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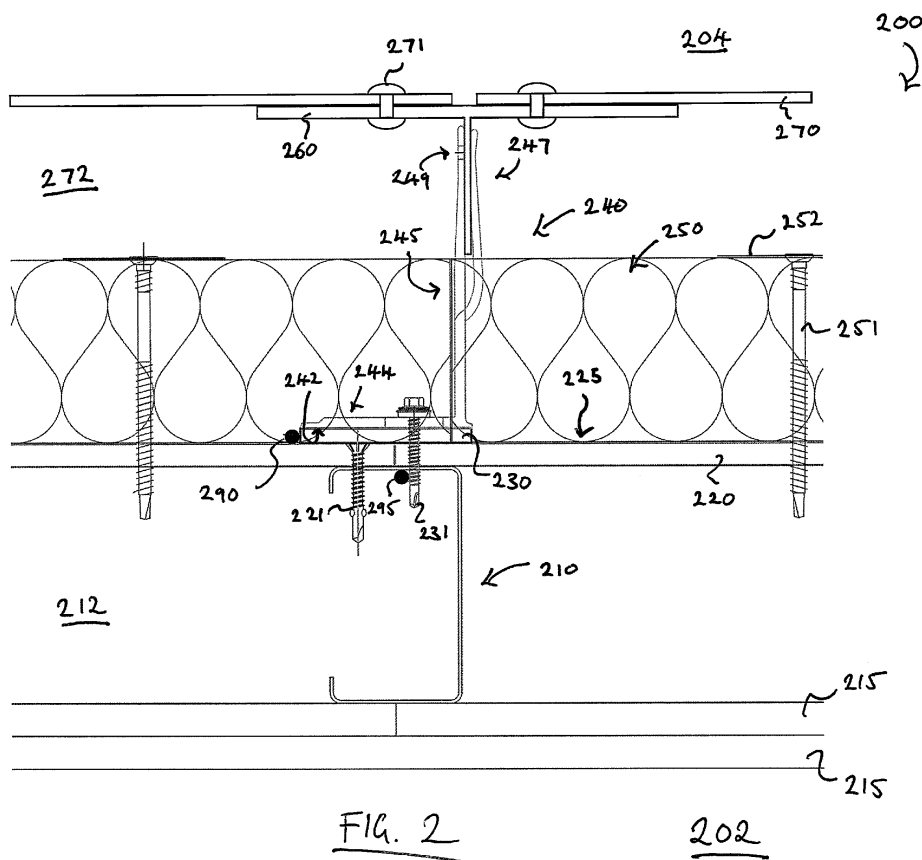
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(54) **FIRE-RESISTANT SPACER BODY USE IN STRUCTURAL CLADDING**

(57) Apparatus, a method of manufacturing and a structure are disclosed. The apparatus comprises at least one spacer body (230) locatable between at least one panel-like element (220) that covers at least one side of an underlying framework (210) of a portion of a structure, and a support bracket (240) of the portion, to provide an

island-like stand off region between a major surface (225) of the panel-like element and a base surface of the support bracket, wherein the spacer body is manufactured from at least one material that is non-combustible and thermally insulating.



Description

[0001] The present invention relates to a method and apparatus for helping to maintain integrity of a portion of a structure in the event of a fire. In particular, but not exclusively, the present invention relates to a spacer body that is manufactured from at least one material that is non-combustible and thermally insulating and provides a standoff region with respect to a panel-like element of a portion of a structure for a support bracket to rest on. Providing the material of the spacer body as a non-combustible material means that the spacer body will not melt during a fire and helps the support bracket remain rigidly secured to the structure.

[0002] Conventionally, many structures such as houses, hotels, warehouses, office blocks, retail outlets, skyscrapers, education facilities, industrial plants and the like may employ cladding for one or more of their visible surfaces. Cladding is beneficial in the industry as it utilises materials that are cheap, versatile, straightforward to manufacture and install, weather resistant, environmentally friendly and can be readily customised to design requirements. However, in order to satisfy safety requirements, such cladding systems typically must include at least one component dedicated to fire resistance. Fire-resistant components are used to impart a degree of control over fires that start both inside and outside of a structure. The fire-resistance of these components are tested according to accepted test standards as discussed below.

[0003] Certain conventional test procedures of test structures utilise British Standard BS EN 1363-1 in the United Kingdom which is based on European Standard EN 1363-1. The contents of these standards are incorporated herein by reference. BS EN 1363-1 relates to carrying out a fire test against two layers of blockwork and the test effectively determines if a particular cavity barrier made from a fire-resistant material stops a fire spreading from one side of the barrier to the other. Wall-like constructions are tested either from an interior face of the wall-like construction to an exterior face (i.e. simulating a fire starting inside a structure) or from an exterior face to an interior face (i.e. simulating a fire starting outside a structure) to determine whether a fire can penetrate through the wall in either direction. Fire testing of wall-like constructions is defined by associated British Standards BS EN 1364-1 and 1365-1 in the United Kingdom which are based on European Standards EN 1364-1 and EN 1365-1. The contents of these standards are incorporated herein by reference. Another fire test that relates to performance of certain materials as fire stops is defined by British Standard BS EN 8414-1 in the United Kingdom. The contents of this standard are incorporated herein by reference. This standard is used principally to ensure the performance of the outermost cladding material and to understand the combustibility of this cladding. Furthermore, fire classification of construction products and building elements themselves is tested accord-

ing to British Standard BS EN 13501-1 in the United Kingdom which is based on European Standard EN 13501-1. The contents of these standards are incorporated herein by reference.

[0004] Typically, suppliers of cavity barriers (i.e. horizontal or vertical barriers made from a fire resistant material that are used to compartmentalise part of a structure such as in a region behind an outer cladding layer) for structures using cladding only show the cavity barriers secured back to masonry substrates or timber frames (i.e. as they have presumably been tested). In practice however, instead of masonry substrates and timber frames, it is more common for structures that employ cladding to be based on an underlying metal framework construction with one or more sheathing boards covering the framework on its' externally facing side. Subsequently, a number of supporting brackets are attached to the sheathing boards by being fixed through to the underlying framework before cavity barriers and a layer of thermally insulating material is added to cover the sheathing boards and the supporting brackets, wherein the cavity barriers are typically fixed directly to the sheathing board(s). An externally visible cladding layer can then be mounted on the supporting brackets. However, at present there is very little (if any) test data to support that cavity barriers will remain fixed during and after a fire if they are simply fixed back to the sheathing boards according to recognised test standards of BS EN 1364-1 or BS EN 1365-1 as these tests do not necessitate the use of cavity barriers. It therefore appears that cavity barriers are often being supplied and installed against sheathing boards on-site without any evidence in the field which suggests that they will be suitable in the event of a fire according to accepted UK or European fire test standards.

[0005] A problem with installing materials under this presumption is that it is unknown how the structure will perform in the event of a fire as the fire tests used by suppliers or testers have not tested structures which have attempted to replicate what is actually built on-site. This problem appears to have gone unrecognised due to the fact that different components used for a structure with cladding are provided by different suppliers who tend to focus on the individual elements of the cladding system they are supplying. For example, a wall-like construction including an underlying framework with sheathing boards on one side and plasterboards on the other is typically tested in isolation without any cavity barriers whereas the cavity barriers themselves are typically tested independent of the wall on which they will eventually be mounted. It therefore seems that no holistic approach has been taken with respect to fire-resistance of part of a structure as a whole as there is not actually any harmonised test procedure requiring that the structure must be tested as a whole. The potential fire risks associated with constructing a typical portion of a structure as a whole (i.e. when a cavity barrier is actually fixed back to a wall based on an underlying metal framework and one

or more sheathing boards) therefore appears to not have been seriously considered.

[0006] The potential fire risks are exacerbated by the fact that, in practice, in addition to the thermal insulation and cavity barriers, support brackets which attach to a cladding support member or rail (that hold the externally visible cladding panels) and other penetrations are also fixed back to the sheathing boards and/or the underlying metal framework. The support brackets and cladding support members act together to hold the outer cladding panels in place. Conventionally between the support bracket and the sheathing board a plastic or thermal foam packer is used which offsets the bracket from the sheathing board. This packer aims at thermally insulating the wall of the structure and is also used for aligning the support bracket. However, during a fire test, suppliers or testers have never taken into account that support brackets, packers and other penetrations are used some of which are exposed to the fire and extend through the thermally insulating material and into the sheathing boards and/or the underlying framework.

[0007] A problem which arises when support brackets and other penetrations are present during a fire is that they allow heat to transfer to the sheathing board putting greater stress on a wall construction. This can result in the sheathing boards starting to crack after around 20-40 minutes of exposure to the fire. During a fire on a conventional structure the plastic packers also melt leaving no packer remaining behind the support bracket. As a result, during and after the fire the aluminium support bracket is not held tightly against the cracked sheathing boards as there is no packer remaining to hold the bracket securely in place. There is therefore a possibility that large sections of the sheathing boards may fall away. As the cavity barriers are typically fixed back to the sheathing boards and the sheathing boards may have fallen away, the cavity barriers can thus end up being essentially unsupported. This therefore also creates a possibility that the cavity barriers themselves might fall away. This could cause a major problem in that the fire could then be able to directly contact layers of plasterboard on the opposing side of the framework (e.g. an inner surface of a wall). These layers of plasterboard may well resist the fire penetration for a shorter period of time compared to if the sheathing boards and cavity barriers remained attached to the structure.

[0008] It is an aim of the present invention to at least partly mitigate at least one of the above-mentioned problems.

[0009] It is an aim of certain embodiments of the present invention to help maintain integrity of a portion of a structure during a fire.

[0010] It is an aim of certain embodiments of the present invention to help thermally insulate a portion of a structure during normal conditions (i.e. when the structure is not under attack from a fire).

[0011] It is an aim of certain embodiments of the present invention to help extend a period of time it takes

for a fire to penetrate from one side of a portion of a structure to another side with respect to conventional structures.

[0012] It is an aim of certain embodiments of the present invention to help reduce the total temperature increase of part of a portion of a structure over a predefined period of time (e.g. 120 minutes) with respect to conventional structures.

[0013] According to a first aspect of the present invention there is provided apparatus for spacing apart components of a portion of a structure, comprising at least one spacer body locatable between at least one panel-like element that covers at least one side of an underlying framework of a portion of a structure, and a support bracket of the portion, to provide an island-like stand off region between a major surface of the panel-like element and a base surface of the support bracket wherein the spacer body is manufactured from at least one material that is non-combustible and thermally insulating.

[0014] Aptly the material is a class A1 or class A2 material in accordance with British Standard BS EN 13501-1.

[0015] Aptly the material is at least one of gypsum, gypsum concrete, fibre cement, calcium silicate, calcium silicate cement, cement particles, magnesium oxide, diatomaceous silica, perlite or pumice.

[0016] Aptly the spacer body is manufactured from a single material or a homogenous mixture of a plurality of materials.

[0017] Aptly responsive to at least one surface of the spacer body being exposed to a test fire with a predefined temperature variation for a predetermined time; the material provides a temperature increase of a surface of the spacer body less than about around 50°C and/or a mass loss of the spacer body less than about around 50% of an original mass of the spacer body before being exposed to the fire and/or a duration of time in which flames are continuously present on a surface of the spacer body less than about around 20 seconds.

[0018] Aptly the material is unmelttable during the test fire.

[0019] Aptly the predefined temperature variation follows a logarithmic temperature-time relationship.

[0020] Aptly the predetermined time is 30 minutes or 60 minutes or 90 minutes or 120 minutes.

[0021] Aptly the material has a thermal conductivity of less than about around 0.5 W/mK and/or less than about around 0.2 W/mK and/or less than about around 0.15 W/mK and/or less than about around 0.05W/mK.

[0022] Aptly the spacer body comprises a first abutment surface and a further abutment surface arranged in a substantially parallel relationship and spaced apart by a predetermined distance, the first abutment surface being locatable against the major surface of the panel-like element and the further abutment surface being locatable against the base surface of the support bracket.

[0023] Aptly the predetermined distance is about around 1 mm to 30mm, and optionally about around 3mm

to 25mm.

[0024] Aptly at least one of the first and further abutment surface has a surface area of less than 400cm² and/or less than 200cm² and/or less than 150cm² and/or is in a range of about around 20cm² to 120cm².

[0025] Aptly the surface area of the first and further abutment surface is substantially equal.

[0026] Aptly a peripheral edge region of the spacer body extends between the first and further abutment surface in a direction substantially perpendicular to the first and/or further abutment surface.

[0027] Aptly the surface area of the first abutment surface is greater than the surface area of the further abutment surface or the surface area of the further abutment surface is greater than the surface area of the first abutment surface.

[0028] Aptly a peripheral edge region of the spacer body extends between the first and further abutment surface in a direction that is non-perpendicular to the first and/or further abutment surface.

[0029] Aptly at least one of the first and further abutment surface is substantially rectangular or substantially elliptical or substantially O-shaped or substantially I-shaped or substantially T-shaped.

[0030] Aptly the spacer body comprises one or more through holes and/or partial through holes for aligning the spacer body and/or receiving a fixing element that secures the support bracket to the panel like-elements and/or the underlying framework.

[0031] Aptly the further abutment surface is at least partially surrounded by a lip region, the further abutment surface thereby providing a recessed region for receiving the support bracket.

[0032] Aptly the lip region protrudes a predetermined distance beyond the further abutment surface from a peripheral edge region extending between the first and further abutment surface of the spacer body.

[0033] Aptly the lip region is integrally formed with the spacer body or is provided as a separate part that is attached to the spacer body.

[0034] Aptly the further abutment surface comprises at least one recess and/or at least one projection to mate with a respective projection and/or recess of the support bracket.

[0035] Aptly the support bracket is manufactured from a metal, optionally aluminium, steel or the like.

[0036] Aptly the panel-like element is a sheathing board.

[0037] Aptly the panel-like element is manufactured from at least one further material, wherein the further material is at least one of gypsum, plywood, cement particles, fibre cement, magnesium oxide, calcium silicate cement or the like.

[0038] Aptly the at least one panel-like element is provided as a plurality of panel-like elements arranged in a side by side relationship.

[0039] Aptly the underlying framework is manufactured from at least one metal and/or wood material.

[0040] Aptly the portion of the structure comprises at least part of an internal and/or external wall of the structure and/or a floor of the structure and/or a ceiling of the structure and/or a roof of the structure or the like.

5 **[0041]** Aptly the structure is a house, a hotel, a warehouse, an office block, a retail outlet, a skyscraper, an education facility, an industrial plant or the like.

[0042] According to a second aspect of the present invention there is provided a method of manufacturing a portion of a structure, comprising the steps of providing at least one panel-like element to cover at least one side of an underlying framework of a portion of a structure; and securing a support bracket and at least one spacer body, manufactured from at least one material that is non-combustible and thermally insulating, to the panel-like element, whereby the spacer body provides an island-like stand off region between a major surface of the panel-like element and a base surface of the support bracket.

10 **[0043]** Aptly the method further comprises securing the spacer body to the panel-like element and subsequently securing the support bracket to the spacer body.

[0044] Aptly the method further comprises securing the support bracket and the spacer body to the panel-like element substantially simultaneously.

15 **[0045]** Aptly the method further comprises providing the underlying framework as a first plurality of elongate beam elements and a second plurality of elongate beam elements arranged substantially perpendicular to, and securable to, the first beam elements.

20 **[0046]** Aptly the method further comprises providing the panel-like element as a plurality of panel-like elements arranged in a side by side relationship.

[0047] Aptly the method further comprises securing the panel-like element to the underlying framework with at least one fixing element.

25 **[0048]** Aptly the method further comprises providing the support bracket as a substantially L-shaped or substantially U-shaped or substantially box-shaped bracket.

30 **[0049]** Aptly the method further comprises securing the support bracket and the spacer body to the panel-like element by providing at least one fixing element through respective through holes of the support bracket and the spacer body and securing the fixing element to the panel-like element and/or the underlying framework.

35 **[0050]** Aptly the method further comprises providing a thermally insulating element over the spacer body and the support bracket and securing the thermally insulating element to the panel-like element with at least one fixing element.

40 **[0051]** Aptly the thermally insulating element is manufactured from at least one still further material, wherein the still further material is at least one of mineral wool, fiberglass, cellulose, polyurethane foam, expanded polystyrene (EPS), extruded polystyrene (PIR), polyisocyanurate foam, phenolic foam, cement foam or the like.

45 **[0052]** Aptly the method further comprises securing a cladding support member to a clip-like region at an end

of a support region of the support bracket that extends substantially perpendicularly away from a base region of the support bracket and securing at least one cladding element to the cladding support member.

[0053] Aptly the method further comprises providing at least one board element on an opposing side of the underlying framework.

[0054] According to a third aspect of the present invention there is provided a structure, comprising an underlying framework, at least one panel-like element that covers at least one side of the underlying framework, at least one support bracket, and for each support bracket, a respective spacer body, manufactured from at least one material that is non-combustible and thermally insulating, disposed between the panel-like element and the support bracket to provide an island-like stand off region between a major surface of the panel-like element and a base surface of the support bracket.

[0055] Certain embodiments of the present invention provide a cost-effective solution for helping to maintain integrity of a structure in the event of a fire.

[0056] Certain embodiments of the present invention provide spacer bodies which are cheap to manufacture and which are easy to install as part of a portion of a structure.

[0057] Certain embodiments of the present invention provide at least one rigid spacer body that does not melt in the event of a fire and is locatable between at least one panel-like element and a support bracket to thereby help ensure the support bracket remains rigidly secured to the panel-like element in the event of a fire.

[0058] Certain embodiments of the present invention provide at least one spacer body that is manufactured from at least one material that is non-combustible and thermally insulating. Such a spacer body helps to thermally insulate a structure during normal use and also helps to maintain integrity in the event of a fire.

[0059] Certain embodiments of the present invention provide an island-like stand off region between at least one panel-like element and a respective support bracket to help thermally insulate the panel-like element from temperatures experienced by the support bracket.

[0060] Certain embodiments of the present invention help extend a period of time it takes for a fire to penetrate from one side of a portion of a structure to another side with respect to conventional structures.

[0061] Certain embodiments of the present invention help reduce the total temperature increase of part of a portion of a structure over a predefined period of time (e.g. 120 minutes) with respect to conventional structures.

[0062] Certain embodiments of the present invention will now be described hereinafter, by way of example only, with reference to the accompanying drawings in which:

Figure 1 illustrates a structure;

Figure 2 illustrates a portion of a structure;

Figure 3 illustrates a spacer body for spacing apart components of a portion of a structure;

Figure 4A illustrates a side view of a support bracket;

Figure 4B illustrates a front view of a support bracket;

Figure 4C illustrates a top view of a support bracket;

Figure 5 illustrates an underlying test framework of a test structure;

Figure 6 illustrates the framework of Figure 5 covered by a plurality of sheathing boards;

Figure 7 illustrates placement of support brackets, cavity barrier brackets and thermocouples on the test structure of Figure 6;

Figure 8 illustrates the positioning of elements of a thermally insulating material over the test structure of Figure 7;

Figure 9 illustrates positioning of cavity barriers on the test structure of Figure 8;

Figure 10 illustrates a cladding support member or rail and outer cladding panel for connecting to at least one support bracket;

Figure 11 illustrates a temperature-time plot of a furnace during a fire test;

Figure 12 illustrates an average temperature-time plot of an opposing side of the test structure during a fire test (i.e. an unexposed side);

Figure 13 illustrates a temperature-time plot measured by thermocouples in proximity to respective support brackets; and

Figure 14 illustrates a temperature-time plot measured by thermocouples on the underlying framework in a position behind respective support brackets.

[0063] In the drawings like reference numerals refer to like parts.

[0064] Figure 1 illustrates a structure 100 such as an office block. However, according to certain embodiments of the present invention the structure may also be a house, a hotel, a warehouse, a retail outlet, a skyscraper, an education facility, an industrial plant or the like. The structure 100 illustrated in Figure 1 includes one or more external walls 105 and a roof 110. It will be appreciated that the structure 100 may also include one or more internal walls, one or more floors and/or one or more ceil-

ings.

[0065] Figure 2 illustrates a portion 200 of a structure such as the structure illustrated in Figure 1 and in particular illustrates an exterior wall portion that may provide a barrier between an interior region 202 of a structure and an exterior region 204 of a structure. However, the skilled person will appreciate that the structure may be any type of structure that may make use of cladding. The skilled person will appreciate that whilst Figure 2 illustrates the portion 200 as being an exterior wall, the portion may also be an interior wall, a floor, a roof, or a ceiling or the like.

[0066] The portion 200 of the structure includes an underlying framework 210 that itself includes a plurality of upright elongate beam elements and a plurality of horizontal elongate beam elements. The upright and horizontal beam elements are arranged substantially perpendicular to one another and may be secured to each other to form the underlying framework that provides the foundation for adding further components to the portion 200 of the structure. The C-shaped section of the underlying framework shown in Figure 2 is an upright beam element (a stud) which may be connected to one or more horizontal beam elements (not shown) on a first and/or further side of a gap region 212. Optionally, the gap region 212 may be filled with air, thermal insulation or the like. The underlying framework may be manufactured from a metal such as steel and may be known as a steel framing system (SFS) such as a Metsec SFS. Alternatively, the underlying framework may also be manufactured from wood/timber. The skilled person will appreciate that the underlying framework may also be constructed from a combination of both wood and metal materials. During construction of a structure, the upright beam elements of the underlying framework 210 may be secured to pre-prepared foundations for a structure, such as a large deposit of concrete or the like. The upright studs may have a width of about around 70mm to 200mm and aptly may be about around 90mm and adjacent studs may be spaced about around 600mm apart.

[0067] On one side of the underlying framework 210 there is provided one or more board elements 215 such as plasterboards, fibre cement boards, chipboards, MDF boards or the like that are arranged in a side by side relationship to form a first layer. The thickness of the board elements 215 is about around 5mm to 20mm. Aptly the thickness is about around 15mm. Optionally, a second layer of board elements 215 may also be provided over the first layer. The skilled person will appreciate that more than two layers may be provided if desired and the board elements 215 do not necessarily have to be manufactured from the same material. The layer or layers of board elements 215 cover the underlying framework 210 on an inside-facing direction of the structure (towards the bottom, interior region 202, of Figure 2) so that the underlying framework 210 is not visible to a person positioned at an interior region 202 of a structure. In other words, as will be appreciated by a person skilled in the

art, each board element 215 is a board having a uniform thickness and two pairs of spaced apart long edges with a first surface on one side of the long edges and a further surface on an opposite side of the long edges. Depending on orientation in use, either the first or further surface of the board element 215 may face an interior region 202 of the structure. The board elements 215 may be secured to the underlying framework with at least one fixing element such as a screw, nut and bolt arrangement or the like.

[0068] On an opposing side of the framework 210 to the layers of board elements 215, at least one panel-like element 220 is provided having a thickness of about around 5mm to 20mm. Aptly the thickness is about around 9mm to 12mm and a width and length up to about around 2400mm. The panel-like element 220 covers the underlying framework 210 in an outside-facing direction (towards the top, exterior region 204, of Figure 2) so that the underlying framework 210 is not visible to a person positioned at an exterior region 204 of the structure. The panel-like element 220 may be a sheathing board and may be manufactured from at least one material such as gypsum, plywood, cement particles, fibre cement, magnesium oxide, calcium silicate cement or the like. The panel-like elements 220 may be manufactured from a single one of any of these materials or as a homogeneous or inhomogeneous mixture thereof. A plurality of panel-like elements 220 may be arranged in a side by side relationship to form a layer of panel-like elements. The skilled person will appreciate that each panel-like element 220 does not necessarily have to be manufactured from the same material(s). The layer of panel-like elements 220 provides a substantially flat surface facing an exterior region 204 of the structure on which further components may be mounted. That is to say that each panel-like element 220 is a panel typically having a uniform thickness and two pairs of spaced apart long edges with a first surface on one side of the long edges and a further surface on an opposite side of the long edges. Depending on orientation in use, either the first or further surface of the panel-like element 220 may be a major surface 225 which is locatable against a surface of at least one spacer body 230 and a surface of at least one thermally insulating element 250 of the portion 200 of the structure. It will also be appreciated by the person skilled in the art that one or more fixing elements 221 may be used to secure the panel-like element or elements to the underlying framework. Optionally, the fixing elements 221 may be screws, nut and bolt arrangements or the like.

[0069] Figure 2 also illustrates how at least one rigid spacer body 230 and at least one support bracket 240 may be secured to the panel-like element or elements 220. Optionally, the spacer body 230 may first be secured to the panel-like element 220 using at least one fixing element (not shown) before subsequently securing the support bracket 240 to the spacer body 230. In other words, the spacer body 230 may be fixed to the panel-like element 220 before the support bracket 240 is fixed

to the spacer body 230 by providing at least one fixing element 231 through respective through holes or partial through holes of the support bracket 240 and the spacer body 230. The fixing elements are thereby secured to the panel-like element 220 and/or the underlying framework 210 to thereby secure the support bracket 240 to the spacer body 230. Alternatively, the support bracket 240 and the spacer body 230 may be secured to the panel-like element or elements 220 substantially simultaneously. For example, the spacer body 230 may be held on the panel-like element 220 by hand and a support bracket 240 may then be placed on the spacer body 230 or the spacer body 230 and the support bracket 240 may be held together by hand and be placed on the panel-like element 220 at the same time. At least one fixing element 231 may then be provided through respective through holes or partial through holes of the support bracket 240 and the spacer body 230. The fixing elements 231 are secured to the panel-like element 220 and/or the underlying framework 210 to secure the spacer body 230 and the support bracket 240 to the panel-like element 220. In this way, the spacer body 230 thereby provides an island-like stand off region between the major surface 225 of the panel-like element 220 and a base surface 242 of the support bracket 240. In other words, the support bracket 240 rests on an abutment surface (see also Figure 3) of the spacer body 230 such that the support brackets base surface 242 is spaced apart from the major surface 225 of the panel-like element 220. Optionally, the fixing element 231 may be a screw (with or without one or more washer elements), a nut and bolt arrangement or the like. Adjacent spacer bodies 230 and support brackets 240 may be provided spaced apart by about around 600mm to stay aligned with the underlying framework 210.

[0070] Figure 2 also illustrates at least one thermally insulating element 250 that may be provided over the spacer body 230 and support bracket 240 and fixed to the panel like element or elements 220 with at least one fixing element 251 such as a screw and an associated pressure plate 252 which may be metal or plastic. Optionally, and as illustrated, the thermally insulating element 250 can be manufactured from a flexible, low density (between about around 10 to 200 kg/m³) material that is used to cover the panel-like elements 220 of the portion 200 of the structure to provide thermal insulation without adding excessive load to the structure. Optionally, the thermally insulating element 250 may be manufactured from a material that is fibrous and/or is non-combustible. For example, the thermally insulating elements 250 may be manufactured from at least one material such as mineral wool, fiberglass, cellulose, polyurethane foam, expanded polystyrene (EPS), extruded polystyrene (PIR), polyisocyanurate foam, phenolic foam, cement foam or the like. The thermally insulating elements 250 may be manufactured from a single one of any of these materials or as a homogeneous or inhomogeneous mixture thereof. The skilled person will also

appreciate the thermally insulating elements 250 used for a structure do not necessarily have to be manufactured from the same material(s). The thermally insulating elements 250 may be provided in a side by side arrangement but a gap may be left between respective elements to provide for insertion of so-called cavity barriers. The thermally insulating elements 250 may have a thickness of about around 50mm to 300mm and aptly is about around 75mm. The length and width of the elements 250 may be up to about around 1200mm.

[0071] As can be seen in Figure 2, at least one support region 245 of a support bracket 240 extends perpendicularly away from a base region 244 of the support bracket through a thermally insulating element 250. The support region 245 comprises a clip-like region 247 at an end of the support region 245. A cladding support member or rail 260 may be secured to the clip region 247 using one or more optional fixing elements (not shown) locatable through at least one respective through hole 249 of the clip-like region and through hole (not shown) of the support cladding support member 260. At least one cladding element 270 is secured to the cladding support member or rail 260 using at least one fixing element 271 such as a rivet. A plurality of cladding elements may be provided in a side by side relationship in this way to provide an externally visible outer surface of the portion 200 of the structure. That is to say that a person standing at the outer region 204 of the structure would be able to view an outer surface of the cladding elements 270 when looking at the structure. Between an inside-facing surface of the cladding elements 270 and an outside-facing surface of the thermally insulating elements 250 there is provided a gap 272 which may be filled with air for ventilation, further thermally insulating elements or the like.

[0072] During a fire test, a thermocouple 290 may be attached in proximity to the support bracket 240 to measure a temperature variation in a region of the support bracket. The thermocouple 290 may correspond to thermocouple TC25, TC27 or TC28 as discussed below. Example temperatures measured from thermocouple 290 during a fire test are shown in Figure 13. A further thermocouple 295 may be provided on a backside of a panel-like element 220 during a fire test in a region directly behind a support bracket 240. The thermocouple 295 may correspond to thermocouple TC13-18 or TC20-21 as discussed below. Example temperatures measured from thermocouple 295 during a fire test are shown in Figure 14.

[0073] Figure 3 shows a spacer body 300 in more detail. The spacer body 300 illustrated in Figure 3 has a uniform thickness and has a first abutment surface 310 and a further abutment surface 320 arranged in a substantially parallel relationship and spaced apart by a predetermined distance. The abutment surfaces 310, 320 abut against an adjacent surface of a panel-like element or a support bracket in use. The first abutment surface 310 may be located against the major surface 225 of the panel-like element 220 and the further abutment surface

320 may be located against a base surface 242 of the support bracket 240. The first abutment surface 310 may be substantially parallel to the major surface 225 and the further abutment surface 320 may be substantially parallel to the base surface 242 of the support bracket 240. The first 310 and/or the further abutment surface 320 may have a surface area of less than 400cm² and/or less than 200cm² and/or less than 150cm² and/or is in a range of about around 20cm² to 120cm². The predetermined distance between the first 310 and further abutment surface 320 may be about around 1mm to 30mm, and optionally about around 3mm to 25mm.

[0074] As illustrated in Figure 3, the surface area of both abutment surfaces 310, 320 is substantially equal such that a peripheral edge region 330 of the spacer body 300 extends between the first 310 and further abutment surface 320 in a direction substantially perpendicular to the first and/or further abutment surface. However the person skilled in the art will appreciate that according to certain embodiments of the invention the surface area of the first abutment surface 310 may be greater than the surface area of the further abutment surface 320 or the surface area of the further abutment surface may be greater than the surface area of the first abutment surface. The peripheral edge region 330 of the spacer body thereby extends between the first and further abutment surface in a direction that is non-perpendicular to the first and/or further abutment surface. Furthermore, the abutment surfaces 310, 320 of the spacer body 300 shown in Figure 3 are both substantially rectangular. However, it will be appreciated that according to certain embodiments of the present invention at least one of the abutment surfaces 310, 320 may be substantially rectangular or substantially elliptical or substantially O-shaped or substantially I-shaped or substantially T-shaped.

[0075] The spacer body 300 illustrated in Figure 3 also comprises one or more through holes 340 and/or partial through holes for aligning the spacer body and/or receiving a fixing element 231 that secures the support bracket 240 to the panel like-elements 220 and/or the underlying framework 210. That is to say that the through holes 340 do not need to extend all the way through the thickness of the spacer body 300 and may simply provide a recessed region which guides a fixing element 231 into the partial through hole. Using a tool to fix the fixing element to the panel-like element 220 and/or the underlying framework 210 then causes the fixing element 231 to penetrate through to the surface of the spacer body 300 beneath the partial through hole.

[0076] As illustrated in Figure 3, the spacer body 300 has a substantially flat further abutment surface 320 and the spacer body is cuboid-shaped. However, according to certain embodiments of the present invention the further abutment surface 320 may at least partially be surrounded by a lip region (not shown). This results in the further abutment surface 320 acting as a recessed region which can receive the support bracket 240 and can prevent lateral movement of the support bracket 240 once

the support bracket is positioned in the recessed region. Optionally, the lip region projects from the peripheral edge region 330 and extends beyond the further abutment surface 320 to thereby provide a recessed region defined by the lip region (not shown) and the further abutment surface 320. Optionally, the lip region may be integrally formed with the spacer body or may be provided as a separate part that is attached to the spacer body.

[0077] According to certain embodiments of the present invention, the further abutment surface 320 may include at least one recess (not shown) and/or at least one projection (not shown) to mate with a respective projection and/or recess of the support bracket 240. This can help to ease alignment of the support bracket 240 to the spacer body 300. In other words, the through holes 340 may provide a rudimentary guide to align the spacer body 300 and the support bracket 240 and the respective projections and recesses may provide a further guide which can provide more accurate alignment.

[0078] The spacer body 300 illustrated in Figure 3 may be manufactured from at least one material that is non-combustible and thermally insulating. The term non-combustible material is used throughout this specification and is taken to mean a substance that, under expected conditions, when subjected to fire or heat, does not support combustion or a substance that only supports combustion for a short period of time (on the order of seconds, e.g. less than 20 seconds). Optionally, not supporting combustion may mean that a non-combustible material does not ignite and/or burn. Optionally, not supporting combustion may mean that a non-combustible material does not release flammable vapours. A non-combustible material should be classified as a class A1 or class A2 material according to BS EN 13501-1. The term thermally insulating material is also used throughout this specification and is taken to mean a substance that, when placed between objects in thermal contact or in range of radiative influence, can substantially reduce heat transfer (i.e. the transfer of thermal energy between the objects having differing temperature) between the objects. A thermally insulating material should have a thermal conductivity at least less than 3 W/mK.

[0079] According to certain embodiments of the present invention, the spacer body 300 may be manufactured from a material or materials that are classified as class A1 or class A2 materials according to BS EN 13501-1. Exemplary materials that may be used for the spacer body 300 are gypsum, gypsum concrete, fibre cement, calcium silicate, calcium silicate cement, cement particles, magnesium oxide, diatomaceous silica, perlite or pumice. Aptly the spacer body 300 is manufactured from calcium silicate cement. The spacer body 300 may be manufactured from a single material such as one of the materials listed above or alternatively may be manufactured from a homogenous or inhomogeneous mixture of a plurality of materials such as a plurality of the materials listed above. As will be appreciated by a person skilled in the art, the spacer body 300 shown in Figure 3

may be manufactured according to a manufacturing process that can be used to produce boards of material such as boards of fibre cement. Such boards are typically manufactured by processing a number of raw materials (e.g. sand, cellulose fibres, binders) into at least one sheet and curing these sheets in an autoclave to help the materials crystallise and give the fibre cement boards their strength. These boards may then be cut down according to conventional techniques to produce a spacer body.

[0080] According to BS EN 13501-1, a class A1 should satisfy the following criteria responsive to being exposed to a test fire which has a predefined temperature variation (shown in more detail in Figure 11) and over a predetermined time. Responsive to such a test fire, a temperature increase of a surface of the A1 material should be less than about around 30°C, a mass loss of the A1 material should be less than about around 50% of an original mass of the A1 material before being exposed to the fire, and no flames should be present on a surface of the A1 material during the test. Additionally, a gross heat of combustion (PCS) (i.e. a heat of combustion of a substance when the combustion is complete and any produced water is entirely condensed under specified conditions) of the A1 material should be less than about around 2 MJ/m² or 2 MJ/kg.

[0081] According to BS EN 13501-1, a class A2 should satisfy the following criteria responsive to being exposed to a test fire which has a predefined temperature variation (shown in more detail in Figure 11) and over a predetermined time. Responsive to such a test fire, a temperature increase of a surface of the A2 material should be less than about around 50°C, a mass loss of the A2 material should be less than about around 50% of an original mass of the A2 material before being exposed to the fire, and a duration of time in which flames are continuously present on a surface of the A2 material should be less than about around 20 seconds. Additionally, a gross heat of combustion (PCS) of the A2 material should be less than about around 4 MJ/m² or 3 MJ/kg.

[0082] In addition, during a fire test certain class A1 and A2 materials should have a Fire Growth Rate Index (FIGRA) of less than about around 20 W/s, a lateral flame spread (LFS) that does not extend to an edge of an A1/A2 material-based specimen and a Total Heat Release in 600s (THR_{600s}) of less than about around 7.5 MJ. Furthermore, during a fire test certain A1/A2 materials should also have a smoke growth rate (SMOGR) of less than about around 30m²/s², a total smoke production with 600s (TSP_{600s}) of less than about around 50 m³ and no flaming droplets and/or particles should be present within 600 s of the start of the test. From the above discussion, the skilled person will appreciate that the spacer body 300 is manufactured from a material or materials that is/are unmeltable during a fire test according to BS EN 1363-1, 1363-2 and 1363-3.

[0083] According to certain embodiments of the presently claimed invention, the thermal conductivity of the material or materials used to manufacture the spacer

body 300 is less than about around 0.5 W/mK. Optionally, the thermal conductivity of the material(s) is less than about around 0.2 W/mK and/or optionally less than about around 0.15 W/mK and/or optionally less than about around 0.05W/mK.

[0084] A density of the spacer body 300 manufactured from one or more non-combustible and thermally insulating materials is about around 500 kg/m³ to 2500 kg/m³ and aptly is about around 1250 kg/m³.

[0085] Figure 4A illustrates a side view of a support bracket 400 (which may be known in the art as a helping hand bracket) and as illustrated in Figure 4A the support bracket 400 is substantially L-shaped. However, according to certain embodiments of the present invention the support bracket may be substantially U-shaped or substantially box-shaped. The side view of the support bracket 400 illustrates a base region 410 with a base surface 420 (shown in Figure 4C) that may be located against the further abutment surface 320 when included as a component of a portion of a structure. Figure 4B shows a front view of the support bracket 400. As can be seen in Figure 4B, the support bracket 400 comprises a support region 430 that extends substantially perpendicularly away from a surface of the base region 410 that is opposite the base surface 420. The support region 430 is substantially flat and comprises at least one slit 432 that extends from an end 435 of the support region 430 opposite the base region 410 toward the base region 410. At least one curved arm member 440 may be connected to a first end 442 of one or more of the slits 432 of the support region 430 to provide an arch-like region extending between a first end 442 and a further end 444 of the slit(s) 432. The end of the support region 435 and a respective arm member 440 each provide a clip-like region 450 that may act as an interference fit when a cladding support member or rail is inserted into the clip-like region 430. That is to say that the curved arm member 440 exerts a force towards part of the end of the support region 435 when a cladding support member is inserted into the clip region 450. At least one through hole may be provided on the support region 430 to receive at least one fixing element which helps secure a cladding support member or rail to the support bracket 400. Furthermore, at least one through hole may also be provided on the base region 410 to receive at least one fixing element that secures the support bracket 400 (and a spacer body) to the panel-like element or elements 220. The support bracket 400 may be manufactured from a metal such as aluminium, steel or the like. A height of the support bracket 400 from the base surface 420 to the end 435 of the support region 430 may be about around 50mm to 350mm and aptly is about around 115mm. A length (L) of the support bracket may be about around 30mm to 350mm and aptly may be about around 90mm or 175mm. A width (W) of the support bracket may be about around 30mm to 120mm and aptly may be about around 65mm. The slits may have a width of approximately 10mm and a length of approximately 75mm.

[0086] Figures 5-9 illustrate the various stages of building an exemplary test structure. It will be appreciated by a person skilled in the art that a test structure manufactured according to Figures 5-9 tries to replicate the conditions that are present in a portion of an actual structure in the event of a fire.

[0087] Turning to Figure 5, an open test frame 500 is illustrated in which an underlying test framework 505 has been installed. The underlying test framework 505 includes a plurality of upright elongate beam elements 510 and a plurality of horizontal elongate beam elements 520. The horizontal beam elements 520 shown in Figure 5 (head and base tracks) are secured to a top and bottom of the test frame. The horizontal beam elements 520 may also be secured to the upright beam elements 510. One of the upright beam elements 510 (vertical studs) may be secured to the test frame at a fixed edge 530 whereas at a free edge 540 of the test frame there is provided approximately 30mm of ceramic fibre insulation to allow some movement of the framework during the fire test. The height and width of the test frame 500 have dimensions that match the size of an open mouth of a furnace which provides the fire test temperature conditions. A predetermined force may also be applied in a downwards direction to a top of the frame to simulate the loading that a portion of a structure experiences in use.

[0088] Figure 6 shows the test frame of Figure 5 including a plurality of sheathing boards 610₁...610₆ that have been disposed over the underlying test framework 505 of Figure 5 to cover the framework. As is illustrated in Figure 6, the sheathing boards 610 are arranged in a side by side relationship. Each sheathing board is secured to part of the underlying test framework 505 with at least one fixing element (not shown). Optionally, a membrane 620 may be used to cover a surface of the sheathing boards opposite to a surface located against the underlying test framework 505. The membrane may be secured to the surface of the sheathing boards 610 using an adhesive and/or one or more fixing elements. On an opposite side of the test framework 505 to the sheathing boards 610, one or two layers of plasterboard (not shown) are secured to the test framework 505 with at least one fixing element.

[0089] Figure 7 shows the locations where support brackets 710, 720 and cavity barrier fixings 730 are secured to the sheathing boards 610 shown in Figure 6. The support brackets 710, 720 are located at positions corresponding to one of the upright beam elements 510 of the underlying test frame 505. Each support bracket 710, 720 has a respective spacer body (not shown) located between the support bracket 710, 720 and the sheathing boards 610. Additionally, Figure 7 illustrates a first set of thermocouples 740 (TCs 1-5) that are used to measure an average temperature rise of the test structure. A second set of thermocouples 750 (TCs 6-12) are also illustrated in Figure 7 which measure a maximum temperature rise of the test structure. The first and second set of thermocouples 740, 750 are located between

the first and second layer of plasterboards (not shown) to measure the temperature that an interior region of a structure may reach during a fire. Additional thermocouples (TCs 13-28) may also be located in proximity to the support brackets 710, 720 or the cavity barrier fixings 730 to measure a specific temperature rise in these regions (see Figure 2). It will be appreciated that each support bracket 710, 720 (with a spacer body) and each cavity barrier fixing 730 may be secured to the sheathing boards 610 using at least one fixing element. These fixing elements may extend through the sheathing boards 610 and be secured to the underlying test framework 505.

[0090] Figure 8 illustrates the locations where thermally insulating elements 810 such as rockwool slabs or rain-screen insulation are secured to the sheathing boards 610 over the support brackets 710, 720 shown in Figure 7. It will be appreciated by the skilled person that other materials may be used instead of rockwool slabs/rain-screen insulation such as other thermally insulating materials or homogeneous/inhomogeneous mixtures of thermally insulating materials. Each thermally insulating element 810 does not have to be manufactured from the same material or mixture of materials. A support region of the support brackets 710, 720 extends through and out of the rockwool slabs 810 to allow further elements to be secured to the support brackets 710, 720. This is also shown in Figure 2. The rockwool slabs 810 are secured to the sheathing boards 610 whilst leaving gaps to allow the cavity barrier fixings 730 to remain exposed. This is to help accommodate cavity barriers to be fixed to the test structure as described below. The rockwool slabs 810 are secured to the sheathing boards 610 using at least one metal fixing element 820 and/or at least one plastic fixing element 830. Each fixing element 820, 830 may have an associated pressure plated to help hold the rockwool slabs securely against the sheathing boards 610.

[0091] Figure 9 illustrates installation of one or more vertical cavity barriers 910 and one or more horizontal cavity barriers 920. Cavity barriers may also be known as fire breaks. The cavity barriers 910, 920 are secured to the cavity barrier fixings 730 shown in Figure 7 by forcing the cavity barriers 910, 920 over the fixings 730 such that the fixings pierce the material comprising the cavity barriers 910, 920. The cavity barriers 910, 920 may be manufactured from rockwool slabs. Alternatively, the cavity barriers 910, 920 may be manufactured from a different material or a homogeneous/inhomogeneous mixture of thermally insulating materials. Furthermore, each cavity barrier 910, 920 does not have to be manufactured from the same material or mixture of materials. The cavity barriers have a thickness that is greater than the thickness of the surrounding rockwool slabs 810. Optionally the thickness of the cavity barriers may be about around 75mm to 300mm. The difference in thicknesses between the cavity barriers 910, 920 and the rockwool slabs 810 results in stepped up and stepped down regions across the surface of the test structure exposed to

the furnace during the test which can help to prevent a fire from spreading easily across the surface of the test structure. Such a construction will be readily appreciated by a person skilled in the art. The cavity barriers 910, 920 may also include a reflective or intumescent coating (not shown) on its furnace-facing surface so that thermal radiation may be reflected during the fire test. Optionally, cladding support rails and cladding panels may be added to the test structure. However, these optional elements tend to quickly fall away after starting the fire test and therefore they effectively make no difference to the test structures fire resistance.

[0092] Figure 10 illustrates a cladding support member 1010 or rail that may be secured to a support bracket. The cladding support member 1010 has a central body portion 1020 and a first wing portion 1030 and further wing portion 1040 that extend in opposing directions substantially perpendicularly away from the central body portion 1010. The central body portion 1020 may be provided into a clip-like region of the support bracket before being secured thereto with one or more fixing elements. At least one cladding panel 1050 may be secured to the cladding support rail 1010 using at least one fixing element such as a rivet 1070.

[0093] Figure 11 illustrates the temperature versus time curve measured during a test fire applied to a test structure as described above in Figures 5 to 9 according to BS EN 1363-1. The predetermined temperature variation of a test fire should follow the equation:

$$T = 345 \log_{10}(8t + 1) + 20$$

where T is the average furnace temperature in degrees Celsius and t is the time in minutes.

[0094] As is illustrated in Figure 11, a number of channels corresponding to different thermocouples within the furnace are used to measure the temperature inside the furnace. The fire test typically continues for a predetermined period of time such as 30 minutes, 60 minutes, or 90 minutes or 120 minutes. However, depending on the specific circumstances of a fire test, the predetermined time period may be any number of minutes between 0 and 300 minutes. Alternatively, the period of time of the test may not be predetermined and the test may be stopped on an ad-hoc basis if for example a part of the test structure fails. As illustrated in Figure 11, the temperature of the furnace during the fire test on the test structure constructed according to Figures 5 to 9 follows the logarithmic temperature time relationship within tolerance for a time of about around 120 minutes.

[0095] Figure 12 illustrates an average temperature variation of the thermocouples located at positions 1-5 (see Figure 7) which are between the two plasterboard layers on the side of the framework unexposed to the test fire. As is illustrated in Figure 12, the maximum temperature rise is well below the accepted limit. If one of

these thermocouples measures a temperature exceeding the maximum allowable limit then the test structure fails the test.

[0096] Figure 13 illustrates a temperature variation of the thermocouples located at positions 25, 27 and 28 shown in Figure 7 during a fire test. The positions of these thermocouples are in proximity to the support bracket and their position during a fire test can be viewed in more detail in Figure 2. The lines corresponding to thermocouples 25 and 28 show measurements of a temperature variation in proximity of a support bracket that is seated on an island-like spacer body manufactured from a material that is non-combustible and thermally insulating. The lines corresponding to thermocouple 27 shows measurements of a temperature variation in proximity of a support bracket that is seated on a conventional plastic packer. As can be seen in Figure 13, the thermocouple associated with the plastic packer generally exhibits a lower rise in temperature than the thermocouples associated with the non-combustible spacer bodies (Y-wall in Figure 13) in the early stages of a fire test (e.g. when less than 70 minutes has elapsed). This is because plastic materials typically have a slightly lower thermal conductivity than materials that are both thermally insulating and non-combustible. That being said, it has been observed that in some instances the rise in temperature in the early stages of a fire test are similar for thermocouples associated with both the plastic packers and the non-combustible spacer bodies (thus demonstrating that the non-combustible spacer bodies are also sufficiently thermally insulating). As the test progresses however, the plastic packers melt leaving little to no material to thermally insulate the associated thermocouple resulting in the temperature measured by this thermocouple beginning to rise more rapidly. By contrast, the non-combustible spacer bodies remain present throughout the fire test (as they do not melt) which results in the associated thermocouples exhibiting a much lower rise in temperature at the latter stages of the test (e.g. above 70 minutes) compared with a thermocouple associated with a plastic packer. It is expected that the temperature measured by the thermocouples associated with the non-combustible spacer bodies begins to reach a plateau due to the thermal transmittance capacity of the non-combustible spacer bodies. As such, not only do the non-combustible spacer bodies help to maintain integrity of a portion of a structure during a fire but they can also, compared to plastic packers, help to reduce the total temperature increase of part of a portion of a structure (e.g. a sheathing board) over a predefined period of time (e.g. 120 minutes). In other words, the non-combustible spacer bodies help to slow a rate of temperature increase of part of a portion of a structure (e.g. a face of a sheathing board) during a fire.

[0097] Figure 14 illustrates a temperature variation of thermocouples 13-18 and 20-21 shown in Figure 7. The positions of these thermocouples are on the underlying framework in a region located directly behind the support bracket as can be viewed in more detail in Figure 2. As

will be apparent to a skilled person from Figures 13 and 14, the temperature in proximity to a support bracket can rise to a temperature between 400-600°C. At such temperatures, the plastic packers will melt leaving the support brackets loose for the remainder of the fire test. Indeed conventional plastics used as packers typically melt at around 100-300°C corresponding to a time of approximately 10-40 minutes. By contrast, a spacer body manufactured from at least one material that is non-combustible and thermally insulating can withstand temperatures of well over 100°C such as temperatures of 400-600°C and the spacer body thus helps to ensure that the support brackets remain rigidly secured to the sheathing boards in the event of a fire.

[0098] Fire tests have been carried out according to BS EN 1364-1 and 1365-1 on test structures which include the components similar to those discussed in Figures 5 through 9. It has been found that the spacer bodies manufactured from a material which is non-combustible and thermally insulating were largely unaffected by the fire test. As a consequence, the remnants of each support bracket (i.e. what was left after the fire test) remained fixed back to the panel-like elements (with a respective spacer body) after the fire test thereby helping to clamp the panel-like elements in place. The panel-like elements were therefore more securely held in place against the underlying framework (opposed to when plastic packers are used) which helped to maintain the integrity of the test structure. That is to say that whilst some panel-like elements may still crack during a fire test (this is largely unpreventable when using metal support brackets due to heat transfer), it is much less likely when using non-combustible spacer bodies that the panel-like elements themselves fall away from the rest of the test structure (opposed to when plastic packers are used which melt and as such there is no clamping effect). As a result, the spacer body helps to maintain integrity of the test structure and thereby the intended fire resistance of the test structure.

[0099] According to certain embodiments of the present invention, a method of manufacturing a portion of a structure is provided. The method may include the steps of providing an underlying framework for the portion of the structure, providing one or more panel-like elements to cover a side of the underlying framework and securing a support bracket and a respective spacer body, manufactured from one or more materials that are non-combustible and thermally insulating, to the panel-like element. The spacer body thereby provides an island-like stand off region between a major surface of the panel-like element and a base surface of the support bracket.

[0100] The method may further include the step of securing the spacer body to the panel-like element and subsequently securing the support bracket to the spacer body. Alternatively, the method may include securing the support bracket and the spacer body to the panel-like element substantially simultaneously.

[0101] Optionally, the method further includes provid-

ing the underlying framework as a two sets of elongate beam elements. One set being upright and the other set being horizontal (i.e. substantially perpendicular to one another). The beams may be secured to one another.

5 The method may also include providing one or more board elements on an opposing side of the underlying framework. Optionally, the method may include securing the panel-like element and/or the board element to the underlying framework with one or more fixing elements.

10 **[0102]** The method may further include providing the panel-like element as multiple panel-like elements arranged in a side by side relationship.

[0103] Optionally the method may include providing the support bracket as a substantially L-shaped, U-shaped or box-shaped bracket.

15 **[0104]** Optionally the method may further include securing the support bracket and the spacer body to the panel-like element by providing one or more fixing elements through respective though holes of the support bracket and the spacer body and securing the fixing elements to the panel-like element and/or the underlying framework.

[0105] Optionally a further method step may include providing a thermally insulating element over the spacer body and the support bracket. Aptly, the method may also include securing the thermally insulating element to the panel-like element with at least one fixing element. Aptly the thermally insulating element may be manufactured from at least one still further material. The still further material comprising at least one of mineral wool, fiberglass, cellulose, polyurethane foam, expanded polystyrene (EPS), extruded polystyrene (PIR), polyisocyanurate foam, phenolic foam, cement foam or the like.

25 **[0106]** Optionally the method may also include securing a cladding support member to a clip-like region at an end of a support region of the support bracket that extends perpendicularly away from a base region of the support bracket. Aptly the method may further include securing one or more cladding elements to the cladding support member.

30 **[0107]** 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.

35 **[0108]** Features, integers, characteristics 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 the features and/or steps are mutually exclusive. The invention is not restricted to any details of any foregoing embodiments. The invention extends to any novel one, or 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.

[0109] The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

Claims

1. Apparatus for spacing apart components of a portion of a structure, comprising:

at least one spacer body locatable between at least one panel-like element that covers at least one side of an underlying framework of a portion of a structure, and a support bracket of the portion, to provide an island-like stand off region between a major surface of the panel-like element and a base surface of the support bracket; wherein the spacer body is manufactured from at least one material that is non-combustible and thermally insulating.

2. The apparatus as claimed in claim 1, wherein the material is a class A1 or class A2 material in accordance with British Standard BS EN 13501-1.
3. The apparatus as claimed in claim 1 or 2, wherein the material is at least one of gypsum, gypsum concrete, fibre cement, calcium silicate, calcium silicate cement, cement particles, magnesium oxide, diatomaceous silica, perlite or pumice.
4. The apparatus as claimed in any preceding claim, wherein the spacer body is manufactured from a single material or a homogenous mixture of a plurality of materials.
5. The apparatus as claimed in any preceding claim, wherein responsive to at least one surface of the spacer body being exposed to a test fire with a predefined temperature variation for a predetermined time; the material provides a temperature increase of a surface of the spacer body less than about around 50°C and/or a mass loss of the spacer body less than about around 50% of an original mass of

the spacer body before being exposed to the fire and/or a duration of time in which flames are continuously present on a surface of the spacer body less than about around 20 seconds.

6. The apparatus as claimed in claim 5, wherein the material is unmeltable during the test fire.
7. The apparatus as claimed in any preceding claim, wherein the material has a thermal conductivity of less than about around 0.5 W/mK and/or less than about around 0.2 W/mK and/or less than about around 0.15 W/mK and/or less than about around 0.05W/mK.
8. The apparatus as claimed in any preceding claim, wherein the spacer body comprises a first abutment surface and a further abutment surface arranged in a substantially parallel relationship and spaced apart by a predetermined distance, the first abutment surface being locatable against the major surface of the panel-like element and the further abutment surface being locatable against the base surface of the support bracket.
9. The apparatus as claimed in claim 8, wherein the predetermined distance is about around 1mm to 30mm, and optionally about around 3mm to 25mm.
10. The apparatus as claimed in claim 8 or 9, wherein at least one of the first and further abutment surface has a surface area of less than 400cm² and/or less than 200cm² and/or less than 150cm² and/or is in a range of about around 20cm² to 120cm².
11. The apparatus as claimed in claim 10, wherein the surface area of the first and further abutment surface is substantially equal.
12. A method of manufacturing a portion of a structure, comprising the steps of:

providing at least one panel-like element to cover at least one side of an underlying framework of a portion of a structure; and securing a support bracket and at least one spacer body, manufactured from at least one material that is non-combustible and thermally insulating, to the panel-like element; whereby the spacer body provides an island-like stand off region between a major surface of the panel-like element and a base surface of the support bracket.
13. The method as claimed in claim 12, further comprising:

securing the spacer body to the panel-like element and subsequently securing the support bracket to

the spacer body.

- 14.** The method as claimed in claim 12, further comprising:

securing the support bracket and the spacer body to the panel-like element substantially simultaneously. 5

- 15.** A structure, comprising:

an underlying framework; 10
at least one panel-like element that covers at least one side of the underlying framework;
at least one support bracket; and
for each support bracket, a respective spacer body, manufactured from at least one material 15
that is non-combustible and thermally insulating, disposed between the panel-like element and the support bracket to provide an island-like stand off region between a major surface of the panel-like element and a base surface of the 20
support bracket. 20

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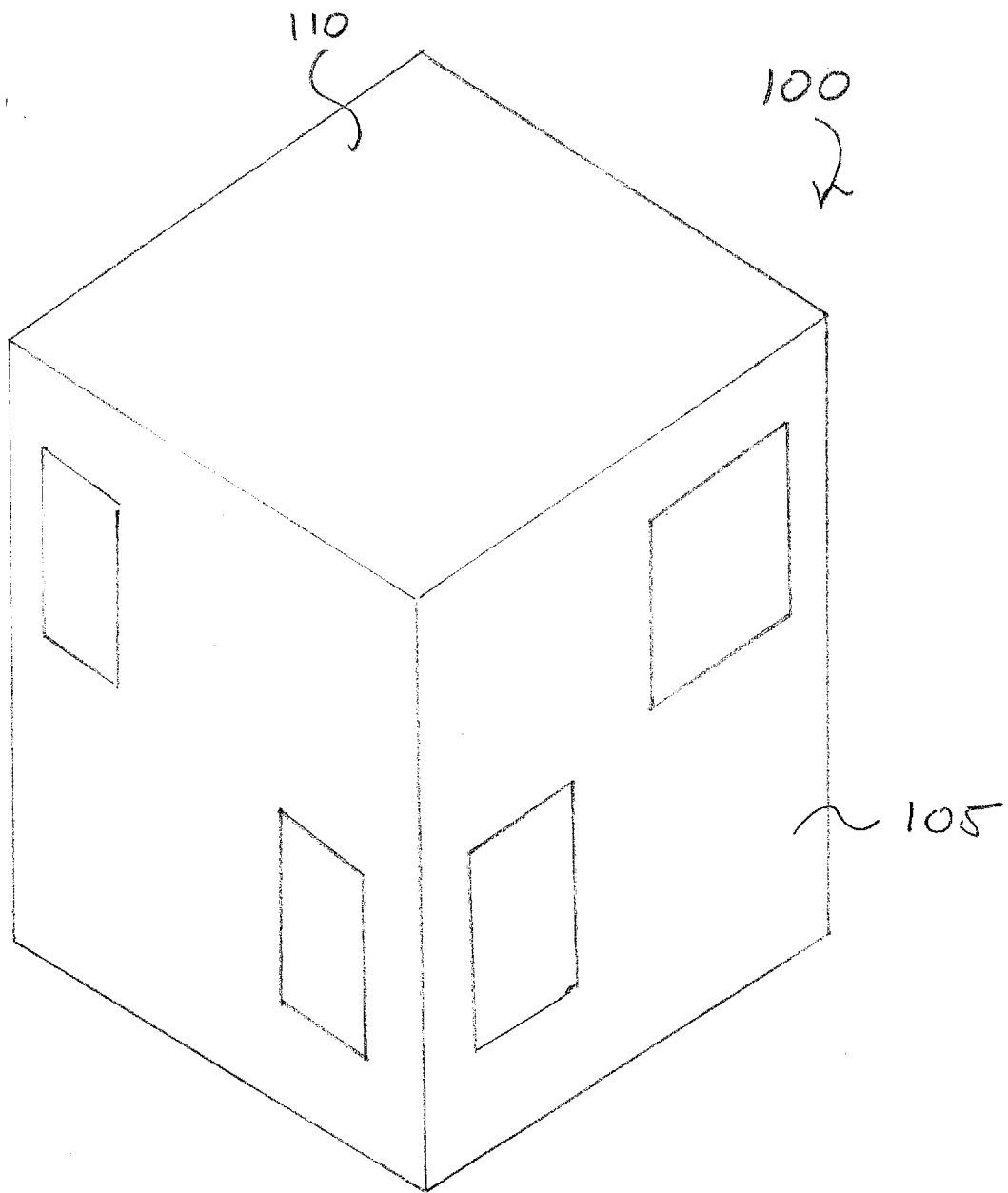
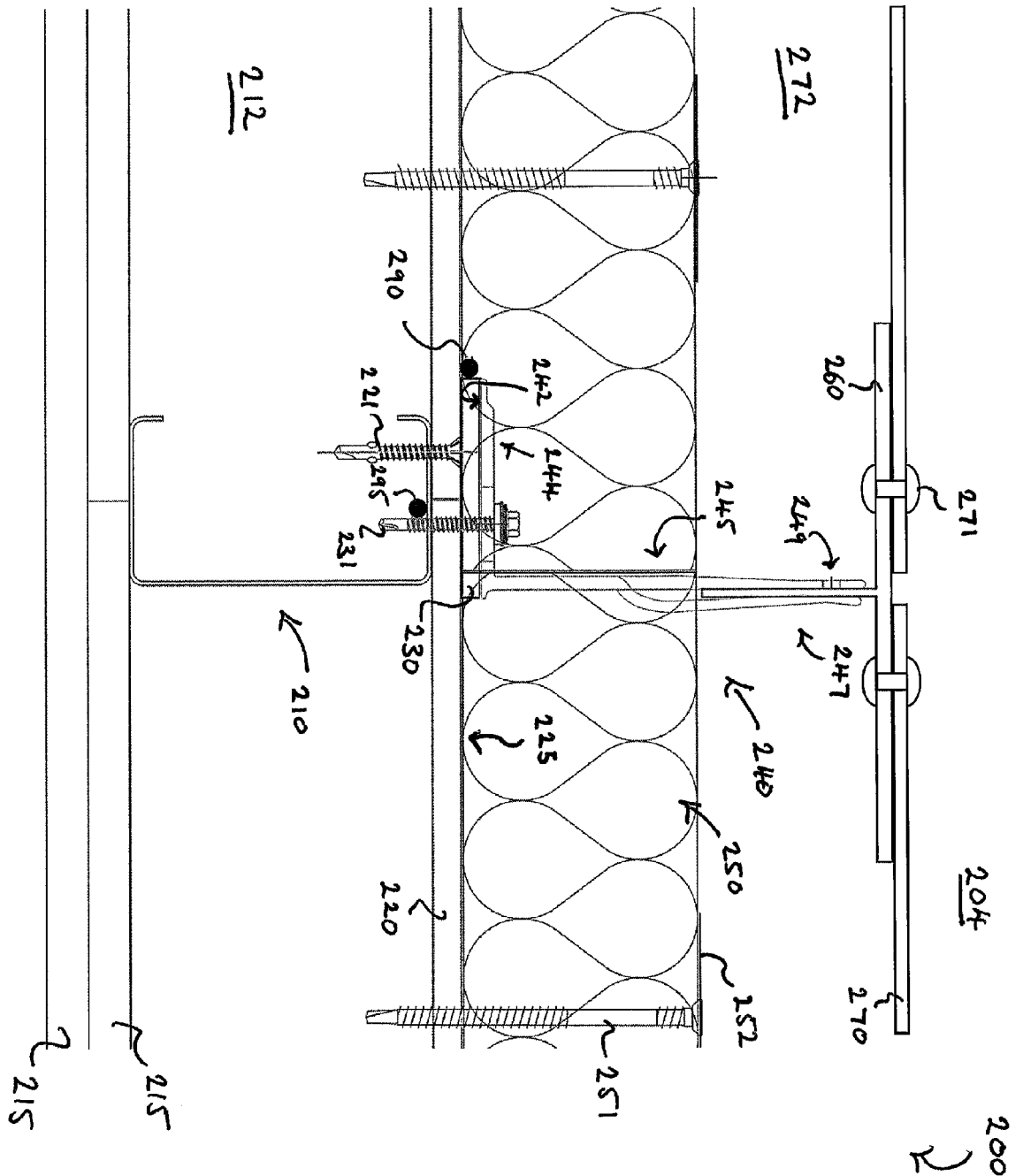
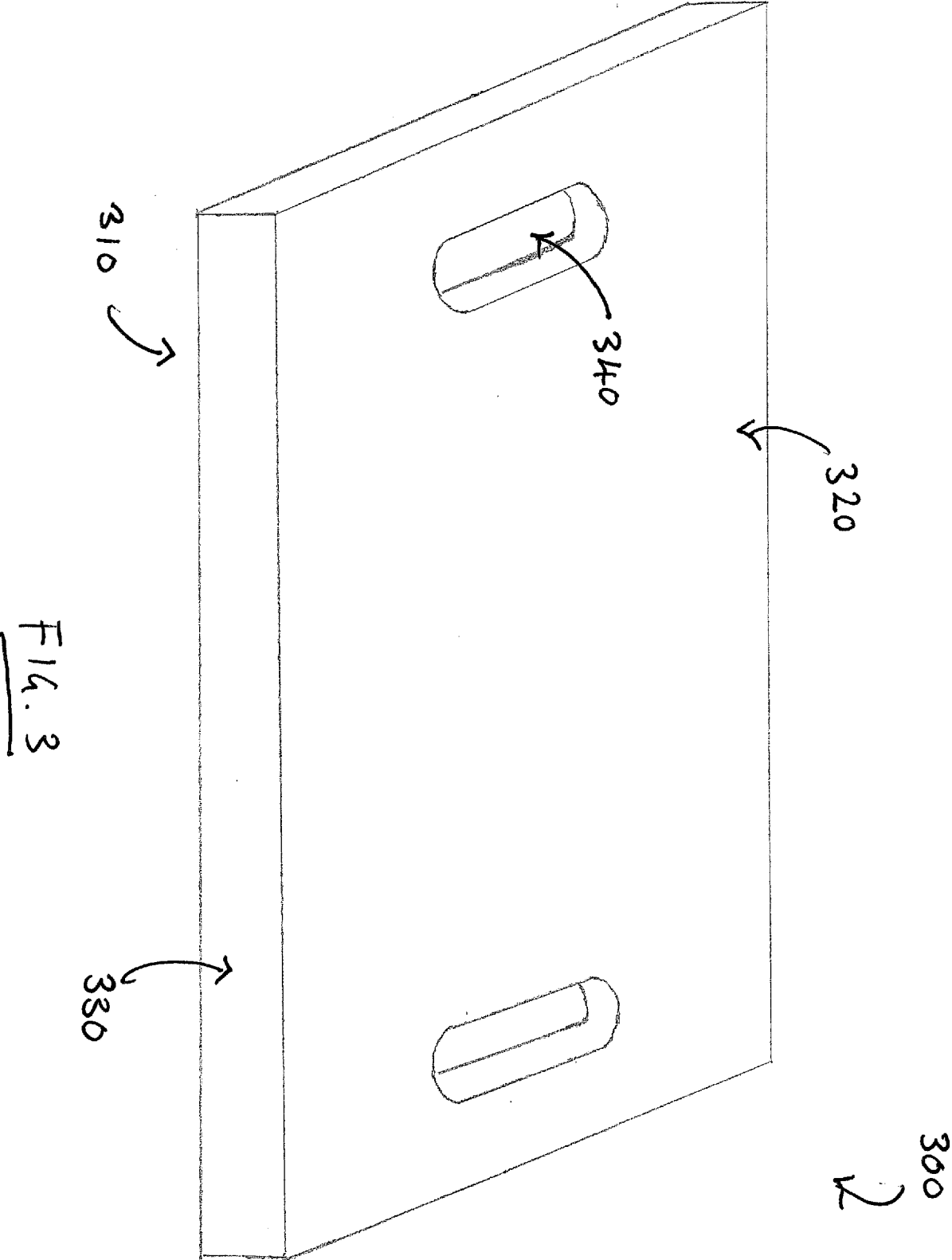


FIG. 1





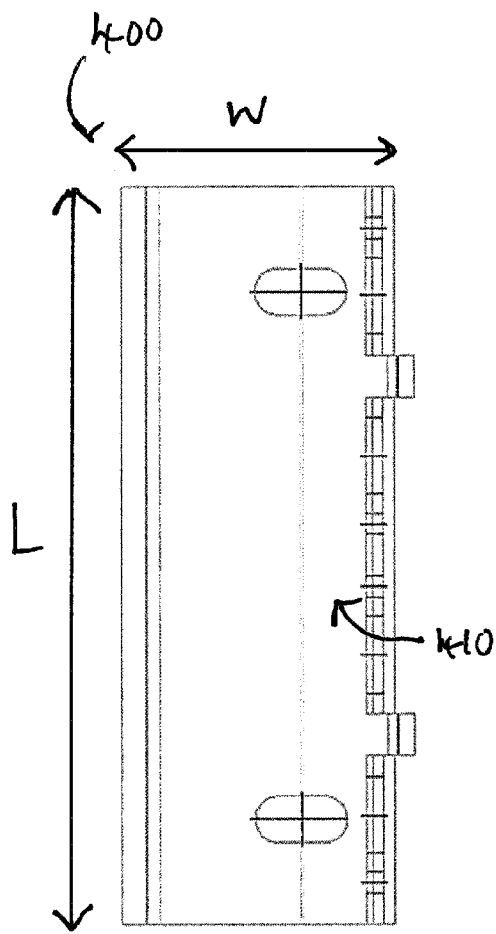


FIG. 4A

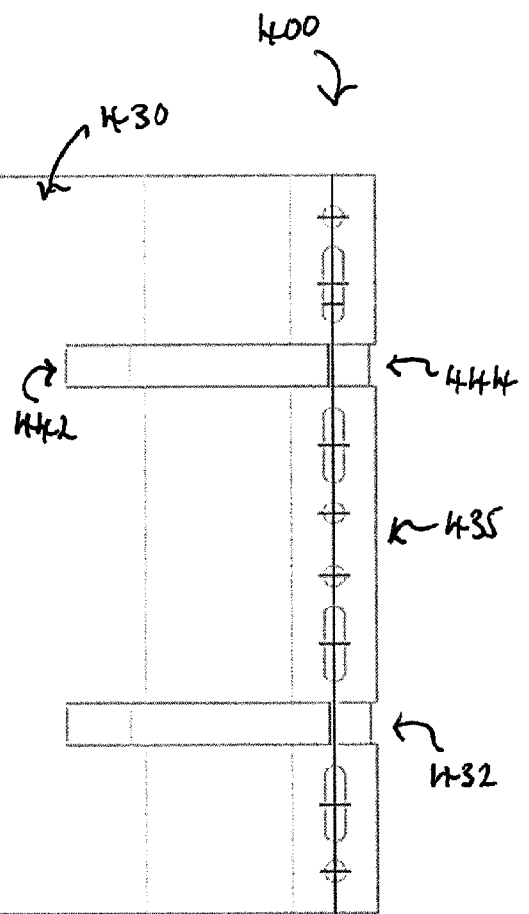


FIG. 4B

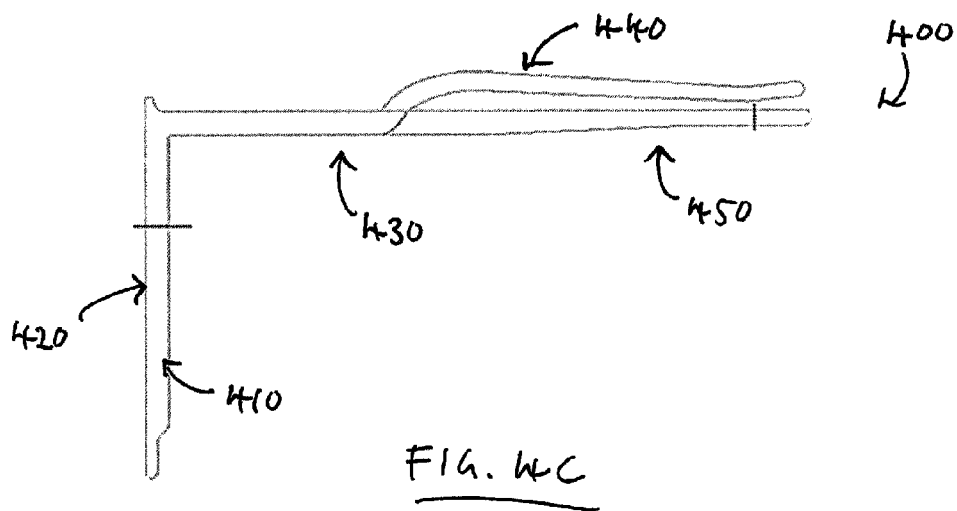


FIG. 4C

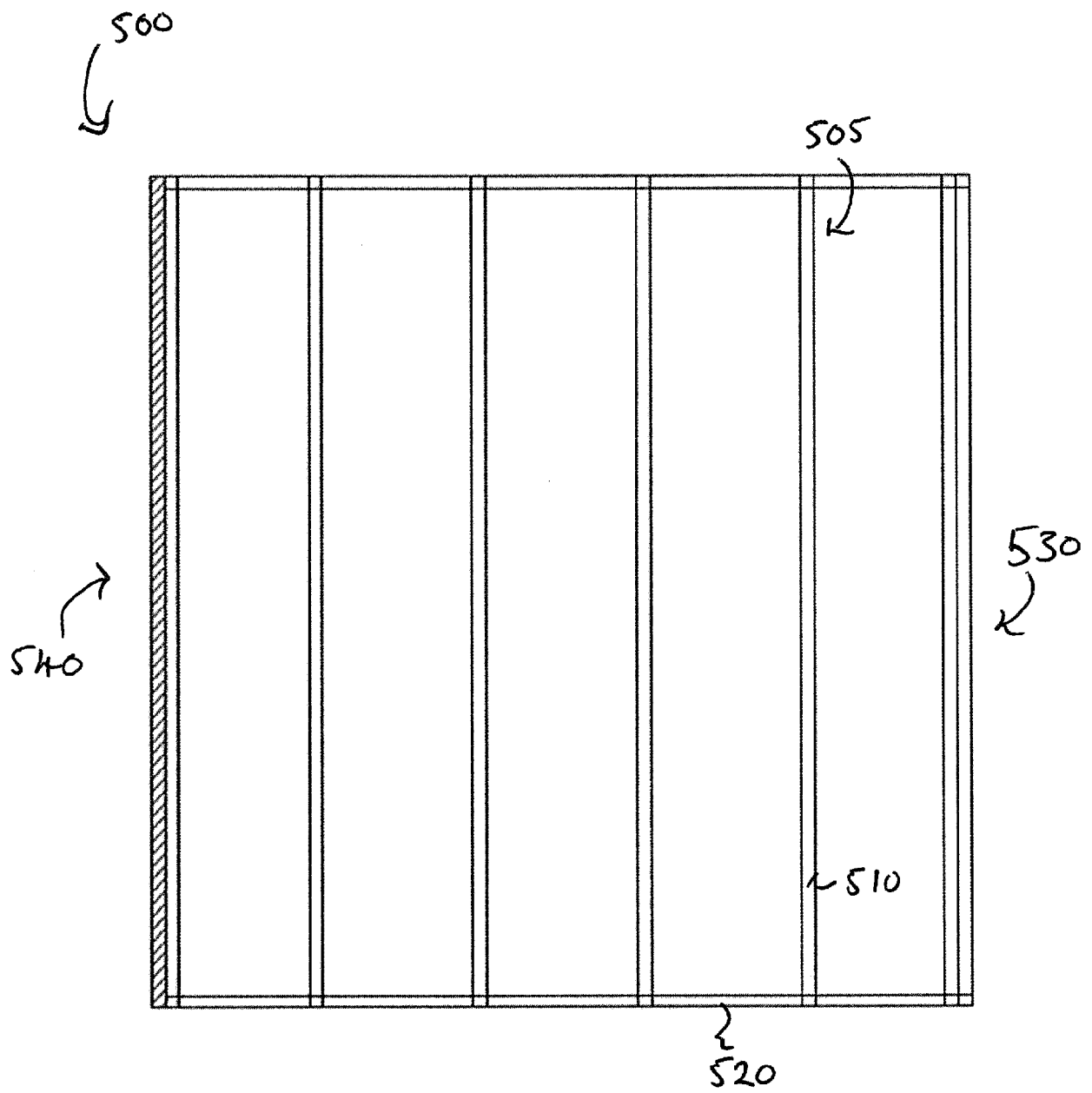


FIG. 5

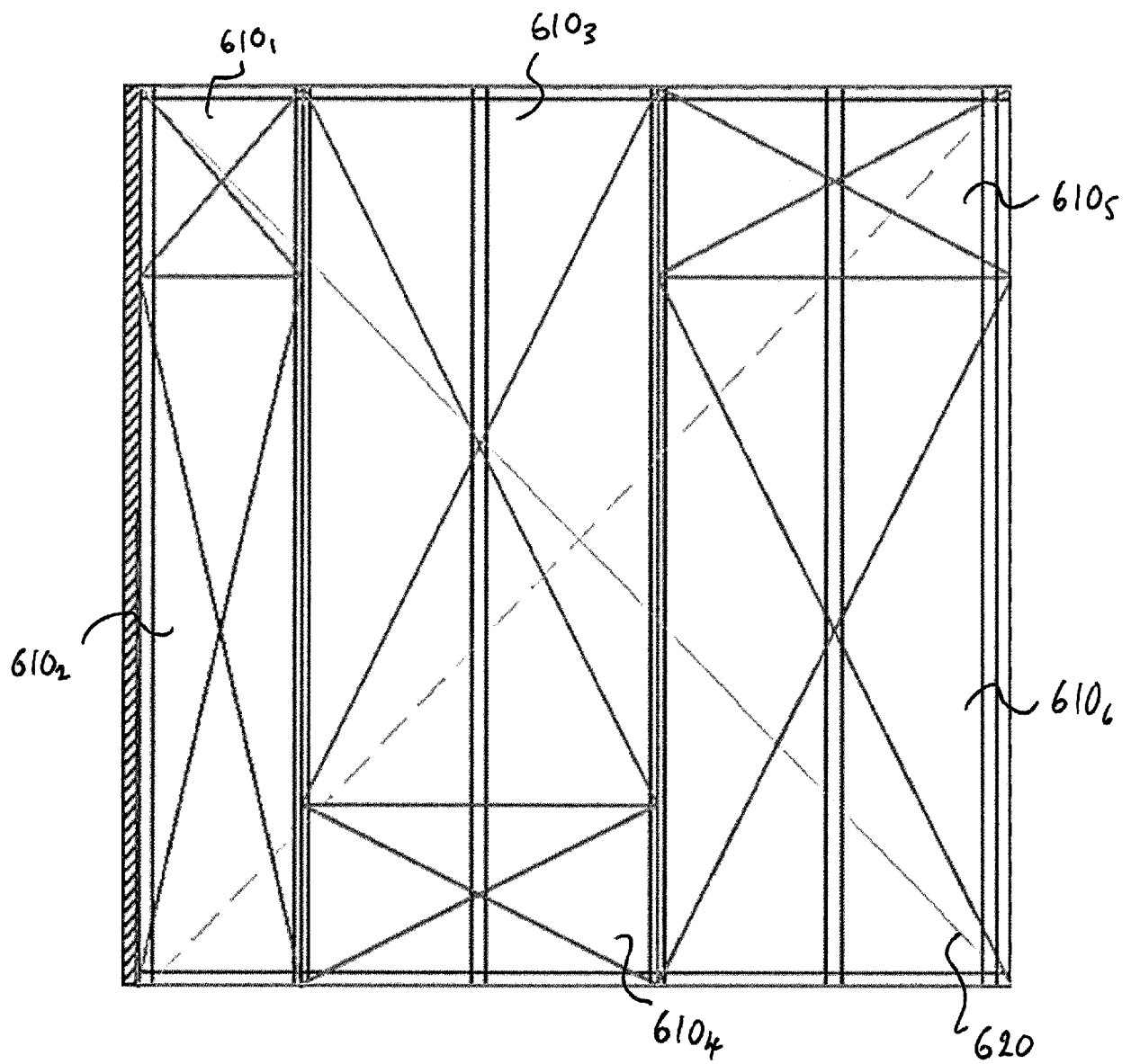


FIG. 6

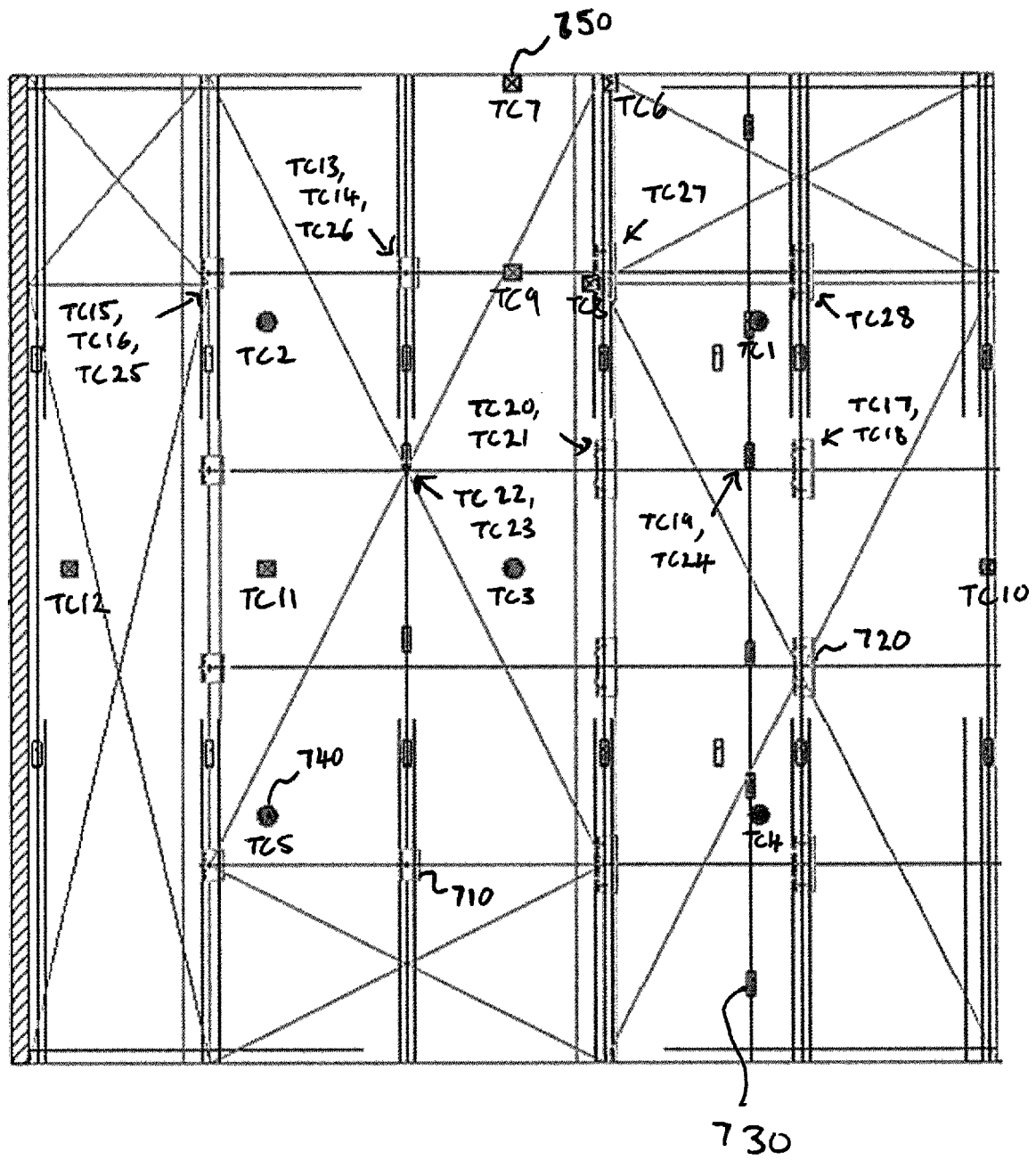


FIG. 7

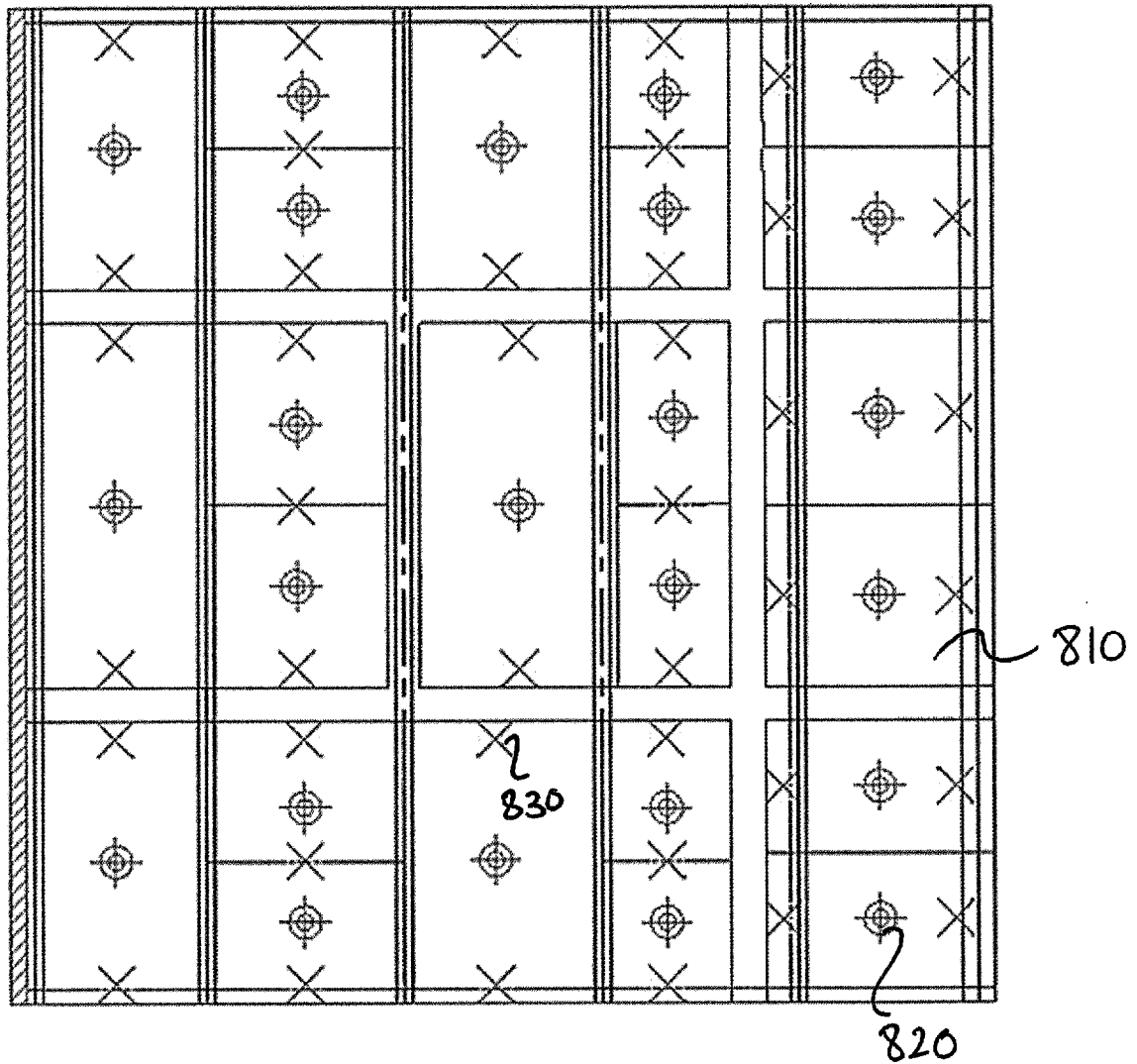


FIG. 8

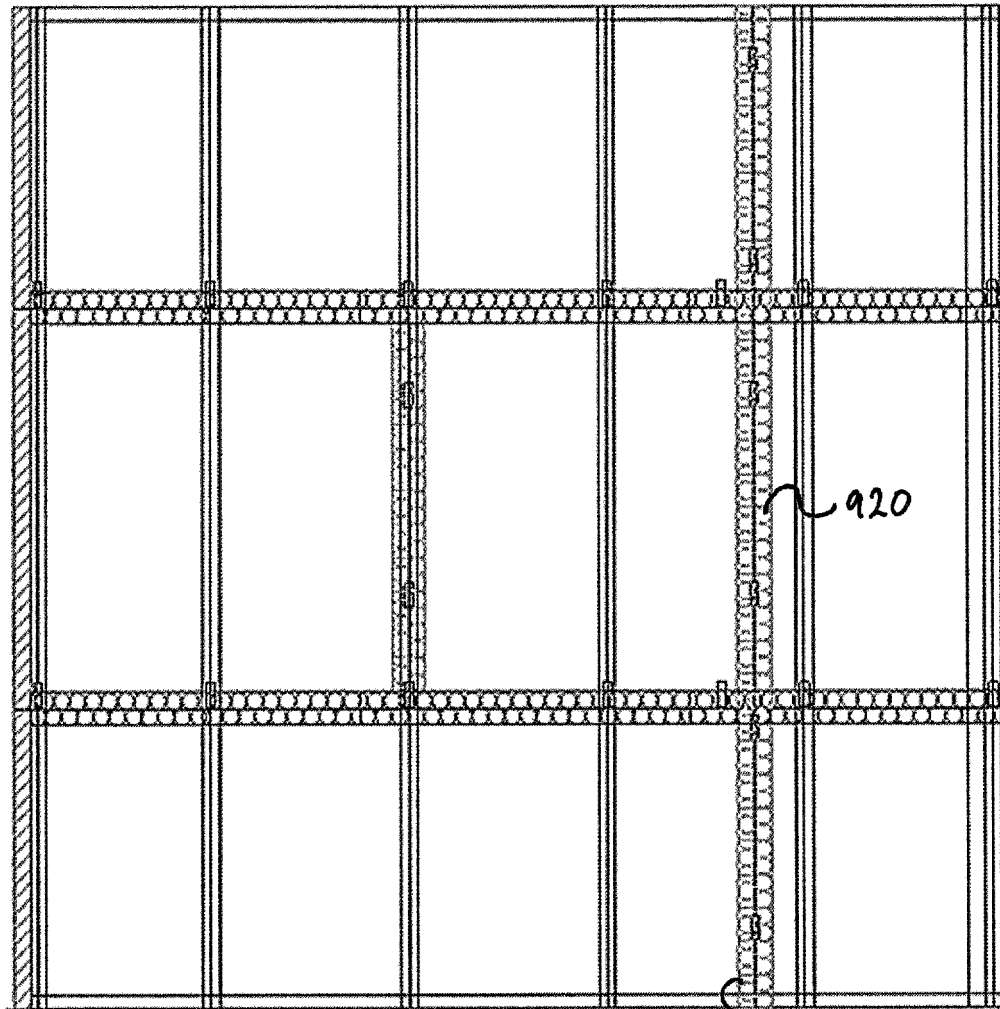


FIG. 9

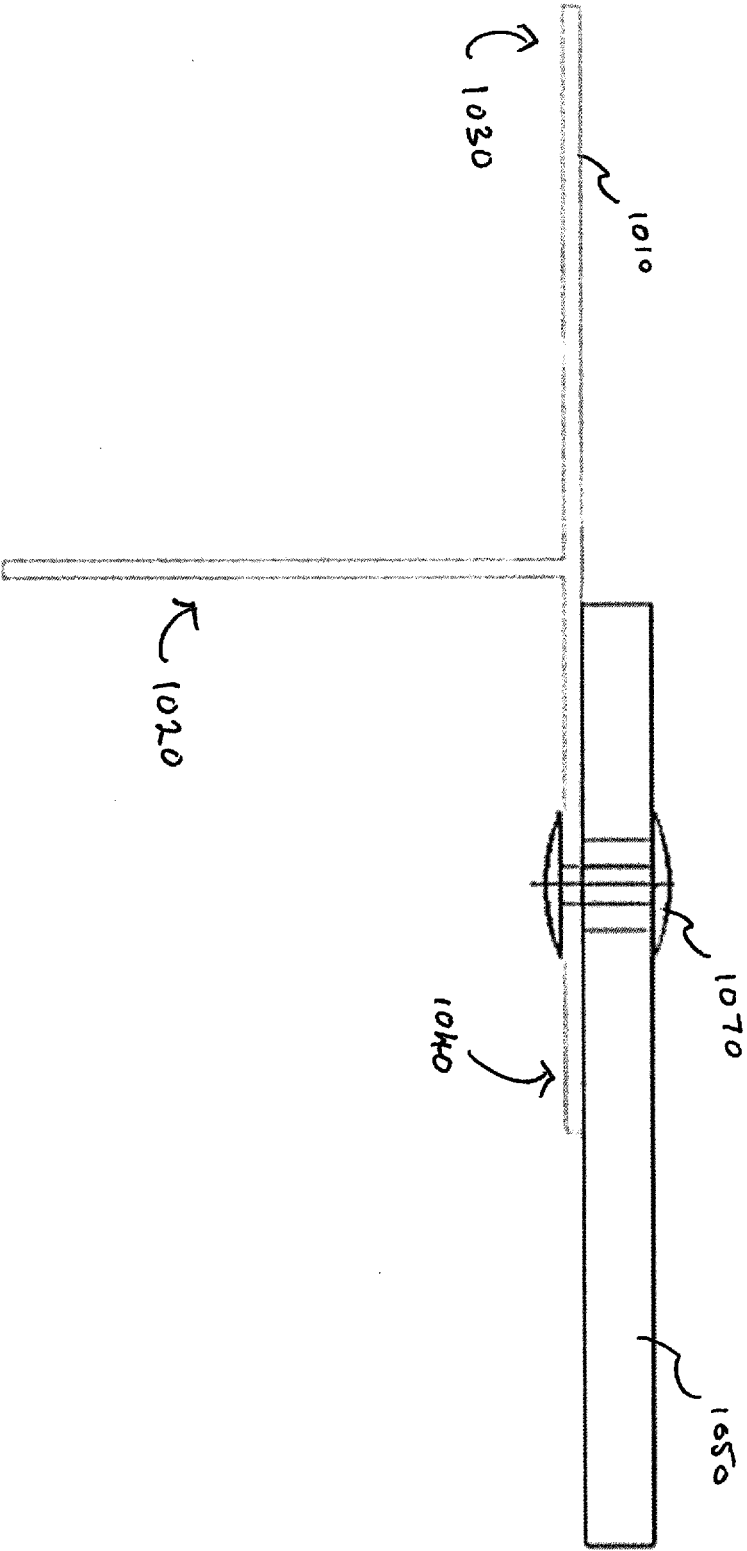
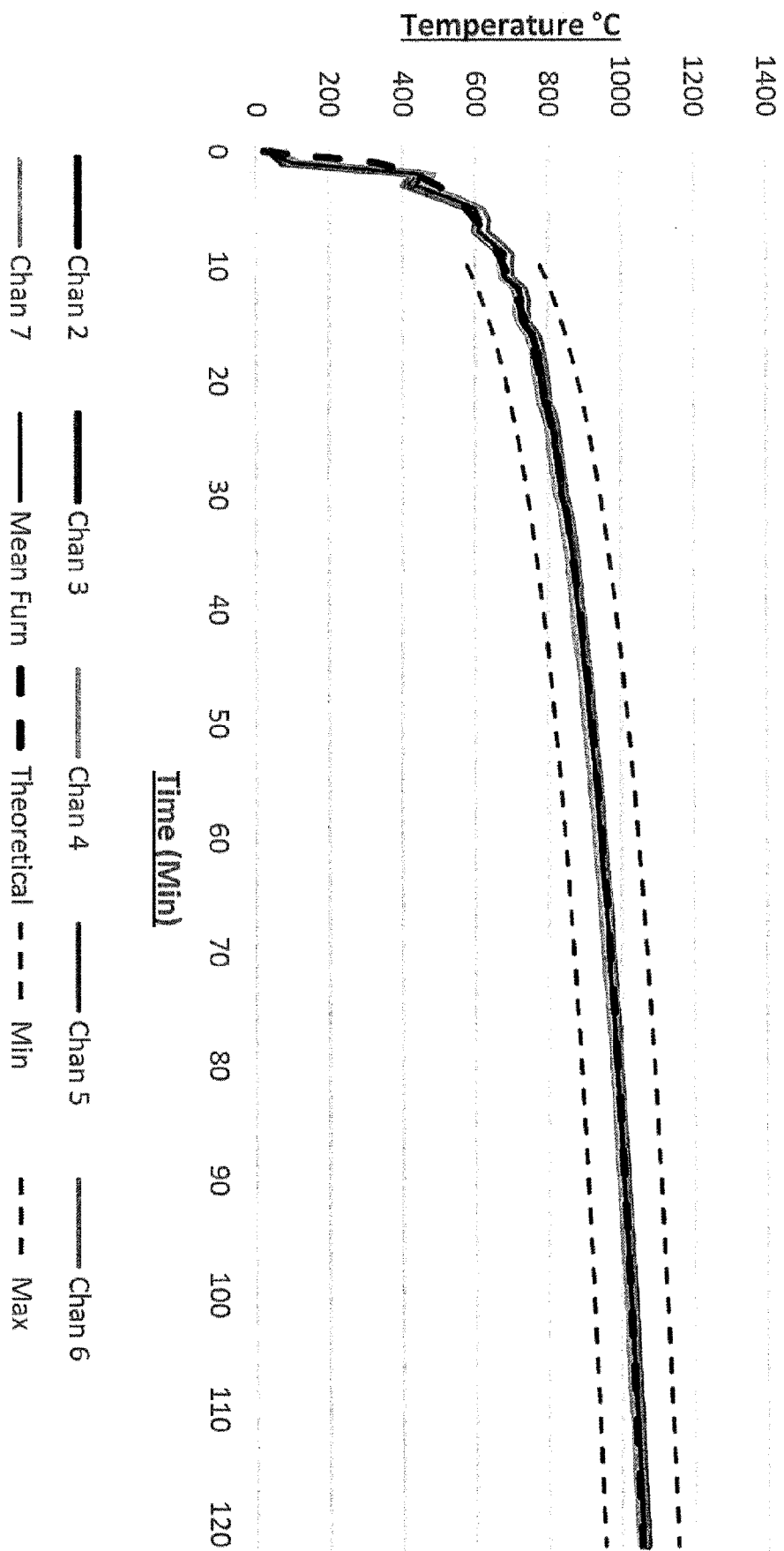
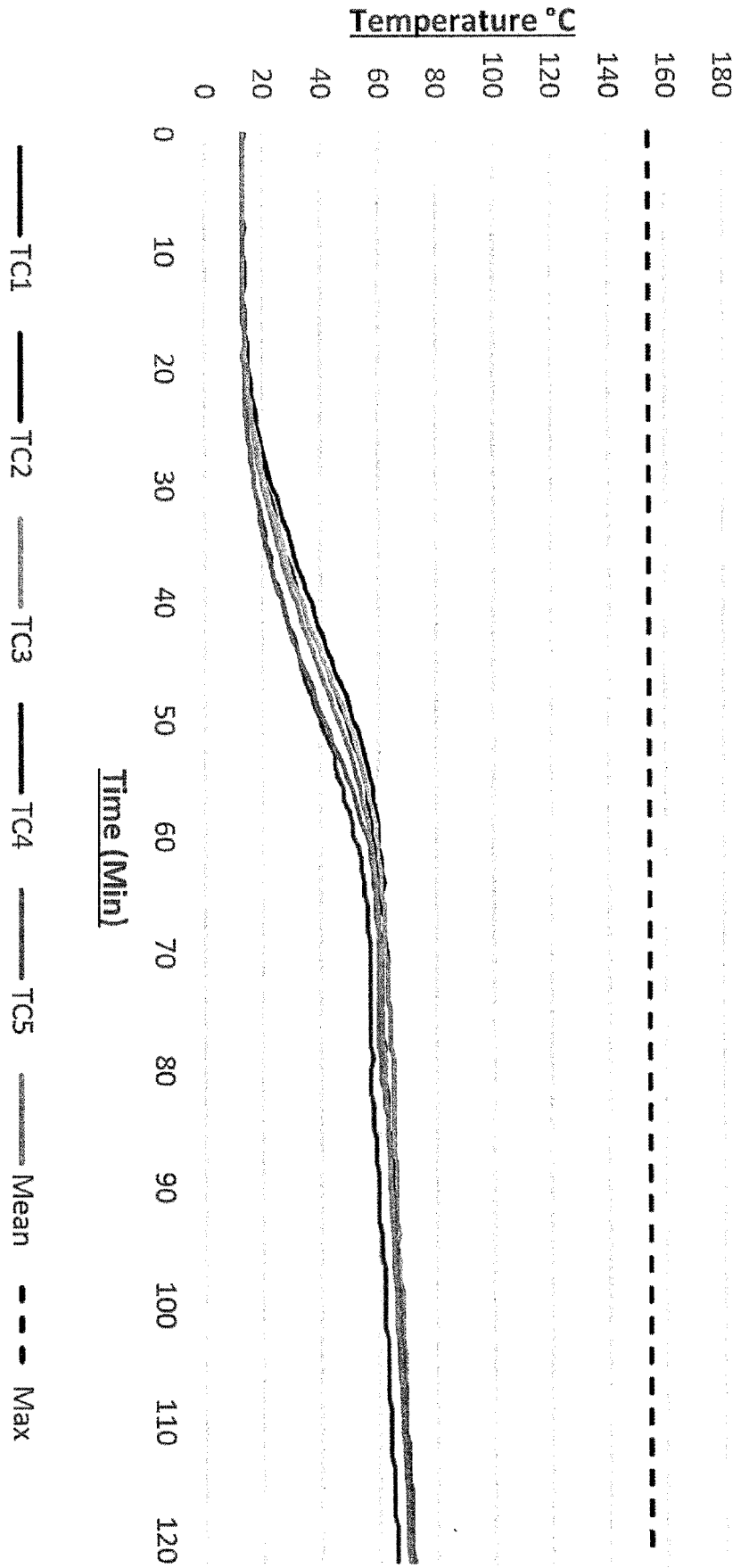


FIG. 10



F16.11



F14.12

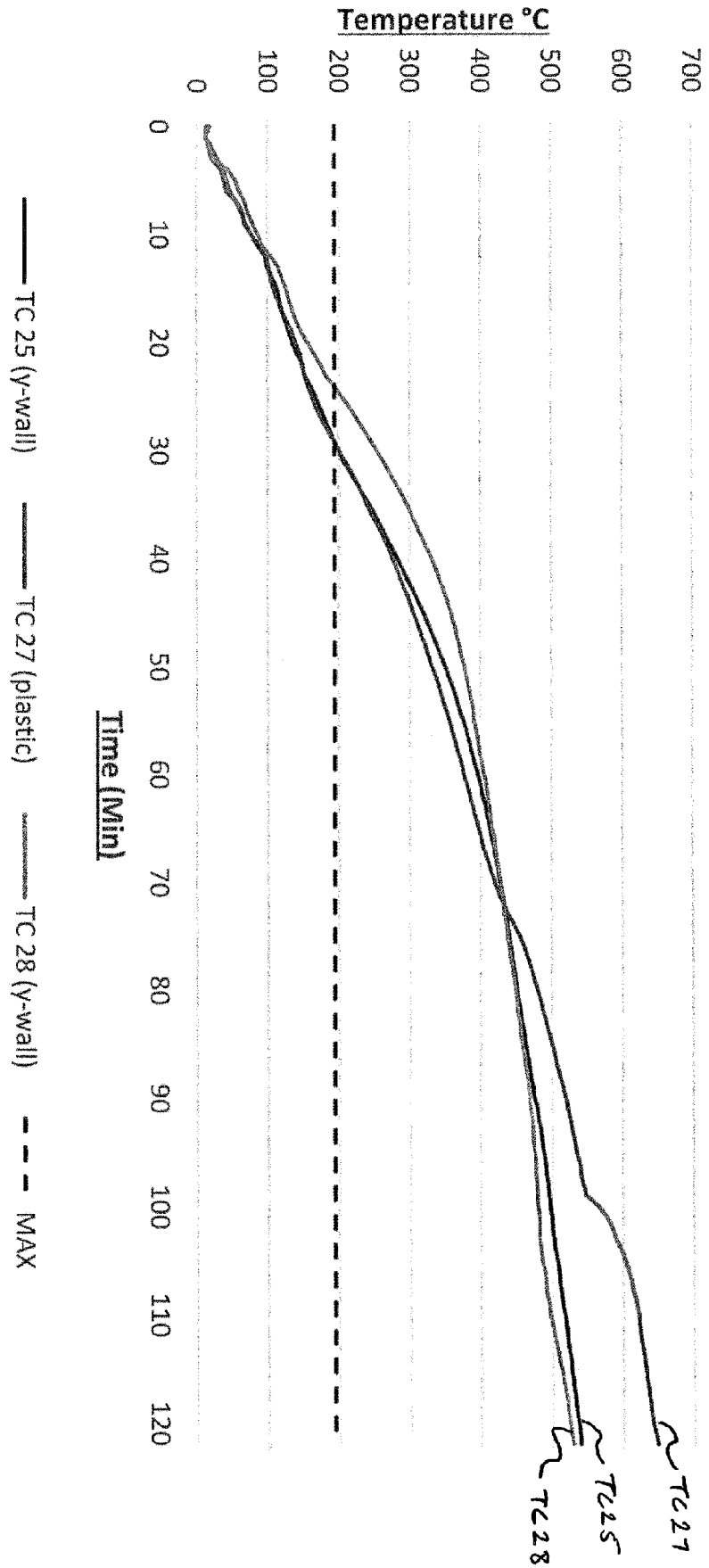
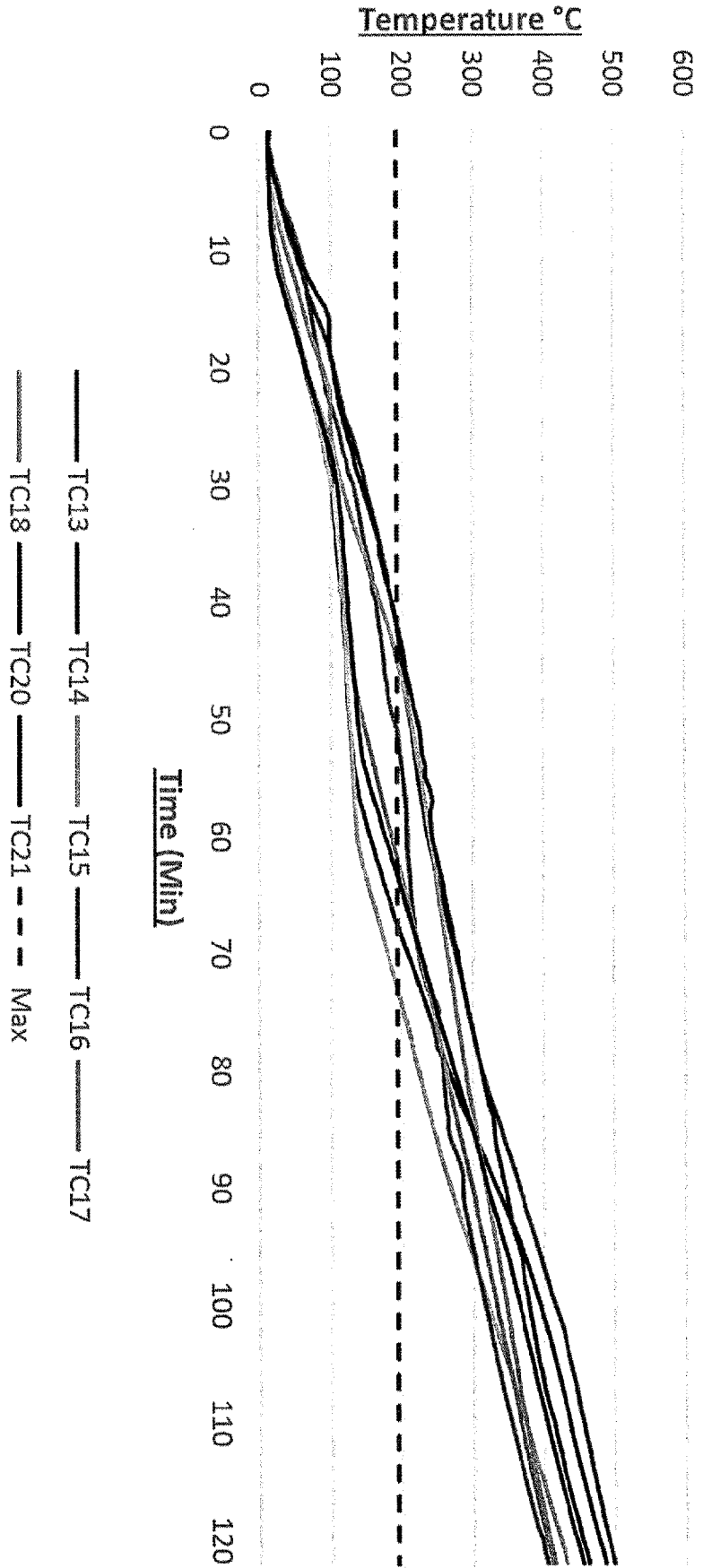


FIG. 13



F14.14



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Application Number
EP 19 19 5333

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			E04F E04B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 February 2020	Examiner Khera, Daljit
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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.
The members are as contained in the European Patent Office EDP file on
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