraint bracket according to any one of the preceding claims, wherein the timber engaging portion and the further timber engaging portion are resiliently biased towards one another and/or the centre of the

base plate.

7. A restraint bracket according to any one of the preceding claims, wherein the, and/or the further timber engaging portion(s) comprises one or more tabs (lugs). 5
8. A restraint bracket according to any one of the preceding claims, wherein the masonry engaging portion is upstanding from an edge of the base plate and substantially perpendicular to the surface of the base plate. 10
9. A restraint bracket according to any one of the preceding claims, wherein a further masonry engaging portion is upstanding from an edge of the base plate opposite the edge of the base plate from which the masonry engaging portion is upstanding and is substantially perpendicular to the surface of the base plate. 15
20
10. A restraint bracket according to any one of the preceding claims, wherein the, and/or the further masonry engaging portion(s) are resiliently biased towards one another and/or the centre of the base plate. 25
11. A restraint bracket according to any one of the preceding claims, wherein the, and/or the further masonry engaging portion(s) comprises one or more tabs (lugs). 30
12. A restraint bracket according to any one of claims 1 to 10, wherein the, and/or the further masonry engaging portion(s) comprises plates. 35
13. A restraint bracket according to any one of the preceding claims, wherein the masonry engaging portion and the further masonry engaging portion form a pair of masonry engaging portions which are configured to co-operate to receive a masonry block between them and against a surface of the base plate. 40
14. A restraint bracket according to any one of the preceding claims, wherein the timber engaging portion and the further timber engaging portion form a pair of timber engaging portions which are configured to co-operate to receive a wall plate, truss plate or gable panel frame member between them and against a surface of the base plate. 45
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15. A roofing system comprising a restraint bracket according to any one of claims 1 to 14 and a gable end panel. 55

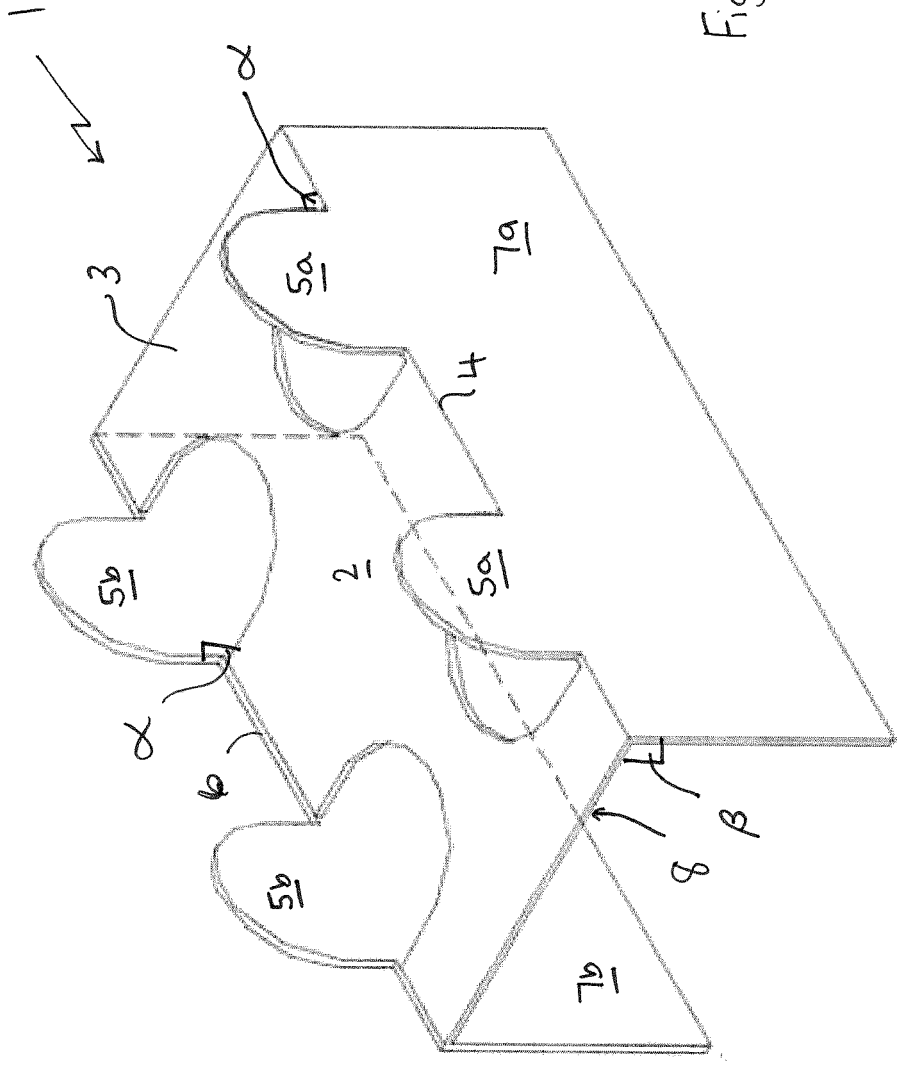
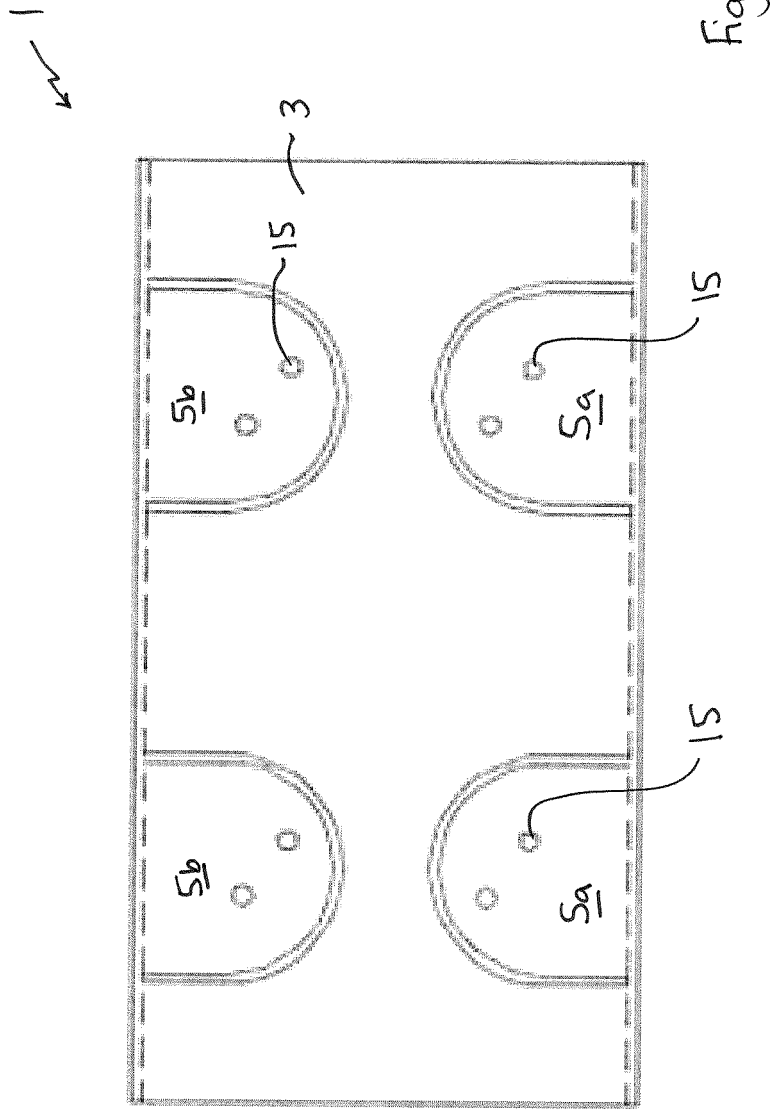


Figure 1



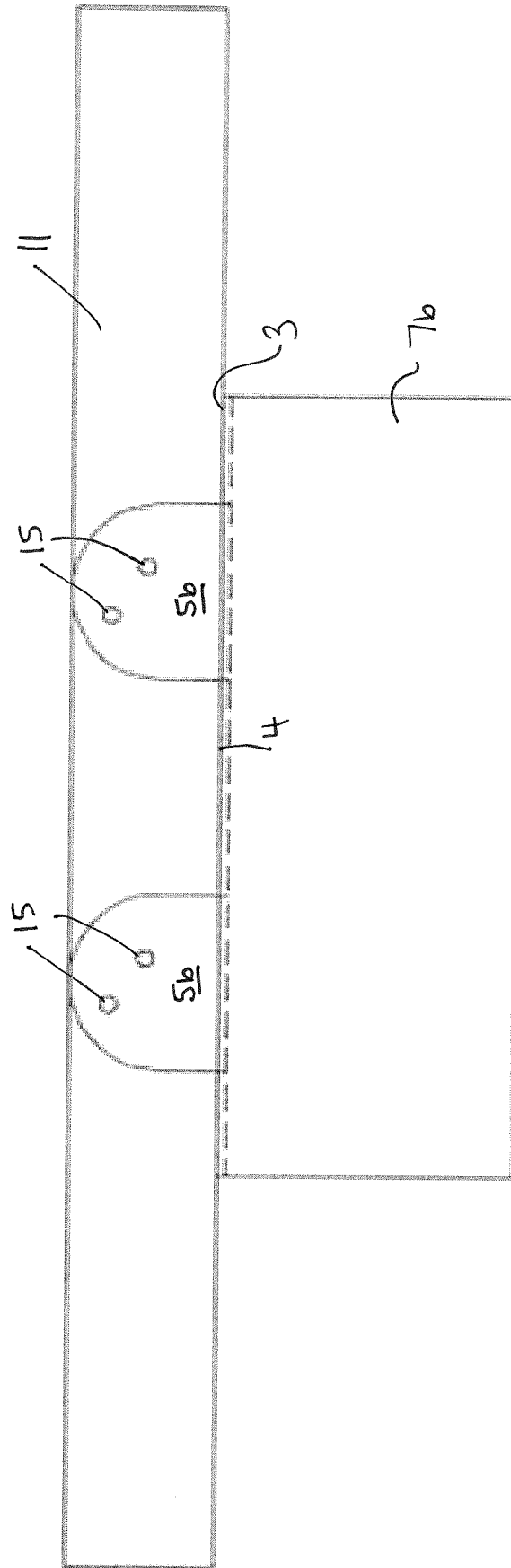


Figure 3

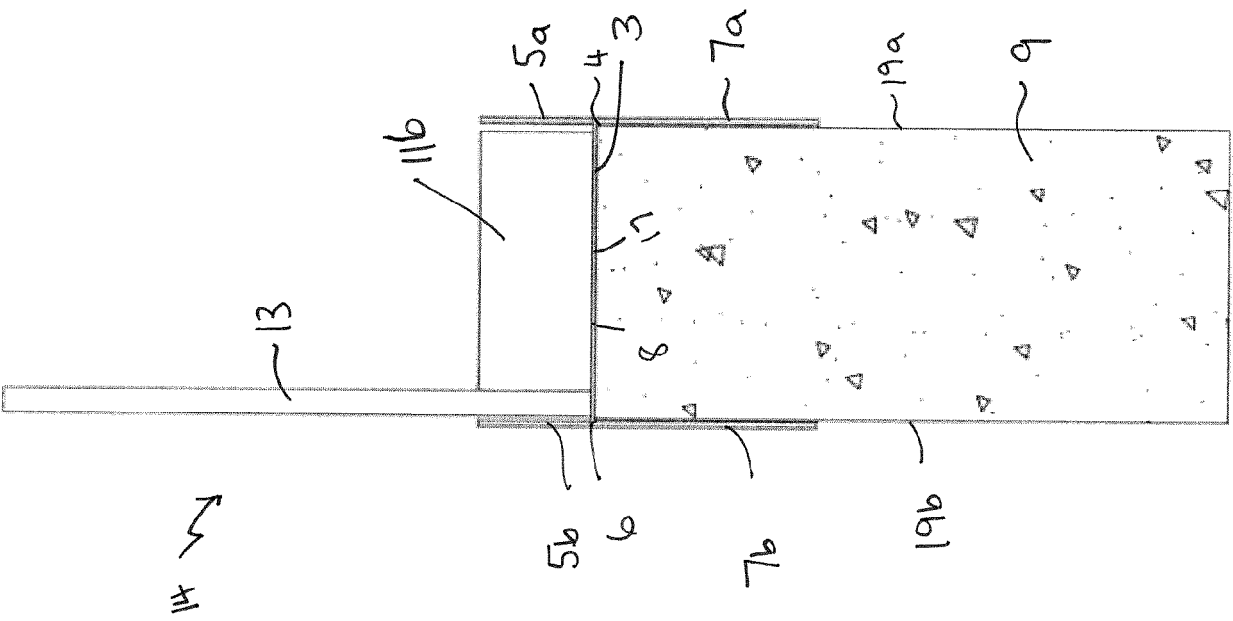
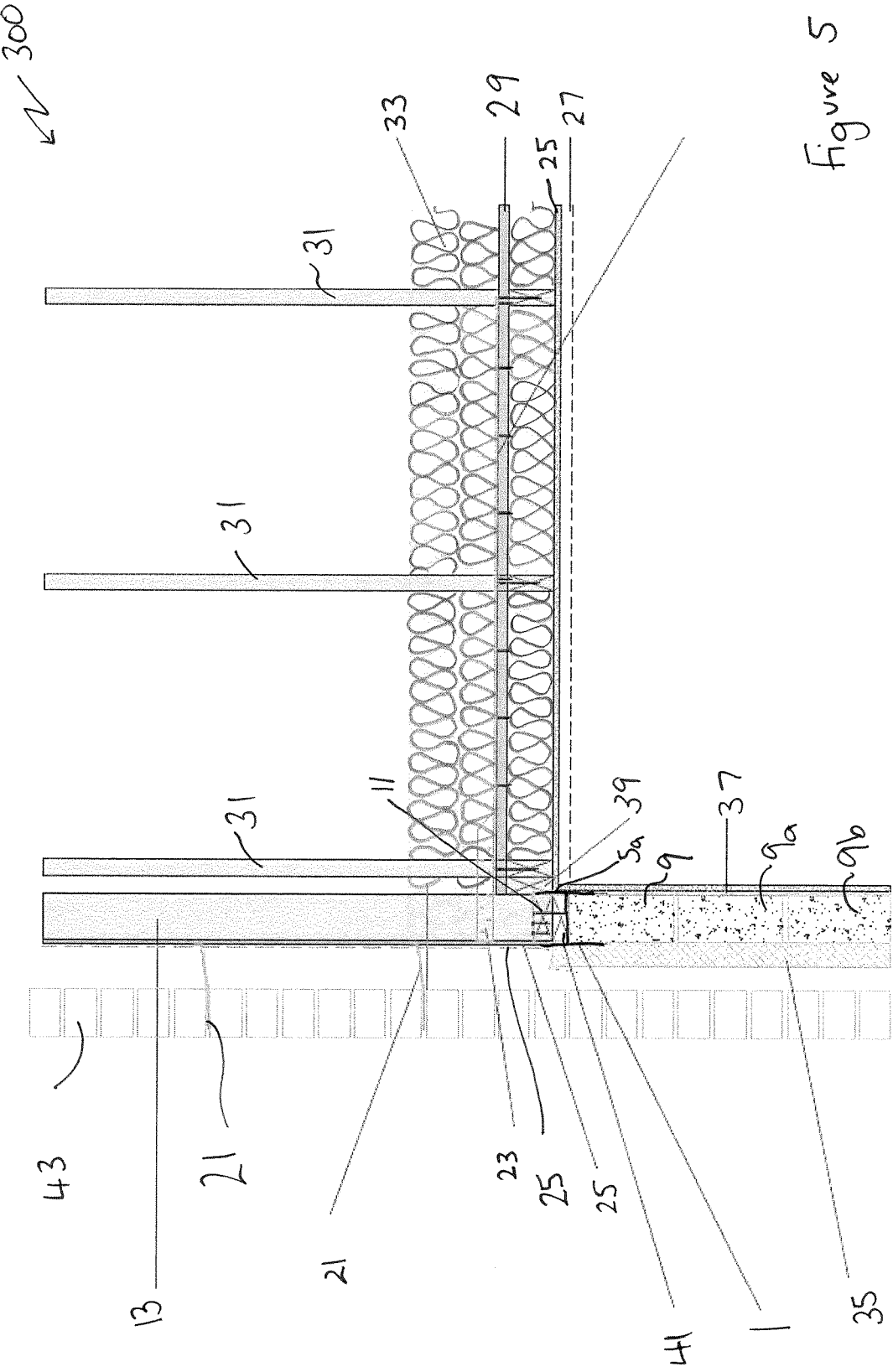


Figure 4



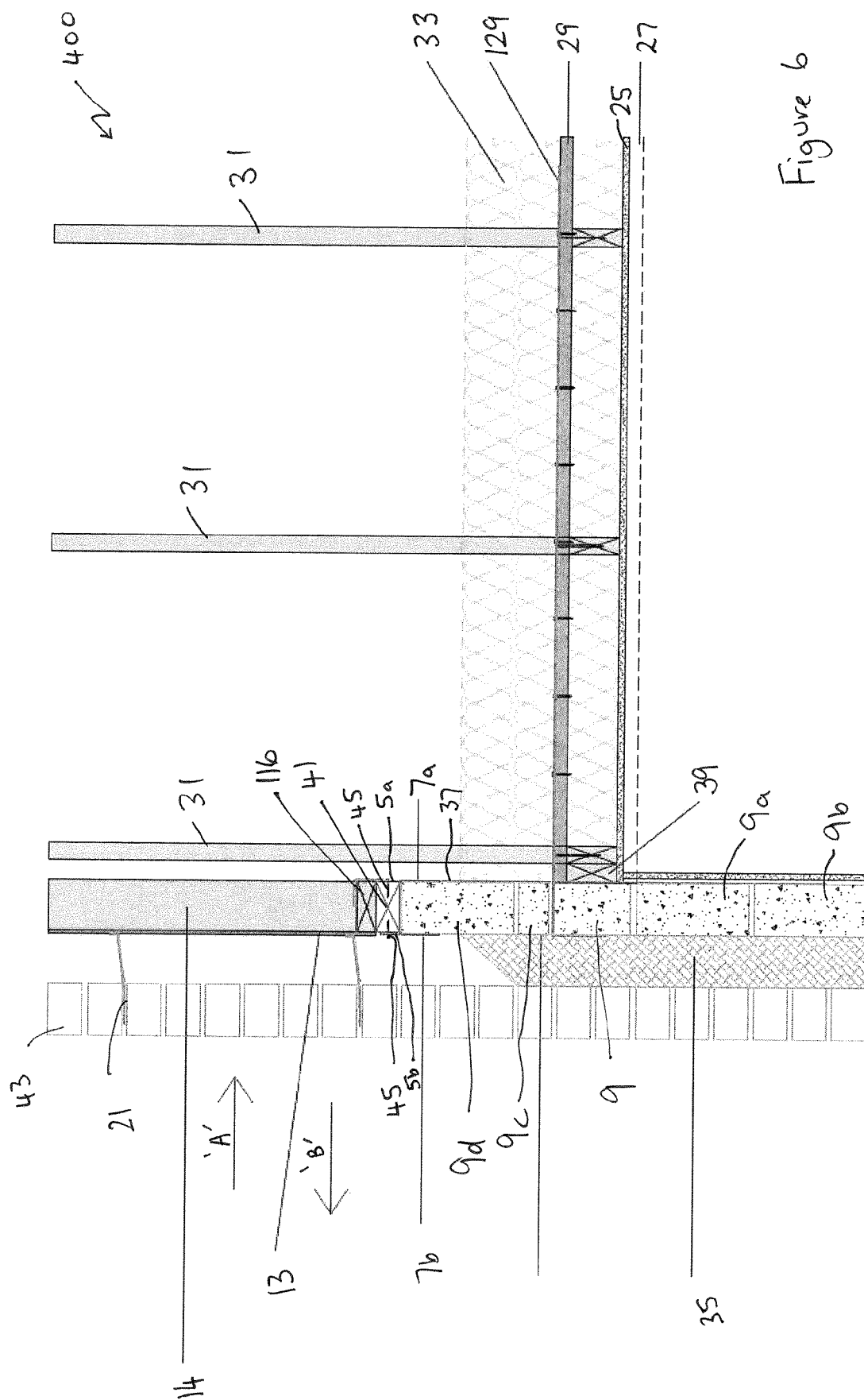


Figure 6

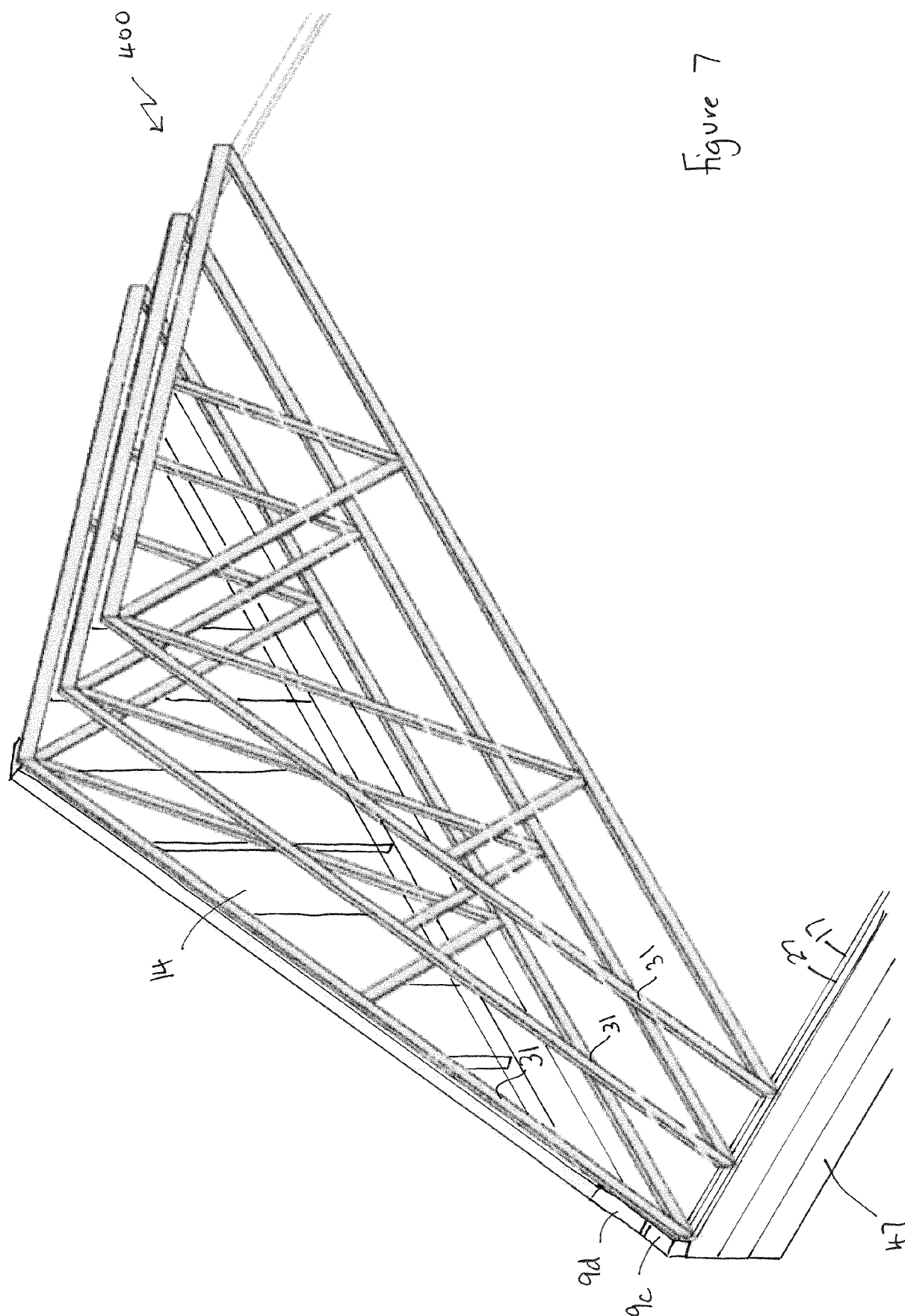


Figure 7

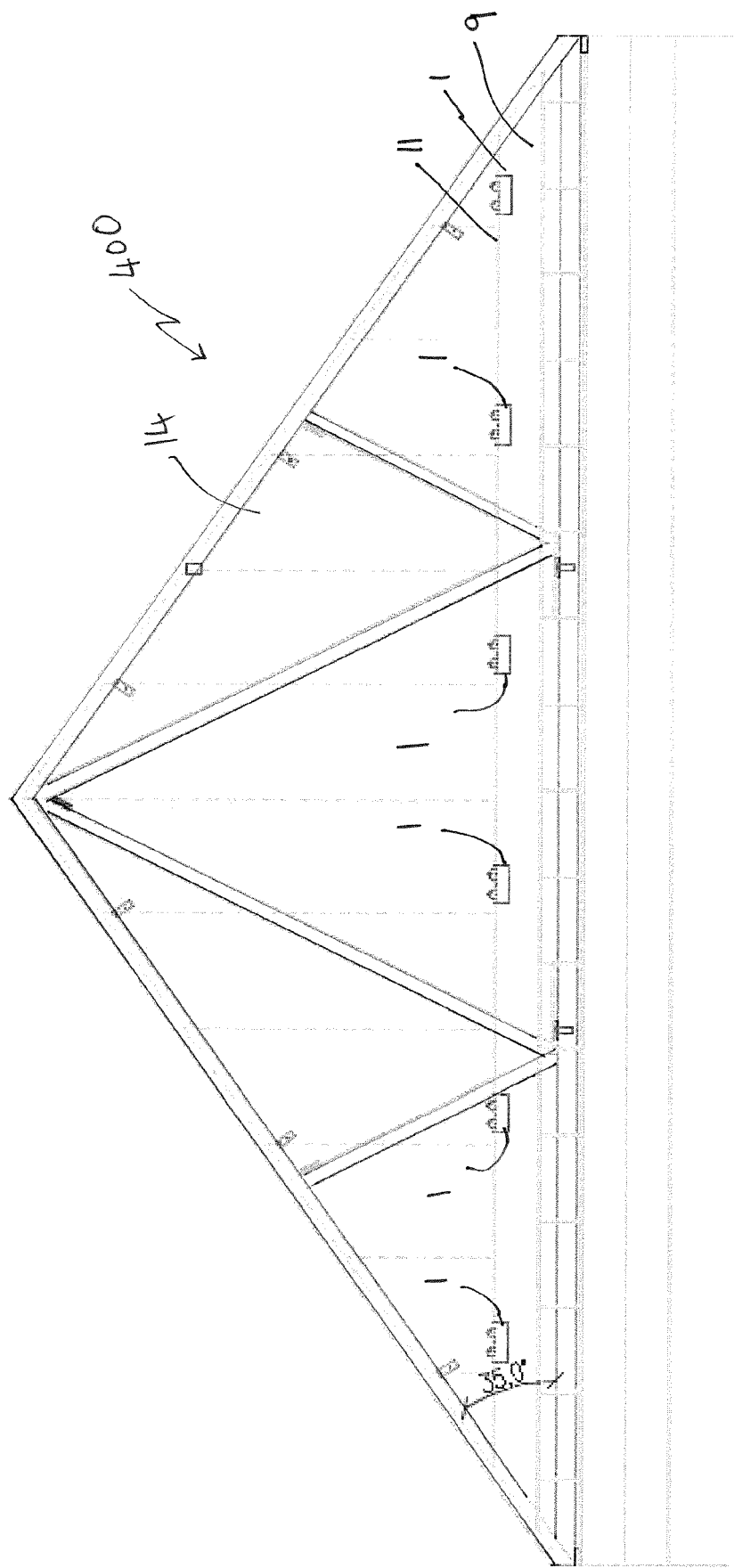


Figure 8

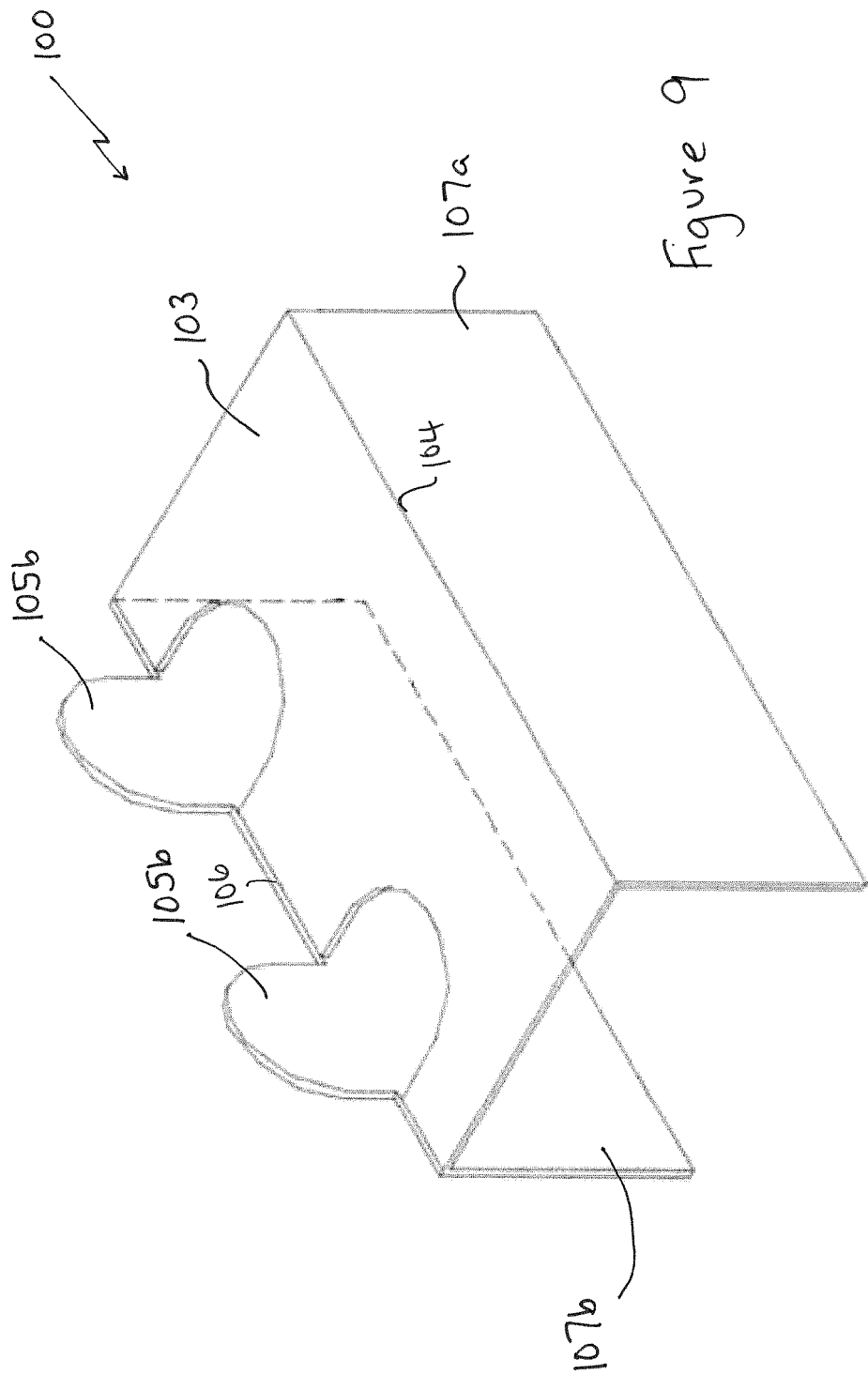


Figure 9

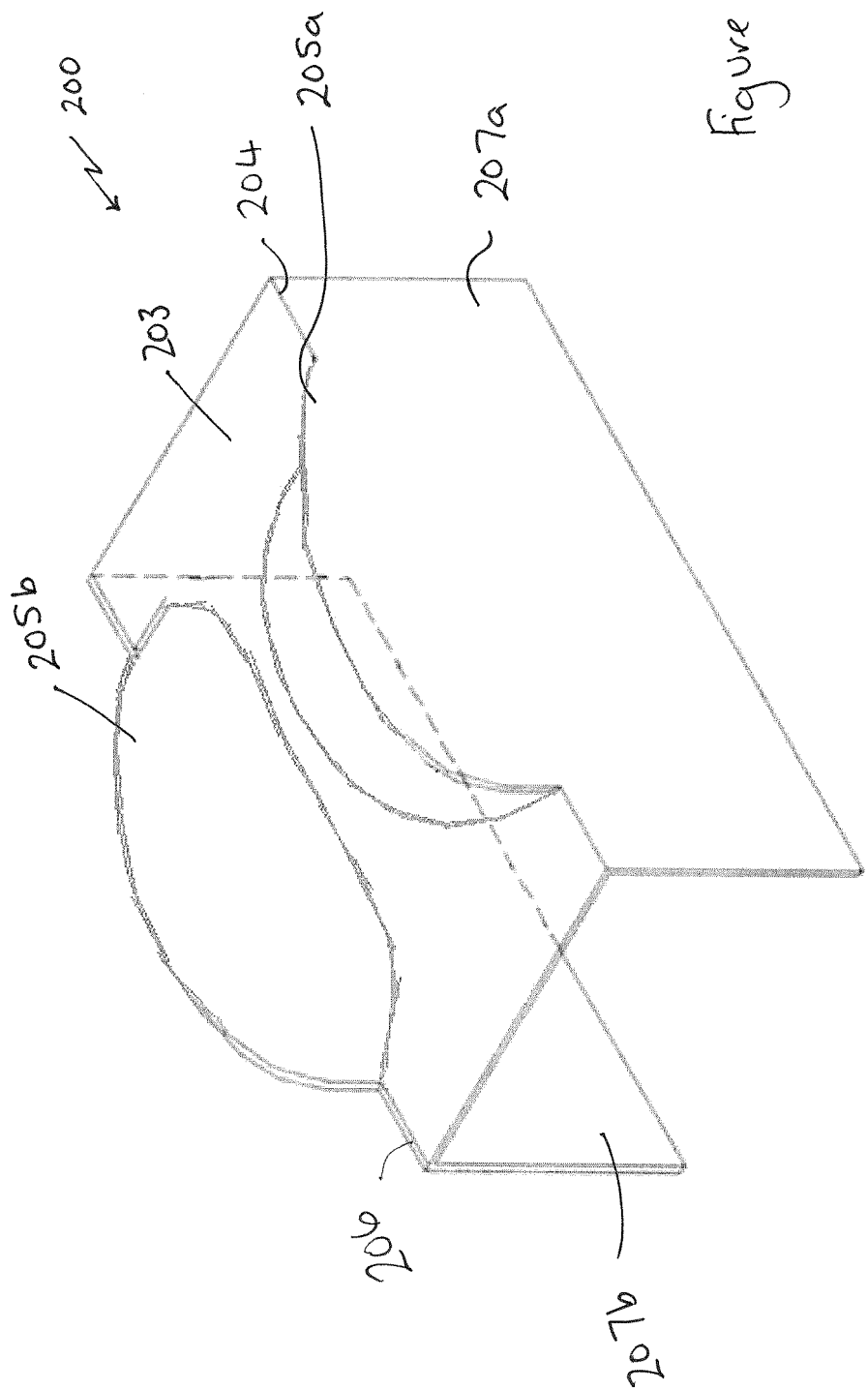


Figure 10



EUROPEAN SEARCH REPORT

Application Number
EP 18 17 1779

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 2 October 2018	Examiner Stern, Claudio
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			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82