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(54) MODULAR CEILING SYSTEM

(57) A modular ceiling system comprises a first channel and a second channel. Each channel includes a base plate, two side plates and two inwardly extending lips. A recess of each channel is defined between the two side plates. A first ceiling bracket includes a base portion engaged in the recess of the first channel and an attachment portion extending out of the recess. The attachment portion includes an attachment plate including an aperture, a plane of the attachment plate being generally parallel to the base plate of the second channel. A second ceiling bracket includes a base portion engaged in the recess of the second channel and an attachment portion

extending out of the recess, the attachment portion including an attachment plate including an aperture, a plane of the attachment plate being generally parallel to the base plate of the second channel. A ceiling panel includes first and second edge recesses. A part of the first channel extends into the first edge recess with the first edge of the ceiling panel parallel to a longitudinal axis of the first channel and a part of the second channel extends into the second edge recess with the second edge of the ceiling panel is parallel to a longitudinal axis of the second channel. The channels lie in the same plane and the ceiling panel is supported by the channels.

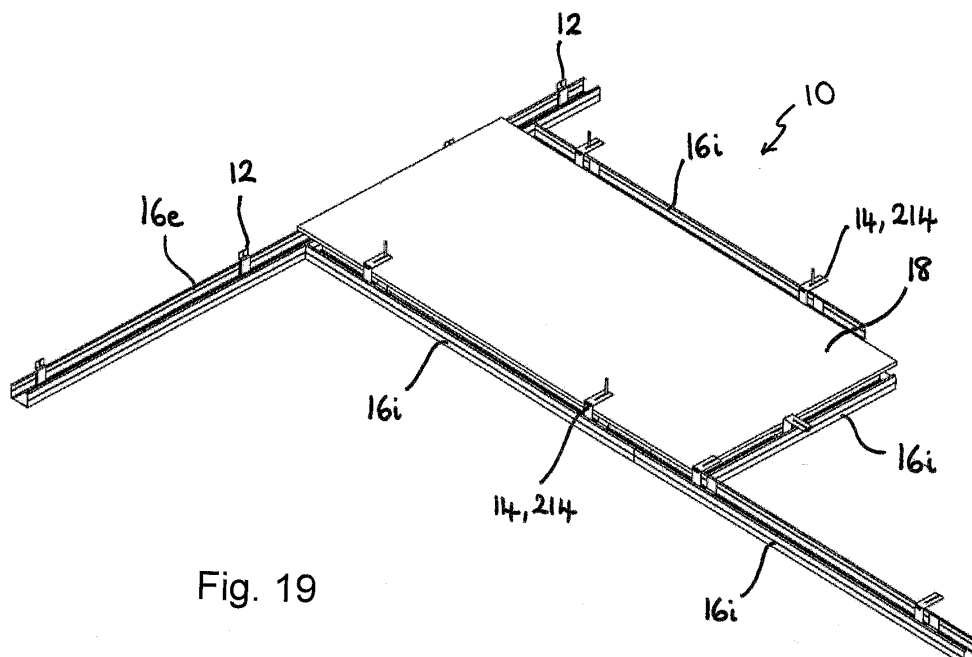


Fig. 19

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a modular ceiling system, a support bracket for a modular ceiling system and to a method of installing a modular ceiling system. The ceiling system of the invention may be used to install a suspended ceiling and may allow a ceiling to be retrofit in an existing building.

BACKGROUND TO THE INVENTION

[0002] Thermally inefficient buildings result in significant energy loss. Consequently, the lower the thermal efficiency of the building, the greater the amount of energy that is required to heat the building. This, in turn, leads to the need to generate more energy which can result in the generation of more carbon dioxide (CO₂). To tackle this problem it is desirable to make houses and other buildings as energy efficient as possible. A primary consideration is the construction or fabric of the buildings, including the structures and materials from which houses and other buildings are made.

[0003] When constructing new buildings and, in particular, new houses, the building can be designed to have excellent insulation so that the energy loss from the building is minimised.

[0004] Many buildings are, however, already occupied and it can therefore be difficult to make significant changes to the structure of these properties. Any major changes to the construction of the building, or even the addition of insulation to the building, may result in prohibitive levels of disruption and cost. Additionally, in some areas, the lack of skilled labour is a major hurdle in undertaking the work required to improve building efficiencies. This means that there are significant difficulties in both delivering the benefits to the occupants and in achieving net zero commitments in relation to CO₂ emissions.

[0005] It is therefore desirable to provide a means of improving the energy efficiency of existing buildings while minimising disruption to occupants of the building. This may be achieved by providing systems to improve the thermal insulation afforded by the walls, roof, doors, windows, or other parts of a building.

[0006] It is an aim of the present invention to provide a ceiling system that may be retrofit in a building to improve the thermal efficiency of the building.

SUMMARY OF THE INVENTION

[0007] A first aspect of the present invention provides a modular ceiling system comprising:

a first channel and a second channel, each of the first and second channels including a base plate, two side plates and two inwardly extending lips, and a

recess of each channel being defined between the two side plates;

a first ceiling bracket including a base portion engaged in the recess of the first channel and an attachment portion extending out of the recess, the attachment portion including an attachment plate including an aperture, a plane of the attachment plate being generally parallel to the base plate of the second channel;

a second ceiling bracket including a base portion engaged in the recess of the second channel and an attachment portion extending out of the recess, the attachment portion including an attachment plate including an aperture, a plane of the attachment plate being generally parallel to the base plate of the second channel; and

a ceiling panel including a first edge recess in a first edge of the ceiling panel and a second edge recess in a second edge of the ceiling panel, a part of the first channel extending into the first edge recess such that the first edge of the ceiling panel is parallel to a longitudinal axis of the first channel and a part of the second channel extending into the second edge recess such that the second edge of the ceiling panel is parallel to a longitudinal axis of the second channel, the first and second channels lying in the same plane and the ceiling panel being supported by the first and second channels.

[0008] The ceiling panel preferably has a first outer surface and an opposite second outer surface. A part of the first outer surface is preferably disposed between the first and second channels and the planes of the attachment plates such that the attachment plates are preferably disposed above and spaced apart from the first outer surface. A part of the first outer surface preferably extends over one of the lips of each of the first and second channels. A part of the second surface preferably extends over a part of an external face of the base plate of each of the first and second channels. In this way, the channel is preferably concealed by edge regions of the ceiling panel.

[0009] The modular ceiling system preferably further comprises a third channel including a base plate, two side plates and two inwardly extending lips, and a recess of the third channel being defined between the two side plates. The modular ceiling system preferably further comprises a wall bracket including a base portion engaged in the recess of the third channel and an attachment portion extending out of the recess, the attachment portion including an attachment plate including an aperture, and a plane of the attachment plate being generally parallel to the side plates of the first channel. A part of the third channel preferably extends into a third edge recess in a third edge of the ceiling panel such that the third edge of the ceiling panel is parallel to a longitudinal axis of the third channel and the ceiling panel is supported by the first, second and third channels.

[0010] The ceiling panel is preferably a laminated panel having first and second outer boards and an insulation layer between the first and second outer boards. The edge recess is preferably disposed between the first and second outer boards. A width of the edge recess may be equal to a thickness of the insulation layer.

[0011] In some embodiments the ceiling panel is a first ceiling panel and the system further comprises a second ceiling panel including a first edge recess in a first edge of the second ceiling panel. A part of the first channel preferably extends into the first edge recess of the second ceiling panel such that the first edge of the second ceiling panel is parallel to a longitudinal axis of the first channel. A part of the first edge of the first ceiling panel is preferably in contact with a part of the first edge of the second ceiling panel so that the first channel is concealed by the first and second ceiling panels.

[0012] Both the first and second ceiling panels may be laminated panels having first and second outer boards and an insulation layer between the first and second outer boards. The edge recesses may be disposed between the first and second outer boards. An external surface of the second outer board of the first ceiling panel is preferably continuous with and lies in the same plane as an external surface of the second outer board of the second ceiling panel. In this way, the external surfaces of the second outer boards form a flat, continuous ceiling that may be easily decorated. For example, it may only be necessary to fill any small gaps between the ceiling boards before painting the external surfaces of the second outer boards.

[0013] In some embodiments one of the first and second ceiling panels may be a heating panel including a heating element disposed between the insulation layer and the second outer board.

[0014] A second aspect of the present invention provides a support bracket for use in the modular ceiling system of the first aspect of the invention. The support bracket comprises:

a base element for insertion in a channel, the channel including a base plate, two side plates and two inwardly extending lips, and the base element comprising a base plate having two opposite insertion edges and two opposite side edges, and the base element comprising a side plate extending from each of the side edges, a distance between the insertion edges being smaller than a distance between the lips of the channel and a distance between the side edges being greater than the distance between the lips of the channel and smaller than a distance between the side plates of the channel; and an attachment element fixed to the base element, the attachment element comprising a stem portion and an attachment portion including an aperture, the stem portion extending perpendicularly from the base plate of the base element between the two side plates of the base element, a height of the stem

portion being greater than a height of the side plates, and the attachment portion extending from the stem portion above the side plates.

[0015] Preferably the stem portion extends parallel to the side plates. Preferably the stem portion is disposed midway between the side plates. The aperture of the attachment portion is preferably elongate so that a position of the bracket when attached to a support structure, such as a joist, can be easily adjusted.

[0016] In some embodiments the attachment portion comprises an attachment plate extending perpendicularly from the stem portion, the aperture extending through the thickness of the attachment plate. In some embodiments the stem portion may include an adjustment section configured to permit adjustment of the stem portion to increase or decrease a distance between the attachment plate and the base element. These brackets are configured to be attached to a ceiling joist or other ceiling structure and to suspend a channel from the base element below the attachment plate.

[0017] In other embodiments the attachment portion comprises an attachment plate extending parallel to but offset from the stem portion, the aperture extending through the thickness of the attachment plate. A plane of the attachment plate preferably lies at the same distance or a greater distance from the stem portion than a plane of one of the side plates. These brackets are configured to be attached to a wall stud or other wall structure.

[0018] The support bracket is preferably formed from sheet metal. The base element and the attachment element may each be made from sheet metal that is folded to form the required shape. The base element and the attachment element may be welded to each other so that the attachment element is permanently fixed to the base element.

[0019] A third aspect of the present invention provides a modular ceiling kit comprising:

a plurality of ceiling panels, the ceiling panels being laminated panels having first and second outer boards and an insulation layer between the first and second outer boards, and an edge recess is disposed between the first and second outer boards; a plurality of ceiling brackets, each of the ceiling brackets being according to the second aspect of the invention and having an attachment portion comprising an attachment plate extending perpendicularly from the stem portion; and a plurality of wall brackets, each of the wall brackets being according to the second aspect of the invention and having an attachment portion comprising an attachment plate extending parallel to but offset from the stem portion.

[0020] The modular ceiling kit may further comprise a plurality of lengths of channel, each length of channel

including a base plate, two side plates extending from side edges of the base plate and two inwardly extending lips extending from the side plates.

[0021] The modular ceiling kit may further comprise a plurality of ceiling panels in the form of heating panels including a heating element disposed between the insulation layer and the second outer board.

[0022] In preferred embodiments of the modular ceiling kit, each of the ceiling panels includes an edge recess that extends around the full perimeter of the ceiling panel.

[0023] A fourth aspect of the present invention provides a method of installing a modular ceiling, the method comprising:

providing a first ceiling bracket according to the second aspect of the invention and having an attachment portion comprising an attachment plate extending perpendicularly from the stem portion, and engaging the first ceiling bracket with a first length of channel by inserting the base element of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel;

securing the first ceiling bracket to a structural ceiling element by inserting a mechanical fastener through the aperture of the bracket into the structural ceiling element so that the first length of channel is suspended from the first ceiling bracket;

sliding a ceiling panel into engagement with the first length of channel, so that a part of the first length of channel is received in an edge recess of the ceiling panel such that a first edge of the ceiling panel is parallel to a longitudinal axis of the first length of channel;

providing a second ceiling bracket according to the second aspect of the invention and having an attachment portion comprising an attachment plate extending perpendicularly from the stem portion, and engaging the second ceiling bracket with a second length of channel by inserting the base element of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel;

securing the second ceiling bracket to a structural ceiling element by inserting a mechanical fastener through the aperture of the bracket into the structural ceiling element so that the second length of channel is suspended from the second ceiling bracket; and sliding the second length of channel into engagement with the edge recess of the ceiling panel such that a longitudinal axis of the second length of channel is parallel to a second edge of the ceiling panel, so

that the ceiling panel is supported by the first and second lengths of channel.

[0024] A fifth aspect of the present invention provides a method of installing a modular ceiling, the method comprising:

providing a wall bracket according to the second aspect of the invention and having an attachment portion comprising an attachment plate extending parallel to but offset from the stem portion, and engaging the wall bracket with a first length of channel by inserting the base element of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel;

securing the wall bracket to a structural wall element by inserting a mechanical fastener through the aperture of the bracket into the structural wall element so that the first length of channel is suspended from the wall bracket;

sliding a ceiling panel into engagement with the first length of channel, so that a part of the first length of channel is received in an edge recess of the ceiling panel such that a first edge of the ceiling panel is parallel to a longitudinal axis of the first length of channel;

providing a ceiling bracket according to the second aspect of the invention and having an attachment portion comprising an attachment plate extending perpendicularly from the stem portion, and engaging the ceiling bracket with a second length of channel by inserting the base element of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel;

securing the ceiling bracket to a structural ceiling element by inserting a mechanical fastener through the aperture of the bracket into the structural ceiling element so that the second length of channel is suspended from the second ceiling bracket; and

sliding the second length of channel into engagement with the edge recess of the ceiling panel such that a longitudinal axis of the second length of channel is parallel to a second edge of the ceiling panel, so that the ceiling panel is supported by the first and second lengths of channel.

[0025] The method of the fourth or fifth aspect of the invention may further comprise:

providing a further ceiling bracket according to the second aspect of the invention and having an attach-

ment portion comprising an attachment plate extending perpendicularly from the stem portion, and engaging the ceiling bracket with a third length of channel by inserting the base element of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel;

providing a further ceiling bracket according to the second aspect of the invention and having an attachment portion comprising an attachment plate extending perpendicularly from the stem portion, and engaging the ceiling bracket with a fourth length of channel by inserting the base element of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel;

securing each of the further ceiling brackets to a structural ceiling element by inserting a mechanical fastener through the aperture of the bracket into the structural ceiling element so that the third and fourth lengths of channel are suspended from the further ceiling brackets;

sliding the third length of channel into engagement with the edge recess of the ceiling panel such that a longitudinal axis of the third length of channel is parallel to a third edge of the ceiling panel; and sliding the fourth length of channel into engagement with the edge recess of the ceiling panel such that a longitudinal axis of the fourth length of channel is parallel to a fourth edge of the ceiling panel, wherein the ceiling panel is generally rectangular so that the first, second, third and fourth lengths of channel extend around the full perimeter of the ceiling panel.

[0026] In preferred embodiments the step of sliding the ceiling panel into engagement with the first length of channel comprises inserting the first length of channel into the edge recess until the first edge of the ceiling panel contacts the stem portion of the first ceiling bracket. In preferred embodiments the step of sliding the second length of channel into engagement with the edge recess of the ceiling panel comprises inserting the second length of channel into the edge recess until the second edge of the ceiling panel contacts the stem portion of the second ceiling bracket.

[0027] Preferred methods may further comprise adjusting a length of the stem portion of at least one of the ceiling brackets so that a plane of the ceiling panel is horizontal.

[0028] Preferred and/or optional features of each aspect and embodiment described above may also be

used, alone or in appropriate combination, in the other aspects and embodiments also.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The invention will now be further described by way of example only and with reference to the accompanying drawings, in which like reference signs are used for like features, and in which:

Figure 1 is a perspective view of a ceiling bracket for use in a modular ceiling system according to a preferred embodiment of the present invention;

Figure 2 is a perspective view of a wall bracket for use in a modular ceiling system according to a preferred embodiment of the present invention;

Figure 3 is an exploded view of the wall bracket of Figure 2;

Figure 4 is a perspective view of a ceiling bracket according to another preferred embodiment of the present invention for use in a modular ceiling system;

Figure 5 is a further perspective view of the ceiling bracket of Figure 4;

Figure 6 is a side view of the ceiling bracket of Figure 4;

Figure 7 shows the ceiling bracket of Figure 1 being inserted into a channel;

Figure 8 is a view from above of the ceiling bracket of Figure 1 being inserted into a channel showing, in particular, the orientation of the bracket with respect to an axis of the channel;

Figure 9 shows the ceiling bracket of Figure 1 engaged with a channel;

Figure 10 is an end view of the ceiling bracket of Figure 1 engaged in a channel;

Figure 11 is a plan view of a ceiling panel for use in a modular ceiling system according to a preferred embodiment of the present invention;

Figure 12 is a side view of the ceiling panel of Figure 11;

Figure 13 is an end view of the ceiling panel of Figure 11;

Figure 14 is an exploded view of the ceiling panel of Figure 11;

Figures 15 to 20 show stages in the construction of a modular ceiling using a modular ceiling system according to an embodiment of the present invention;

Figure 21 shows an edge of a ceiling panel, such as that illustrated in Figures 11 to 14, aligned with but not yet engaged with a ceiling bracket, such as that illustrated in Figures 4 to 6;

Figure 22 shows the ceiling panel and ceiling bracket of Figure 21, with the edge of the ceiling panel engaged with the ceiling bracket;

Figure 23 is an example of a complete modular ceiling according to an embodiment of the present invention;

Figure 24 is an exploded view of a ceiling panel including a radiant heating layer for use in a modular ceiling system according to a preferred embodiment of the present invention;

Figure 25 is an exploded view of a ceiling panel including an alternative radiant heating layer for use in a modular ceiling system according to a preferred embodiment of the present invention; and

Figure 26 shows a kit of parts for construction of a modular ceiling system according to a preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] The modular ceiling system 10 of the present invention generally includes one or more wall brackets 12, one or more ceiling brackets 14, one or more channels 16 and one or more ceiling panels 18.

[0031] The modular ceiling system 10 is designed to be suspended from ceiling/floor joists and additionally secured to walls surrounding the area of the ceiling. The modular ceiling system 10 may be suspended below and possibly connected to an existing ceiling to increase thermal insulation.

[0032] The modular ceiling system 10 utilises standard known C-section or U-section channel 16, as shown most clearly in Figure 7. The channel 16 has a base plate or base section 22 and two side plates or side sections 24. Each of the base plate 22 and side plates 24 is generally planar. Each of the side plates 24 extends from a longitudinal edge of the base plate 22 in a direction generally perpendicular to a plane of the base plate 22, so that the channel 16 has a U-shaped cross-sectional shape perpendicular to a longitudinal axis 26 of the channel 16. A lip 28 extends from a longitudinal edge of each of the side plates 24 furthest from the base plate 22. The lips 28 extend generally perpendicular to planes of the side plates 24 and extend inwardly in directions towards each

other. A gap 30 is defined between the lips 28 which forms a longitudinal opening 30 of the channel 16. The opening 30 provides access to a recess 32 of the channel 16 between the two side plates 24.

[0033] A length of the channel 16 is defined in a direction parallel to the longitudinal axis 26 of the channel 16. A width of the recess 32 is defined as the distance between internal surfaces of the side plates 24 of the channel, and a width of the opening 30 is defined as the distance between the lips 28. It will be appreciated that the width of the opening 30 is less than the width of the recess 32. A height of the recess 32 is defined as the distance between the base plate 22 and a lower or internal surface of each of the lips 28. Furthermore, a width of the channel 16 is defined as the distance between external surfaces of the side plates 24, and a depth of the channel 16 is defined as the distance between an upper or external surface of the lips 28 and a lower or external surface of the base plate 22.

[0034] Referring now to Figure 1, a first preferred embodiment of a ceiling bracket 14 includes a base element 34 and an attachment element 36. The base element 34 is configured to be inserted into the recess 32 of a length of channel 16 through the opening 30 of the channel 16. The base element 34 is further configured to engage in the recess 32 to retain the ceiling bracket 14 in the channel 16 so that the channel 16 can be suspended from the ceiling bracket 14. In this embodiment the base element 34 comprises a base plate or base portion 38 and two side plates or side portions 40.

[0035] The base plate 38 has opposite first and second planar surfaces 42, 44 and in this embodiment has six edges. A first pair of side edges 46 are parallel to each other, a second pair of insertion edges 48 are parallel to each other, and a third pair of end edges 50 are parallel to each other. Angles between adjacent edges are not, however, identical, such that the base plate 38 has the shape of an irregular hexagon.

[0036] A distance between the insertion edges 48 is substantially the same as the width of the opening 30 of the channel 16. The distance between the insertion edges 48 is preferably slightly smaller than the width of the opening 30 so that there is clearance between the base plate 38 and the lips 28, and the base element 34 can pass through the opening 30 with the base plate 38 oriented with the insertion edges 48 parallel to the side plates 24 of the channel 16, as illustrated in Figures 7 and 8.

[0037] A distance between the side edges 46 is substantially the same as or slightly smaller than the width of the recess 32 of the channel 16. Once the base element 34 has been inserted into the channel 16 through the opening 30 in a first orientation with the insertion edges 48 parallel to the side plates 24 of the channel 16, the base element 34 can then be rotated within the recess 32 to a second orientation in which the side edges 46 are parallel to the side plates 24 of the channel 16, as illustrated in Figures 9 and 10.

[0038] The side plates 40 of the base element 34 extend perpendicularly from the side edges 46 of the base plate 38. A height of each of the side plates 40 is substantially the same as or slightly smaller than the height of the recess 32. In this way, when the base element 34 is rotated into the second orientation, the side plates 40 locate under the lips 28 of the channel 16, as shown most clearly in Figure 10. This retains the base element 34 in the recess 32 of the channel 16.

[0039] The attachment element 36 is fixed to the base element 34 so that the attachment element 36 does not move with respect to the base element 34. In this embodiment the attachment element 36 comprises a support plate or support portion 52, a stem portion 54, and an attachment plate or attachment portion 56. The attachment element 36 is fixed to the base element 34 by the support plate 52. In particular the support plate 52 is fixed to the first surface 42 of the base plate 38.

[0040] The stem portion 54 extends from the support portion 52. With the support portion 52 secured to the base element 34, the stem portion 54 extends perpendicular to a plane of the base plate 38. The stem portion 54 is positioned with respect to the base element 34 so that the stem portion 54 is disposed between the two side plates 40. Preferably the stem portion 54 is disposed midway between the side plates 40. In this example, the stem portion 54 extends parallel to the side plates 40. A height of the stem portion 54 is greater than the height of the side plates 40 such that the stem portion 54 protrudes or extends from the base element 34. When the base element 34 is engaged in the recess 32 of a channel 16, the stem portion 54 extends through the opening 30. With the stem portion 54 is disposed midway between the side plates 40, the stem portion is also disposed midway between the lips 28 of the channel 16 and therefore midway across the width of the channel 16.

[0041] The attachment portion 56 extends from an end of the stem portion 54 furthest from the support portion 52. In this embodiment the attachment portion 56 extends generally perpendicularly from the stem portion 54 such that the attachment portion 56 extends over one of the side plates 40 of the base element 34. A plane of the attachment portion 56 is preferably parallel to a plane of the base plate 38. The height of the stem portion 54 is such that there is a gap between the attachment portion 56 and the upper edge of the side plate 40 of the base element 34. The attachment portion 56 includes an aperture 58 extending through the thickness of the attachment portion 56 in a direction perpendicular to the plane of the attachment portion 56. In this embodiment the aperture 58 is elongate. The attachment element 36 is configured to be secured to a ceiling joist or the underside of an upper floor joist by a mechanical fastener 20 extending through the aperture 58 in the attachment portion 56. The mechanical fastener 20 may be a screw or bolt for example.

[0042] In some embodiments, the attachment portion 56 is in the form of an attachment plate 56 and a retaining

channel 60 is secured to a face of the attachment plate 56. The retaining channel 60 is aligned with the aperture 58. In use, the retaining channel 60 may be used to hold a head of a bolt with a shaft of the bolt extending through the aperture 58.

[0043] The ceiling bracket 14 is preferably made of a metal material, most preferably steel. In preferred embodiments the ceiling bracket 14 is made from sheet metal. The attachment element 36 is preferably welded to the base element 34. The attachment element 36 may, in other embodiments, be adhered or otherwise securely and permanently attached to the base element 34.

[0044] Referring now to Figures 2 and 3, a first preferred embodiment of a wall bracket 12 includes a base element 34 and an attachment element 62. The base element 34 of the wall bracket 12 is identical to the base element 34 of the ceiling bracket 14.

[0045] The attachment element 62 is fixed to the base element 34 so that the attachment element 62 does not move with respect to the base element 34. In this embodiment the attachment element 62 comprises a support plate or support portion 64, a stem portion 66, and an attachment plate or attachment portion 68. The attachment element 62 is fixed to the base element 34 by the support plate 64. In particular the support plate 64 is fixed to the first surface 42 of the base plate 38 of the base element 34.

[0046] The stem portion 66 extends from the support portion 64. With the support portion 64 secured to the base element 34, the stem portion 66 extends perpendicular to a plane of the base plate 38. The stem portion 66 is positioned with respect to the base element 34 so that the stem portion 66 is disposed between the two side plates 40. In this example, the stem portion 66 extends parallel to the side plates 40. Preferably the stem portion 66 is disposed closer to one of the side plates 40 than to the other. A height of the stem portion 66 is slightly greater than the height of the side plates 40 such that the stem portion 66 protrudes or extends slightly above the side plates 40 of the base element 34. When the base element 34 is engaged in the recess 32 of a channel 16, the stem portion 66 extends through the opening 30. With the stem portion 66 is disposed midway between the side plates 40, the stem portion is also disposed midway between the lips 28 of the channel 16 and therefore midway across the width of the channel 16.

[0047] The attachment portion 68 extends from an end of the stem portion 66 furthest from the support portion 64. The attachment portion 68 includes an overhang section 70 and a contact section 72. The overhang section 70 extends generally perpendicularly from the stem portion 66 such that the overhang section 70 extends over one of the side plates 40 of the base element 34. The contact section 72 extends from the overhang section 70 in a direction generally parallel to the side plates 40 of the base element 34. Preferably, a dimension of the overhang section 70 is such that, when the base element 34 is engaged in a channel 16, the overhang section 70 ex-

tends over one of the lips 28 of the channel 16 and a plane of the contact section 72 is aligned with a plane of the side plate 24 of the channel 16. The contact section 72 of the attachment portion 68 includes an aperture 74. In this embodiment the aperture 74 is elongate.

[0048] The attachment element 62 is configured to be secured to a wall stud or other part of a wall by a mechanical fastener 20 extending through the aperture 74 in the attachment portion 68. The mechanical fastener 20 may be a screw or bolt for example.

[0049] The wall bracket 12 is preferably made of a metal material, most preferably steel. In preferred embodiments the wall bracket 12 is made from sheet metal. The attachment element 62 is preferably welded to the base element 34. The attachment element 62 may, in other embodiments, be adhered or otherwise securely and permanently attached to the base element 34.

[0050] It will be appreciated that with the wall bracket 12 secured to a wall stud by the attachment element 62, a length of channel 16 may be engaged with the base element 34 such that the channel 16 is supported by and suspended from the base element 34. In particular, each of the side plates 40 of the base element 34 locates between the base plate 22 and a respective lip 28 of the channel 16, and one of the lips 28 locates between the top edge of one of the side plates 40 of the base element 34 and the overhang section 70.

[0051] Similarly, with the ceiling bracket 14 secured to a ceiling joist by the attachment element 36, a length of channel 16 may be engaged with the base element 34 such that the channel 16 is supported by and suspended from the base element 34. In particular, each of the side plates 40 of the base element 34 locates between the base plate 22 and a respective lip 28 of the channel 16, as shown most clearly in Figures 9 and 10.

[0052] Figures 4 to 6 illustrate an alternative embodiment of a ceiling bracket 214. The ceiling bracket 214 includes a base element 234 and an attachment element 236. The base element 234 is identical to the base element 34 of the first embodiment of the ceiling bracket 14.

[0053] The base element 234 comprises a base plate or base portion 238 and two side plates or side portions 240. The base plate 238 has opposite first and second planar surfaces 242, 244 and in this embodiment has six edges. A first pair of side edges 246 are parallel to each other, a second pair of insertion edges 248 are parallel to each other, and a third pair of end edges 250 are parallel to each other. Angles between adjacent edges are not, however, identical, such that the base plate 238 has the shape of an irregular hexagon.

[0054] A distance between the insertion edges 248 is substantially the same as the width of the opening 30 of the channel 16. The distance between the insertion edges 248 is preferably slightly smaller than the width of the opening 30 so that there is clearance between the base plate 238 and the lips 28, and the base element 234 can pass through the opening 30 with the base plate 238

oriented with the insertion edges 248 parallel to the side plates 24 of the channel 16.

[0055] A distance between the side edges 246 is substantially the same as or slightly smaller than the width of the recess 32 of the channel 16. Once the base element 234 has been inserted into the channel 16 through the opening 30 in a first orientation with the insertion edges 248 parallel to the side plates 24 of the channel 16, the base element 234 can then be rotated within the recess 32 to a second orientation in which the side edges 246 are parallel to the side plates 24 of the channel 16.

[0056] The side plates 240 of the base element 234 extend perpendicularly from the side edges 246 of the base plate 238. A height of each of the side plates 240 is substantially the same as or slightly smaller than the height of the recess 32. In this way, when the base element 234 is rotated into the second orientation, the side plates 240 locate under the lips 28 of the channel 16. This retains the base element 234 in the recess 32 of the channel 16.

[0057] In this embodiment the attachment element 236 comprises a support plate or support portion 252, a stem portion 254, and an attachment plate or attachment portion 256. The attachment element 236 is fixed to the base element 234 by the support plate 252. In particular the support plate 252 is fixed to the first surface 242 of the base plate 238. The stem portion 254 extends from the support portion 252. In this embodiment the stem portion 254 includes a drop section 251 and an adjustment section 253. With the support portion 252 secured to the base element 234, the drop section 251 is disposed between the two side plates 240. Preferably the drop section 251 is disposed midway between the side plates 240. In this example, the drop section 251 extends parallel to the side plates 240. A height of the drop section 251 is greater than the height of the side plates 240 such that the drop section 251 protrudes or extends from the base element 234. When the base element 234 is engaged in the recess 32 of a channel 16, the drop section 251 extends through the opening 30. The adjustment section 253 extends from the drop section 251 in a direction generally perpendicular to the drop section 251. In this embodiment the adjustment section 253 extends over one of the side plates 240 of the base element 234. The height of the drop section 251 is such that there is a gap between the adjustment section 253 and the upper edge of the side plate 240 of the base element 234. In this example, the adjustment section 253 includes a trough or cavity 255 for receiving the head of a bolt.

[0058] The attachment portion 256 is secured to the stem portion 254. In this embodiment the attachment portion 256 comprises an adjustment section 276, a spacing section 278 and a contact section 280. The adjustment section 276 and contact section 280 extend from opposite edges of the spacing section 278, and both the adjustment section 276 and contact section 280 extend parallel to each other and perpendicular to the

spacing section 278, such that the attachment portion 256 is at least partially U-shaped.

[0059] Both the adjustment section 253 of the stem portion 254 and the adjustment section 276 of the attachment portion 256 include an aperture. The apertures align to receive the stem of a bolt 282 therethrough, as illustrated in Figures 4 to 6. The head of the bolt 282 is preferably seated in the cavity 255 such that the head of the bolt 282 does not rotate. A nut 284 can then be attached to the stem of the bolt 282 to secure the attachment portion 256 to the stem portion 254 with the two adjustment sections 253, 276 clamped between the head of the bolt 282 and the nut 284.

[0060] The attachment portion 256 is secured to the stem portion 254 so that a distance between the contact section 280 and the base element 234 can be adjusted. This allows the ceiling to be suspended at the desired height below existing ceiling joists or other ceiling structures. It may be desirable, for example, to suspend the ceiling at a greater distance below the ceiling joists to accommodate pipes, ducts and the like. In this embodiment, to increase the distance between the contact section 280 and the base element 234, one or more spacer elements may be positioned between the two adjustment sections 253, 276 before they are clamped between the head of the bolt 282 and the nut 284. The spacer element may be in the form of a nut.

[0061] Referring now to Figures 11 to 14, an exemplary ceiling panel 18 is shown. The ceiling panel 18 comprises first and second outer boards 86, 88 and an insulation layer 90 between the first and second outer boards. The insulation layer 90 preferably provides thermal insulation. The first and second outer boards 86, 88 and the insulation layer 90 are bonded together and are preferably adhered to each other.

[0062] Each of the first and second outer boards 86, 88 and insulation layer 90 are rectangular. The first outer board 86 includes a pair of opposite side edges 92 and a pair of opposite end edges 94. Similarly, the second outer board 88 includes a pair of opposite side edges 96 and a pair of opposite end edges 98. A length of each of the first and second outer boards 86, 88 is defined between the respective pair of end edges 94, 98, and a width of each of the first and second outer boards 86, 88 is defined between the respective pair of side edges 92, 96. The lengths of the first and second outer boards 86, 88 are identical, and the widths of the first and second outer boards 86, 88 are identical. The insulation layer 90 has a pair of opposite side edges 100 and a pair of opposite end edges 102. A length of the insulation layer 90, between the end edges 102, is smaller than the lengths of the first and second outer boards 86, 88. A width of the insulation layer 90, between the side edges 100, is smaller than the widths of the first and second outer boards 86, 88. In this way, with the insulation layer 90 centred between the first and second outer boards 86, 88, the ceiling panel 18 includes an edge recess 104 extending around the full perimeter of the ceiling board 18. In this embodiment a

width dimension of the edge recess 104 is defined as the distance between inner faces of the first and second outer boards 86, 88 and is equal to a thickness of the insulation layer 90. A depth dimension of the edge recess 104 is defined in a direction perpendicular to the respective edge of the first and second outer boards 86, 88 and parallel to a plane of the first and second outer boards 86, 88. Preferably the depth of the edge recess 104 is the same around the full perimeter of the ceiling board 18.

[0063] In preferred embodiments the first and second outer boards 86, 88 comprise gypsum fibre boards. The insulation layer 90 preferably comprises a mineral wool or a closed cell insulating material.

[0064] The side edges 92, 96 of the first and second outer boards 86, 88 define side edges 93 of the ceiling panel 18. A width of the ceiling panel 18 is defined as the distance between the side edges 93. The end edges 94, 98 of the first and second outer boards 86, 88 define end edges 95 of the ceiling panel 18. A length of the ceiling panel 18 is defined as the distance between the end edges 95. It will be appreciated that the modular ceiling system 10 may include ceiling boards 18 having different length and width dimensions.

[0065] The edge recess 104 is configured and sized to receive part of a channel 16. In particular, the width of the edge recess 104 (and therefore the thickness of the insulation layer 90) is substantially the same as a height of the channel 16, and a depth of the edge recess 104 is substantially equal to half the width of the channel 16.

[0066] As well as providing thermal insulation, the ceiling panel 18 may be made of suitable materials to provide fire resistance and/or acoustic insulation.

[0067] Installation of a modular ceiling system 10 will now be described with particular reference to Figures 15 to 22.

[0068] A plurality of wall brackets 12 are secured to wall studs or a wall structure (not shown). The wall brackets 12 may be fixed to the wall studs or wall structure by mechanical fasteners 20, such as screws, extending through the openings 74 in the attachment elements 62. A first length of channel 16e is engaged with the base elements 34 and suspended from the wall brackets 12. In some embodiments one of the side plates 24 of the channel 16e may be clamped between the stem portion 66 of the wall bracket 12 and a part of the wall structure. The first length of channel 16e will be located at a perimeter edge of the final modular ceiling.

[0069] In preferred embodiments each of the openings 74 is elongate in a vertical direction so that the respective heights of the wall brackets 12 can be adjusted to ensure that the first length of channel 16e is level (horizontal).

[0070] A second length of channel 16i is suspended from a plurality of ceiling brackets 14, 214. Each of the ceiling brackets 14, 214 is secured to a ceiling joist or other ceiling structure. The ceiling brackets 14, 214 may be fixed to the ceiling joists by mechanical fasteners 20, such as screws, extending through the openings 58 in the attachment elements 36. The second length of channel

16i is engaged with the base elements 34 and suspended from the ceiling brackets 14, 214.

[0071] In preferred embodiments the ceiling brackets 214 are adjustable such that a distance between the contact section 280 of the attachment element 236 and the base element 234 can be adjusted. This allows the distance between the second length of channel 16i and the ceiling joists to be adjusted to ensure that the second length of channel 16i is level (horizontal) and lies in the same horizontal plane as the first length of channel 16e.

[0072] The second length of channel 16i is positioned so that an end of the channel 16i abuts or lies in close proximity to a side plate 24 of the first length of channel 16e. The longitudinal axis 26 of the second length of channel 16i is preferably perpendicular to the longitudinal axis 26 of the first length of channel 16e. It will be appreciated that the second length of channel 16i spans part of the area of the ceiling and provides an internal support.

[0073] A ceiling panel 18 is then engaged with the first and second channels 16e, 16i. In this example the ceiling panel 18 is slid into engagement with the first channel 16e so that a part of the first channel 16e is received in the edge recess 104 along a first end edge 95 of the ceiling panel 18. The ceiling panel 18 is also slid into engagement with the second channel 16i so that a part of the second channel 16i is received in the edge recess 104 along a first side edge 93 of the ceiling panel 18.

[0074] A further set of ceiling brackets 14, 214 is secured to a ceiling joist proximate a second side edge 93 of the ceiling panel 18. As illustrated in Figures 17 and 21, each ceiling bracket 14, 214 may initially be secured to the ceiling joist such that the base element 34 is separated from or clear of the ceiling panel 18. A third length of channel 16i may then be engaged with and suspended from the base elements 34. The third channel 16i, together with the associated ceiling brackets 14, 214 may then be slid into engagement with the ceiling panel 18, as illustrated in Figures 18 and 22. In particular, the third channel 16i may be moved in a direction perpendicular to its longitudinal axis to insert a part of the third channel 16i in the edge recess 104 along the second side edge 93 of the ceiling panel 18.

[0075] To facilitate this movement of the third channel 16i, the mechanical fastener 20 (for example a screw) which is used to secure the ceiling bracket 14, 214 to the ceiling joist may be initially disposed at a first end of the elongate aperture 58 in the ceiling bracket 14, 214. As the third channel 16i is slid into the edge recess 104, the mechanical fastener may slide towards a second end of the elongate aperture 58 in the ceiling bracket 14, 214. Once the third channel 16i is disposed in the edge recess 104, the mechanical fasteners may then be tightened to secure the ceiling brackets 14, 214 in the desired position.

[0076] Further ceiling brackets 14, 214 are attached to ceiling joists and further channels 16 are suspended from the ceiling brackets 14, 214 so that, preferably, channels

16 are disposed in the edge recess 104 around the full perimeter of the ceiling panel 18. This ensures that the ceiling panel 18 is securely supported between channels 16.

[0077] To create a complete suspended ceiling, a plurality of ceiling panels 18 are suspended from a plurality of channels 16. In preferred embodiments a single length of channel 16 engages with opposing edge recesses 104 of neighbouring ceiling panels 18. A first ceiling panel 18 may engage with a length of channel 16 such that half of the width of the channel 16 is seated in the edge recess 104 of that first panel 18 and a second ceiling panel 18 may engage with the same length of channel 16 such that the other half of the width of the channel 16 is seated in the edge recess 104 of that second panel 18. The opposing side edges 93 of the first and second ceiling panels 18 preferably abut the stem portions 54 of the ceiling brackets 14, 214 supporting the channel 16.

[0078] In the embodiment illustrated in Figure 21 and 22 the depth of the edge recess 104 is approximately half of the width of the channel 16. Accordingly, when the channel 16 is fully inserted into the edge recess 104 so that the edge 93, 95 of the panel 18 abuts the stem portion 54, the side plate 24 of the channel 16 lies in close proximity to the respective edge 100, 102 of the insulation layer 90.

[0079] In other embodiments the depth of the edge recess 104 may be substantially equal to the full width of a channel 16. In these embodiments, when a channel 16 suspended by a ceiling bracket 14, 214 is inserted into the edge recess 104 a gap will remain between the external surface of the side plate 24 and the edge 100, 102 of the insulation layer 90. However, when a channel 16 suspended by a wall bracket 12 is inserted into the edge recess 104 an edge region of the second outer board 88 (defined by the depth of the edge recess 104) is able to cover the full width of the base plate 22 of the channel 16.

[0080] In yet further embodiments a ceiling panel 18 may be provided in which the depth of the edge recess 104 is not the same around the full perimeter of the ceiling panel 18. A depth of the edge recess 104 along one of the side edges or end edges of the ceiling panel 18 may be greater than along the other side edges or end edges. In this way, the edge of the panel 18 having the edge recess 104 with the greater depth may be engaged with a channel 16 suspended from wall brackets 12, while the remaining edges are engaged with channels 16 suspended from ceiling brackets 14, 214.

[0081] To complete the construction of the modular ceiling further brackets 12, 14, 214, channels 16 and panels 18 are added until the complete area of the ceiling is covered. As shown in Figure 20, it is desirable if end edges and side edges of neighbouring ceiling panels 18 contact or abut each other. Not only does this maximise the thermal insulation of the ceiling, but it also creates a continuous lower surface of the ceiling. In particular, it is advantageous if the channels 16 of the modular ceiling

system, are fully concealed by the ceiling panels 18. With neighbouring second outer boards abutting, a continuous lower surface of the modular ceiling is formed which does not need to be plastered before being decorated. It will be understood that while filling of gaps between adjacent ceiling panels 18 may be required, the time taken for filling and drying of the filler will be less than the time required to fully plaster a ceiling and wait for the plaster to dry before painting. This means that the modular ceiling system of the present invention is quick and easy to install and allows the ceiling to be decorated soon after installation, thereby minimising disruption.

[0082] It will be appreciated that both the wall brackets 12 and the ceiling brackets 14, 214 are able to be slid along the length of the channel 16, and located at any position along the length of the channel 16. This allows the brackets 12, 14, 214 to be attached to any and/or all existing wall supports, ceiling/floor joists and other supports, while still providing the necessary support to the channels 16 and ceiling panels 18.

[0083] A further advantage of the modular ceiling system 10 is that the ceiling brackets 14, 214 suspend the ceiling panels 18 at a distance below the ceiling/floor joists or existing ceiling structure. An air gap is therefore formed above the modular ceiling which increases the thermal insulation of the ceiling as it reduces thermal bridging. The suspension of the ceiling panels 18 at a distance below the ceiling/floor joists or existing ceiling structure may also increase the acoustic insulation or sound-proofing of the ceiling.

[0084] In some embodiments of the modular ceiling system 10 it may be desirable to include one or more heating panels 106, 120. These heating panels 106, 120 may be used in place of the ceiling panels 18 described above and may provide radiant heating either via a hot water heating element or via an electric heating element.

[0085] Figure 24 illustrates a heating panel 106 according to an embodiment of the invention. The composite heating panel 106 comprises a first, back board 108, a second, front board 110 and an insulation panel 112. A length of pipe or tubing 114 is disposed between the front board 110 and the insulation panel 112. The tubing 114 provides a conduit through which, in use, a fluid flows. The fluid flowing through the tubing 114 will typically be above ambient temperature. In preferred embodiments the temperature of the fluid is less than 70 °C, more preferably between 20 °C and 70 °C, and more preferably between 25 °C and 50 °C. The tubing 114 is preferably made of a suitable polymeric or metal material. The tubing 114, therefore, provides a heating element of the heating panel 106.

[0086] A heat dissipation panel 116 is disposed between the tubing 114 and the front board 110. One function of this heat dissipation panel 116 is to transfer heat energy more efficiently from the tubing 114 to the front board 110 and, as such, acts as a form of heat sink. The heat dissipation panel 116 also transfers the heat energy from the tubing 114 more evenly over the area of the front

board 110. As such, heat is more evenly radiated from the surface of the front board 110 and the presence of "hot spots" and "cool spots" over the surface of the front board 110 is minimised. A further function of the heat dissipation panel 116 is to protect the tubing 114 from damage. To fulfil these functions, the heat dissipation panel 116 is preferably made of a suitable metal material. In preferred embodiments the heat dissipation panel 116 is made of steel.

[0087] To maximise the efficiency of the composite heating panel 106, and to maximise the amount of heat energy being radiated from the front surface of the front board 110, the tubing 114 is preferably disposed as close to the front surface as possible. In preferred embodiments a channel 118 is provided in a rear surface of the front board 110 for receiving the tubing 114. In preferred embodiments the channel 118 is formed in the rear surface of the front board 110 by computerised numerical control (CNC) machining. In other embodiments the front board 110 may be moulded or otherwise cut or shaped to form the channel 118. A depth or distance between a base of the channel 118 and the front surface of the front board 110 is preferably minimised to result in efficient heat transfer from the tubing 114 to the front surface. This depth or distance is preferably between 1 mm and 10 mm, more preferably between 1 mm and 5 mm, and more preferably about 4 mm. The front board 110 is preferably made from a gypsum fibre board.

[0088] Figure 25 shows an alternative embodiment of a heating panel 120. In this embodiment the heating panel 120 includes a first, back board 122, a second, front board 124 and an insulation panel 126. A carbon fibre heating mat or heating pad 128 is disposed between the front board 124 and the insulation panel 126. In this example the carbon fibre heating pad 128 has electrical connections extending from one end of the heating pad 128. The carbon fibre heating pad 128 provides a heating element of the heating panel 120.

[0089] Both of the illustrated heating panels 106, 120 have an insulation layer or panel 112, 126 that has smaller dimensions than the front and back boards 110, 108, 124, 122, so that an edge recess is formed in the same manner as in the ceiling panels 18 described above. In this way, a heating panel 106, 120 may be installed simply in place of any of the ceiling panels 18 without needing to change any other parts of the modular ceiling system 10.

[0090] Figure 23 illustrates a complete modular ceiling including a plurality wall brackets 12 around a perimeter edge of the ceiling, and a plurality of ceiling brackets 14, 214 distributed or spaced apart over the internal area of the ceiling. The modular ceiling of this example includes a number of standard laminated ceiling panels 18 and a number of heating panels 120 including electrical heating pads 128. All of the ceiling panels 18 and heating panels 120 are supported around their full perimeters by lengths of channel 16.

[0091] It will be appreciated that because the lengths of

channel 16 are received in the edge recesses 104 of the ceiling panels 18 and the heating panels 120, most of the channels 16, between the ceiling panels 18 and heating panels 120, are not visible from either above or below once the ceiling is fully constructed. In this embodiment channels 16 are visible around the perimeter edge of the ceiling.

[0092] It will be appreciated that a plurality of wall brackets 12, a plurality of ceiling brackets 14, 214 and a plurality of ceiling panels 18 may be supplied as a kit. The kit may optionally also include a plurality of lengths of channel 16; however, these may not always form part of the kit as the modular ceiling system 10 utilises standard U-shaped channel 16. As illustrated in Figure 26, a kit may include a number of different sizes of ceiling panel 18. In some embodiments a kit may include ceiling brackets 14, 214 pre-assembled with a length of channel 16. This may be time saving, as at least one ceiling bracket 14, 214 (or wall bracket 12) is required to support each length of channel 16. It will be understood that the position of the ceiling bracket 14, 214 (or wall bracket 12) along the length of the channel 16 may be altered by sliding the bracket 14, 214, 12 through the recess 32 of the channel 16 in a longitudinal direction. Additional brackets 14, 214, 12 may also be engaged with the channel 16 either by inserting the bracket 14, 214, 12 into an end of the recess 32 and then sliding the bracket 14, 214, 12 along the length of the channel to the desired position, or by inserting the bracket 14, 214, 12 at the desired location through the opening 30 of the channel 16.

[0093] Other modifications and variations not explicitly disclosed above may also be contemplated without departing from the scope of the invention as defined in the appended claims.

Claims

1. A modular ceiling system comprising:
 - a first channel and a second channel, each of the first and second channels including a base plate, two side plates and two inwardly extending lips, and a recess of each channel being defined between the two side plates;
 - a first ceiling bracket including a base portion engaged in the recess of the first channel and an attachment portion extending out of the recess, the attachment portion including an attachment plate including an aperture, a plane of the attachment plate being generally parallel to the base plate of the second channel;
 - a second ceiling bracket including a base portion engaged in the recess of the second channel and an attachment portion extending out of the recess, the attachment portion including an attachment plate including an aperture, a plane of

the attachment plate being generally parallel to the base plate of the second channel; and
 a ceiling panel including a first edge recess in a first edge of the ceiling panel and a second edge recess in a second edge of the ceiling panel, a part of the first channel extending into the first edge recess such that the first edge of the ceiling panel is parallel to a longitudinal axis of the first channel and a part of the second channel extending into the second edge recess such that the second edge of the ceiling panel is parallel to a longitudinal axis of the second channel, the first and second channels lying in the same plane and the ceiling panel being supported by the first and second channels.

2. A modular ceiling system according to Claim 1, in which the ceiling panel has a first outer surface and an opposite second outer surface, a part of the first outer surface being disposed between the first and second channels and the planes of the attachment plates and extending over one of the lips of each of the first and second channels, and a part of the second surface extending over a part of an external face of the base plate of each of the first and second channels.
3. A modular ceiling system according to Claim 1 or Claim 2, further comprising:
 - a third channel including a base plate, two side plates and two inwardly extending lips, and a recess of the third channel being defined between the two side plates; and
 - a wall bracket including a base portion engaged in the recess of the third channel and an attachment portion extending out of the recess, the attachment portion including an attachment plate including an aperture, a plane of the attachment plate being generally parallel to the side plates of the first channel,
 - a part of the third channel extending into a third edge recess in a third edge of the ceiling panel such that the third edge of the ceiling panel is parallel to a longitudinal axis of the third channel and the ceiling panel is supported by the first, second and third channels.
4. A modular ceiling system according to any preceding claim, in which the ceiling panel is a first ceiling panel and the system further comprises a second ceiling panel including a first edge recess in a first edge of the second ceiling panel, a part of the first channel extending into the first edge recess of the second ceiling panel such that the first edge of the second ceiling panel is parallel to a longitudinal axis of the first channel, and a part of the first edge of the first ceiling panel is in contact with a part of the first edge

of the second ceiling panel so that the first channel is concealed by the first and second ceiling panels.

5. A modular ceiling system according to Claim 4, in which both the first and second ceiling panels are laminated panels having first and second outer boards and an insulation layer between the first and second outer boards, wherein the edge recesses are disposed between the first and second outer boards, and in which an external surface of the second outer board of the first ceiling panel is continuous with and lies in the same plane as an external surface of the second outer board of the second ceiling panel.

6. A modular ceiling system according to Claim 4 or Claim 5, in which one of the first and second ceiling panels is a heating panel including a heating element disposed between the insulation layer and the second outer board.

7. A support bracket for use in the modular ceiling system of any one of Claims 1 to 6, the support bracket comprising:

a base element for insertion in a channel, the channel including a base plate, two side plates and two inwardly extending lips, and the base element comprising a base plate having two opposite insertion edges and two opposite side edges, and the base element comprising a side plate extending from each of the side edges, a distance between the insertion edges being smaller than a distance between the lips of the channel and a distance between the side edges being greater than the distance between the lips of the channel and smaller than a distance between the side plates of the channel; and an attachment element fixed to the base element, the attachment element comprising a stem portion and an attachment portion including an aperture, the stem portion extending perpendicularly from the base plate of the base element between the two side plates of the base element, a height of the stem portion being greater than a height of the side plates, and the attachment portion extending from the stem portion above the side plates.

8. A support bracket according to Claim 7, in which the stem portion extends parallel to the side plates and the stem portion is disposed midway between the side plates.

9. A support bracket according to Claim 7 or Claim 8, in which the attachment portion comprises an attachment plate extending perpendicularly from the stem portion, the aperture extending through the thick-

ness of the attachment plate, and in which the stem portion includes an adjustment section configured to permit adjustment of the stem portion to increase or decrease distance between the attachment plate and the base element.

10. A support bracket according to Claim 7 or Claim 8, in which the attachment portion comprises an attachment plate extending parallel to but offset from the stem portion, the aperture extending through the thickness of the attachment plate, wherein a plane of the attachment plate lies at the same distance or a greater distance from the stem portion than a plane of one of the side plates.

11. A modular ceiling kit comprising:

a plurality of ceiling panels, the ceiling panels being laminated panels having first and second outer boards and an insulation layer between the first and second outer boards, and an edge recess is disposed between the first and second outer boards;

a plurality of ceiling brackets, each of the ceiling brackets being according to Claim 9; and

a plurality of wall brackets, each of the wall brackets being according to Claim 10.

12. A modular ceiling kit according to Claim 11, further comprising a plurality of lengths of channel, each length of channel including a base plate, two side plates extending from side edges of the base plate and two inwardly extending lips extending from the side plates.

13. A modular ceiling kit according to Claim 11 or Claim 12, further comprising a plurality of ceiling panels in the form of heating panels including a heating element disposed between the insulation layer and the second outer board.

14. A method of installing a modular ceiling, the method comprising:

providing a first ceiling bracket according to Claim 9 and engaging the first ceiling bracket with a first length of channel by inserting the base element of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel;

securing the first ceiling bracket to a structural ceiling element by inserting a mechanical fastener through the aperture of the bracket into the structural ceiling element so that the first length

of channel is suspended from the first ceiling bracket;
 sliding a ceiling panel into engagement with the first length of channel, so that a part of the first length of channel is received in an edge recess of the ceiling panel such that a first edge of the ceiling panel is parallel to a longitudinal axis of the first length of channel; 5
 providing a second ceiling bracket according to Claim 9 and engaging the second ceiling bracket with a second length of channel by inserting the base element of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel; 10
 securing the second ceiling bracket to a structural ceiling element by inserting a mechanical fastener through the aperture of the bracket into the structural ceiling element so that the second length of channel is suspended from the second ceiling bracket; and 15
 sliding the second length of channel into engagement with the edge recess of the ceiling panel such that a longitudinal axis of the second length of channel is parallel to a second edge of the ceiling panel, so that the ceiling panel is supported by the first and second lengths of channel. 20
 25
 30

15. A method of installing a modular ceiling, the method comprising:

35
 providing a wall bracket according to Claim 10 and engaging the wall bracket with a first length of channel by inserting the base element of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel; 40
 securing the wall bracket to a structural wall element by inserting a mechanical fastener through the aperture of the bracket into the structural wall element so that the first length of channel is suspended from the wall bracket; 45
 sliding a ceiling panel into engagement with the first length of channel, so that a part of the first length of channel is received in an edge recess of the ceiling panel such that a first edge of the ceiling panel is parallel to a longitudinal axis of the first length of channel; 50
 providing a ceiling bracket according to Claim 9 and engaging the ceiling bracket with a second length of channel by inserting the base element 55

of the bracket through a longitudinal opening of the channel with the base element in a first orientation and rotating the base element into a second orientation in which the side plates of the base element engage with the channel to retain the base element in a recess of the channel;
 securing the ceiling bracket to a structural ceiling element by inserting a mechanical fastener through the aperture of the bracket into the structural ceiling element so that the second length of channel is suspended from the second ceiling bracket; and
 sliding the second length of channel into engagement with the edge recess of the ceiling panel such that a longitudinal axis of the second length of channel is parallel to a second edge of the ceiling panel, so that the ceiling panel is supported by the first and second lengths of channel.

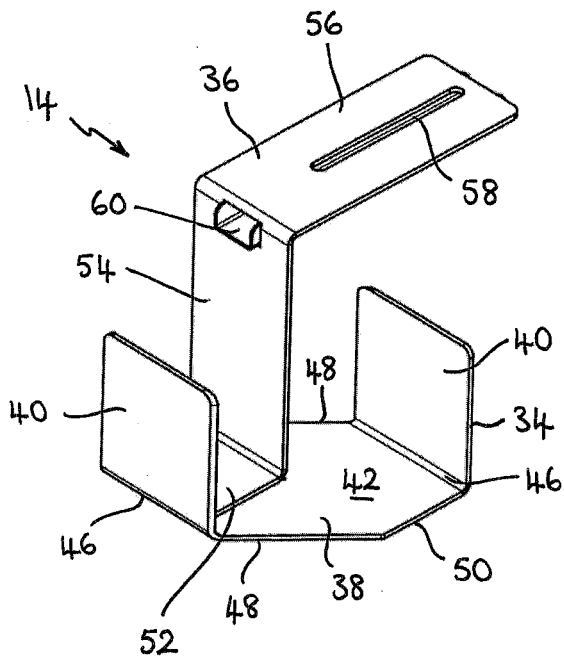


Fig. 1

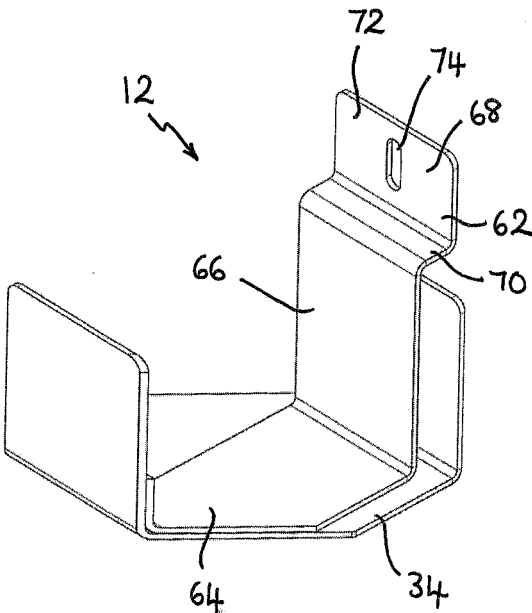


Fig. 2

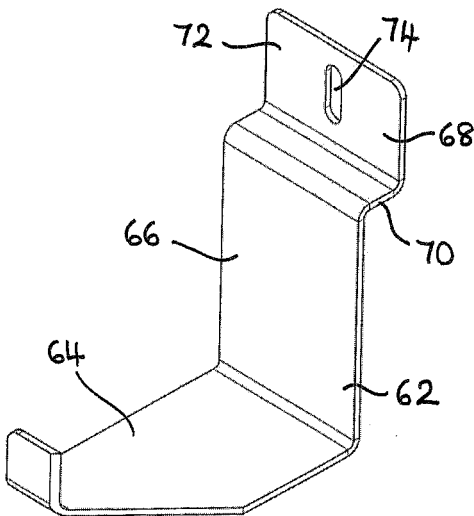


Fig. 3

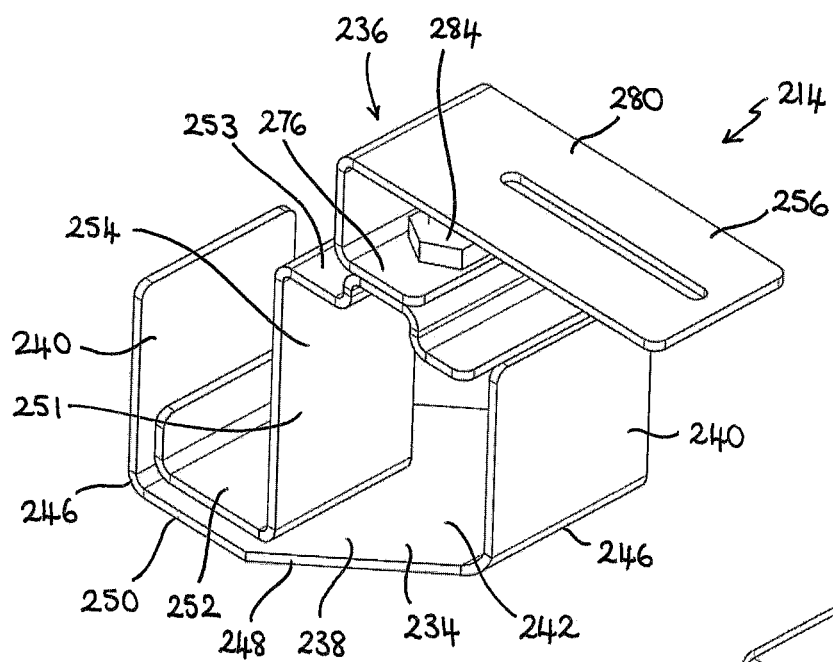


Fig. 4

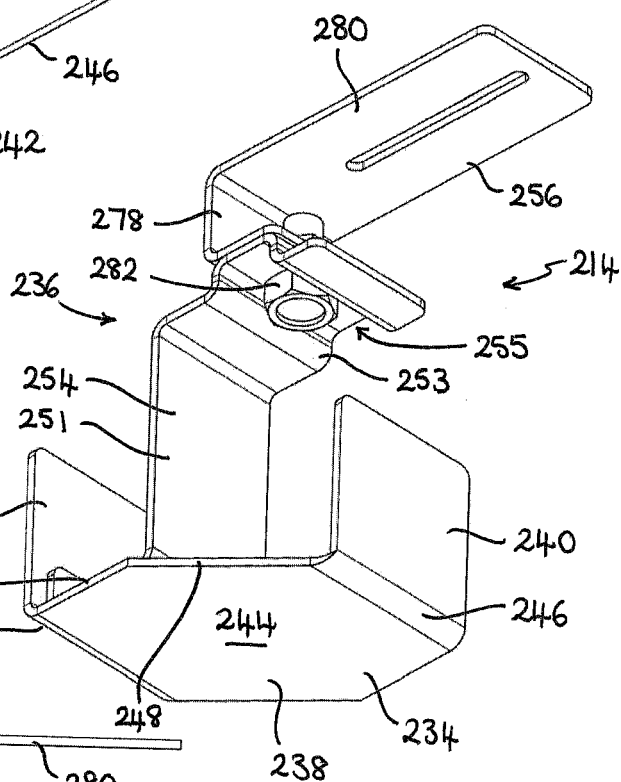


Fig. 5

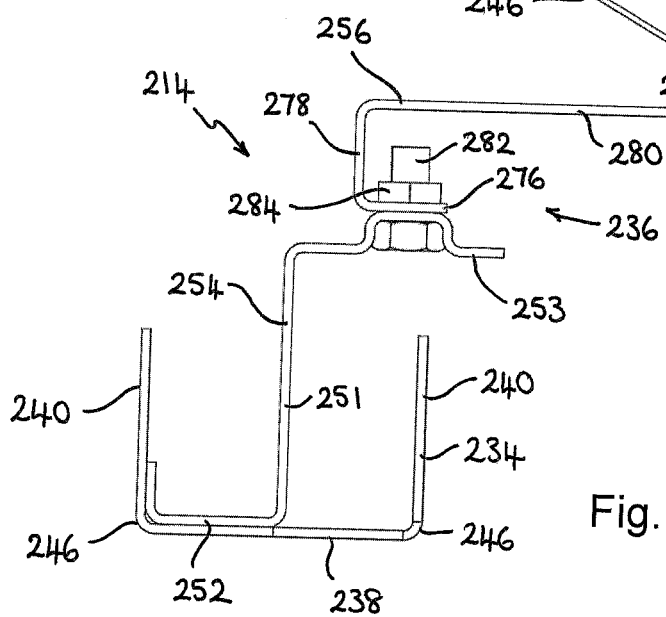
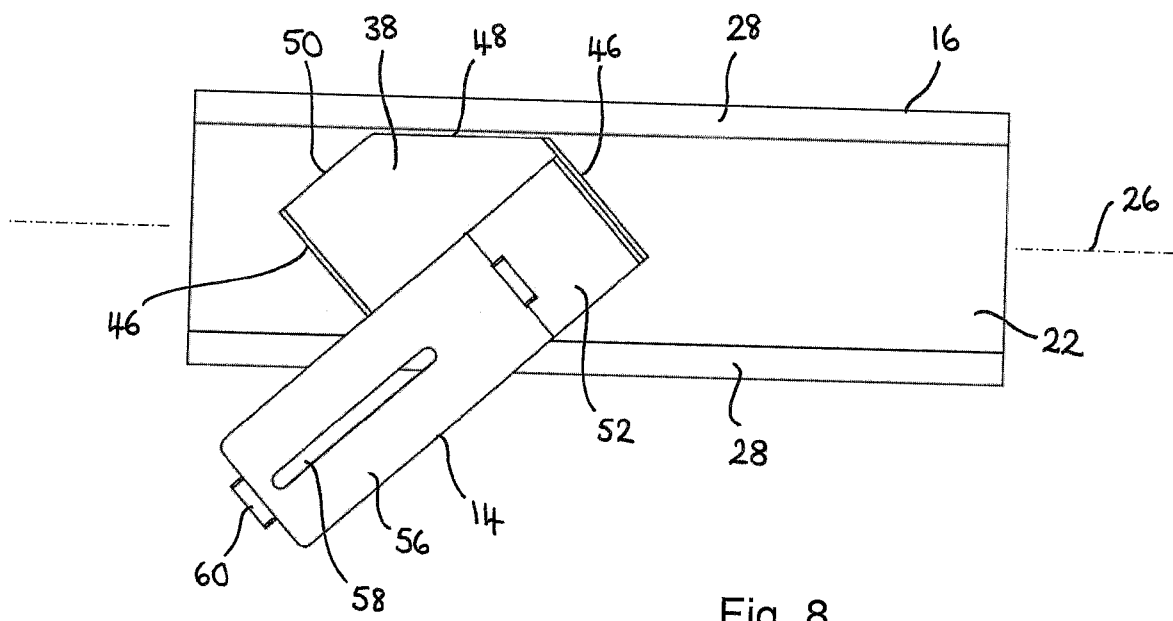
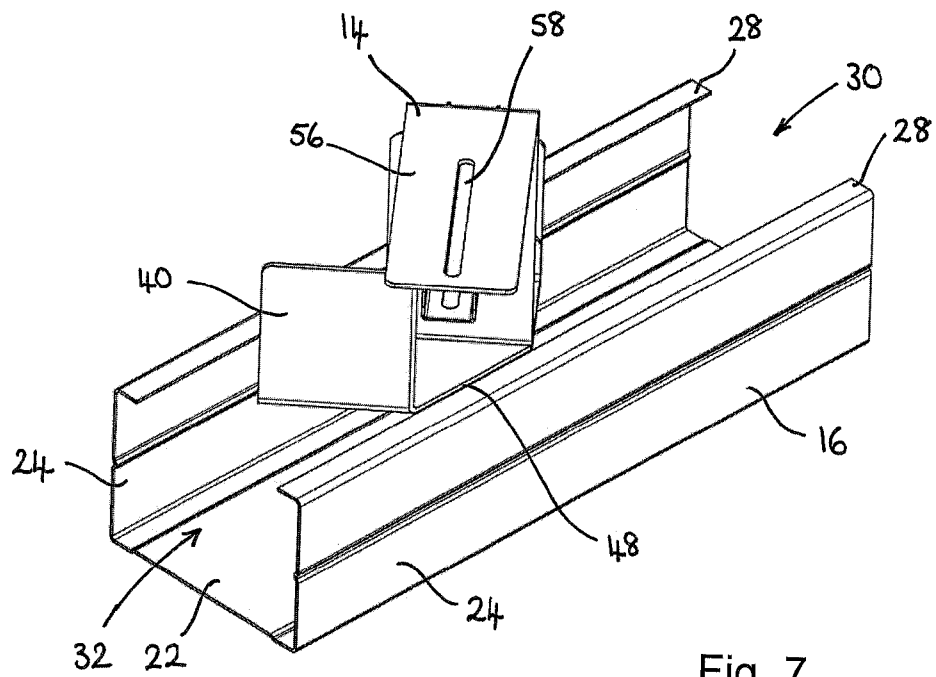


Fig. 6



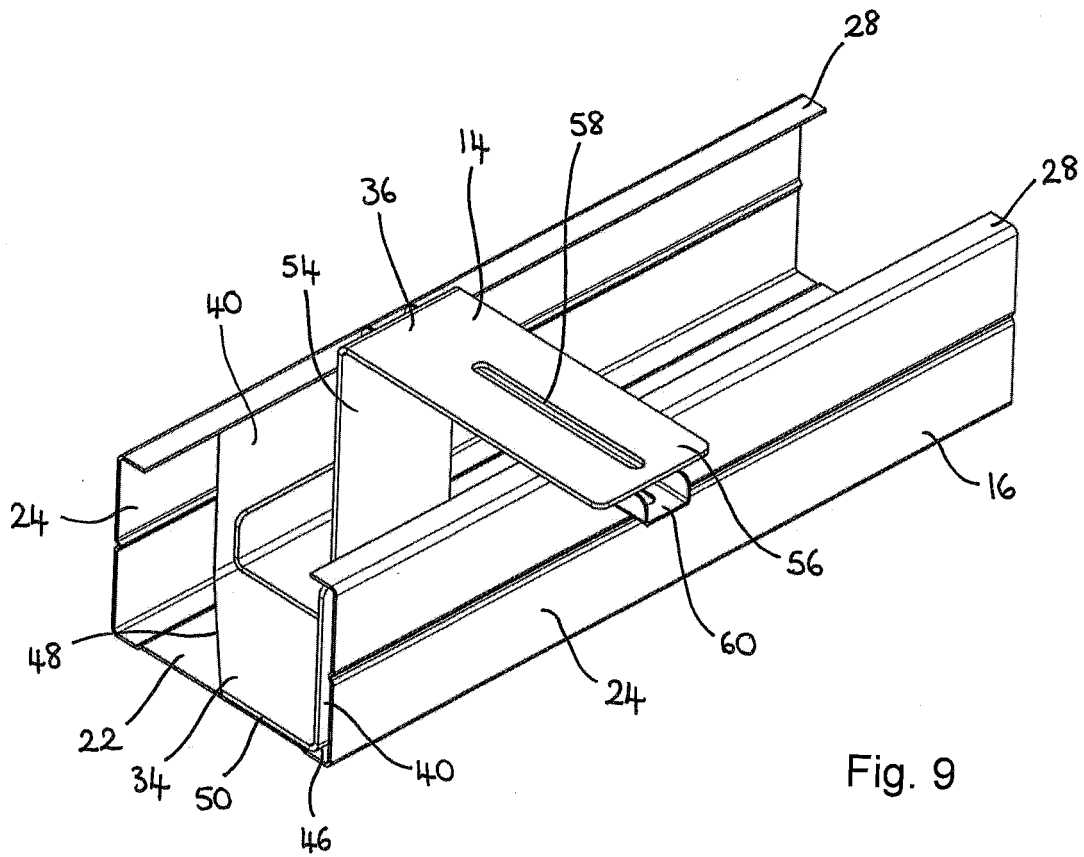


Fig. 9

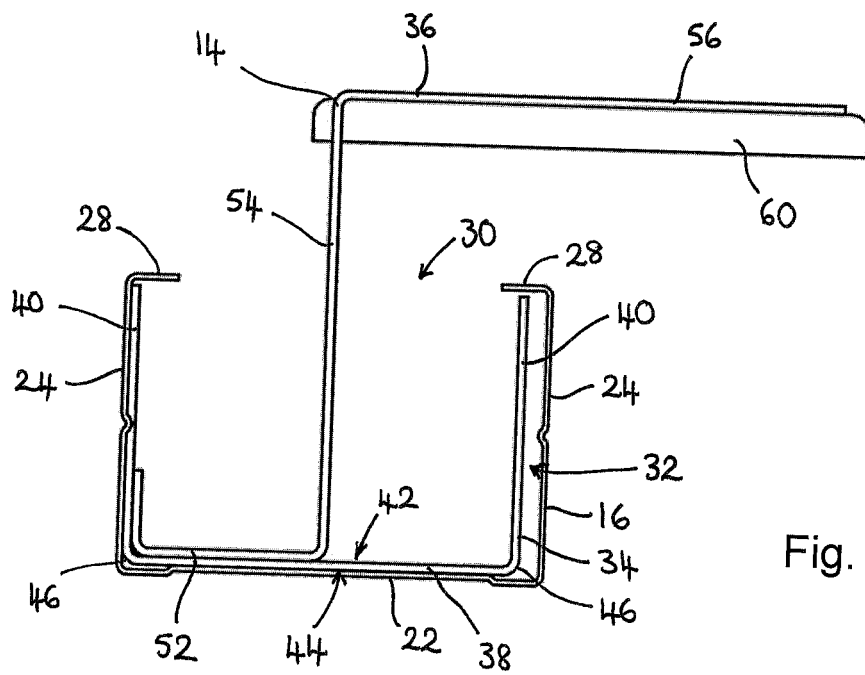
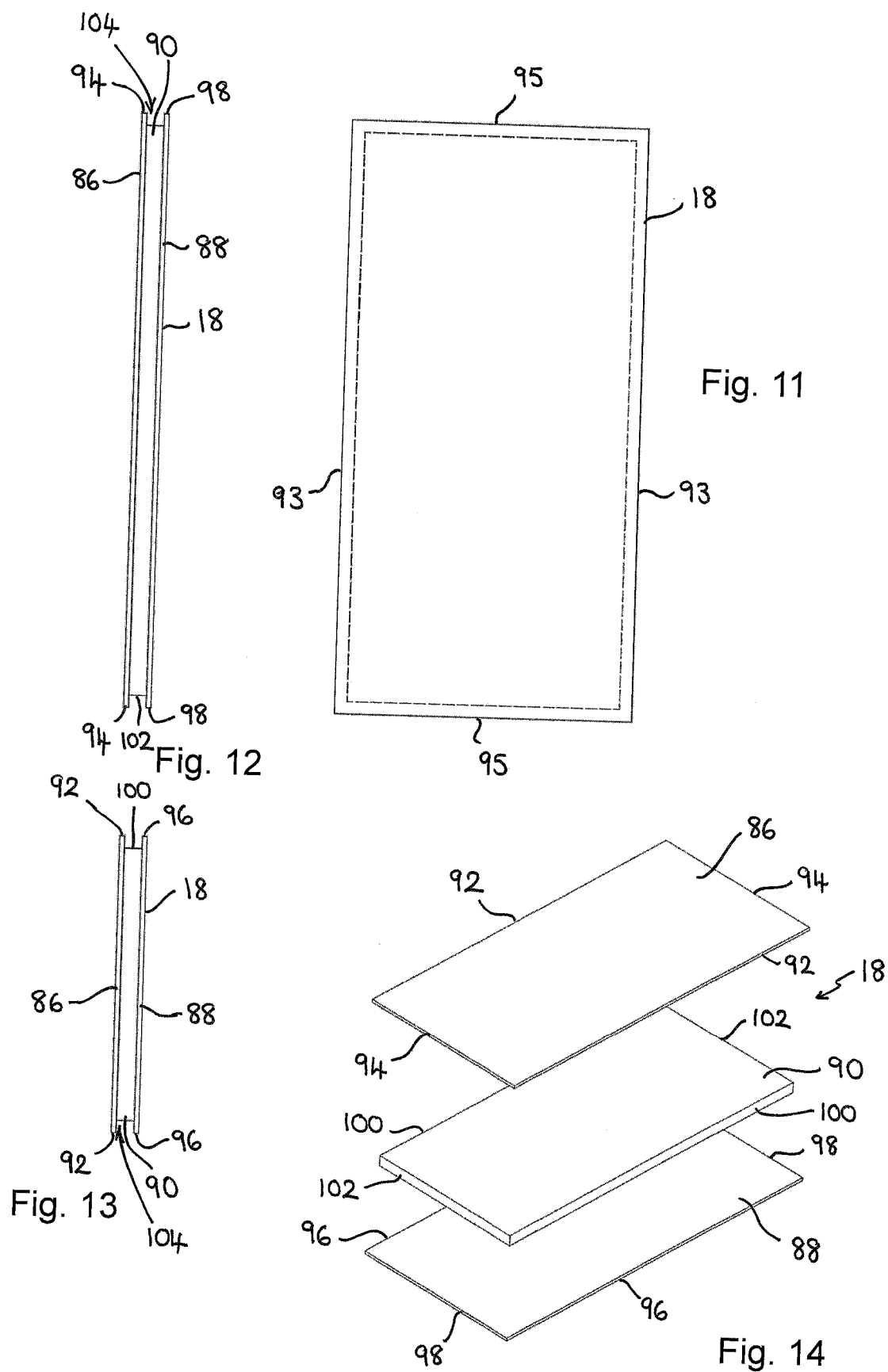
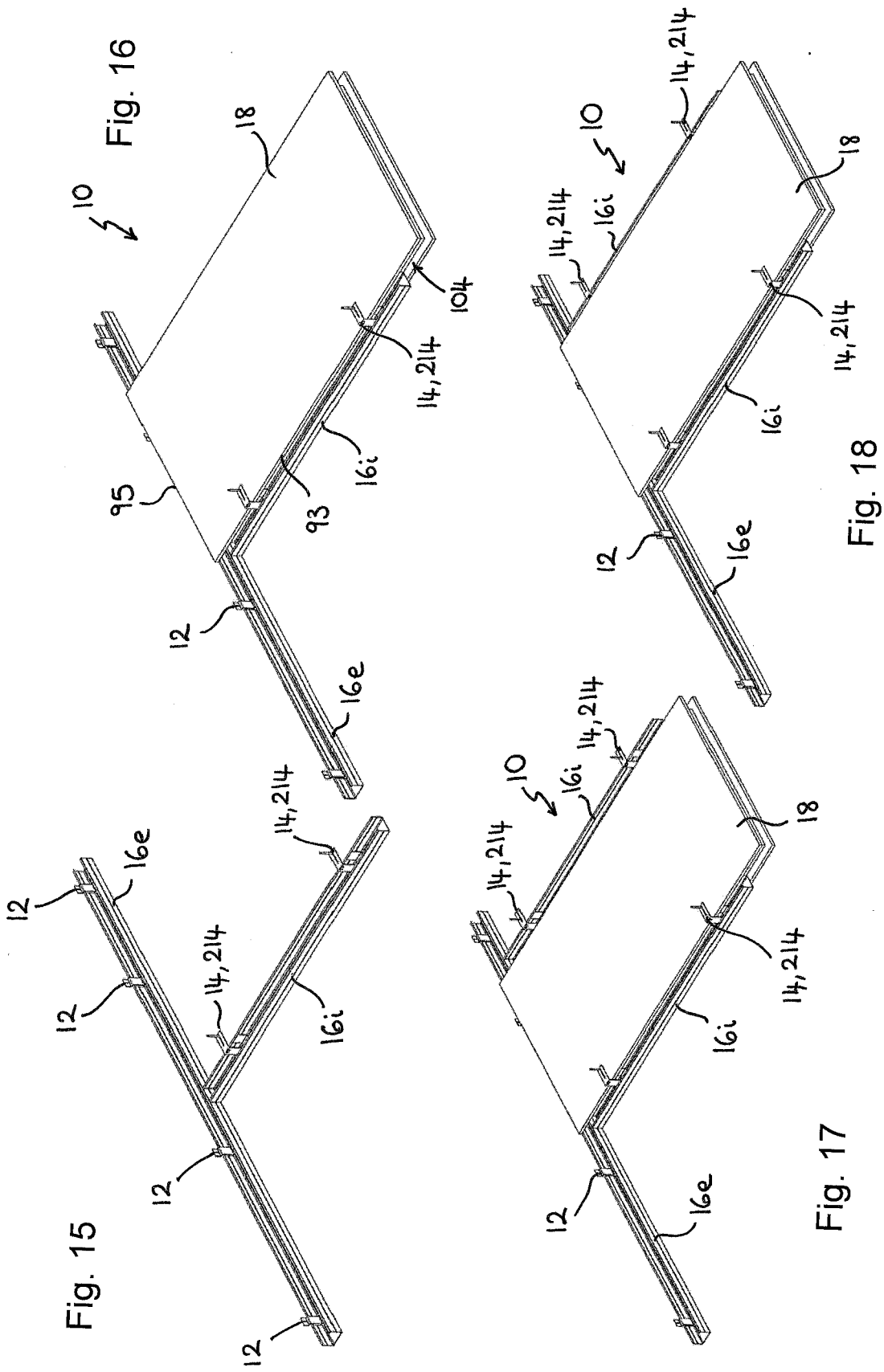
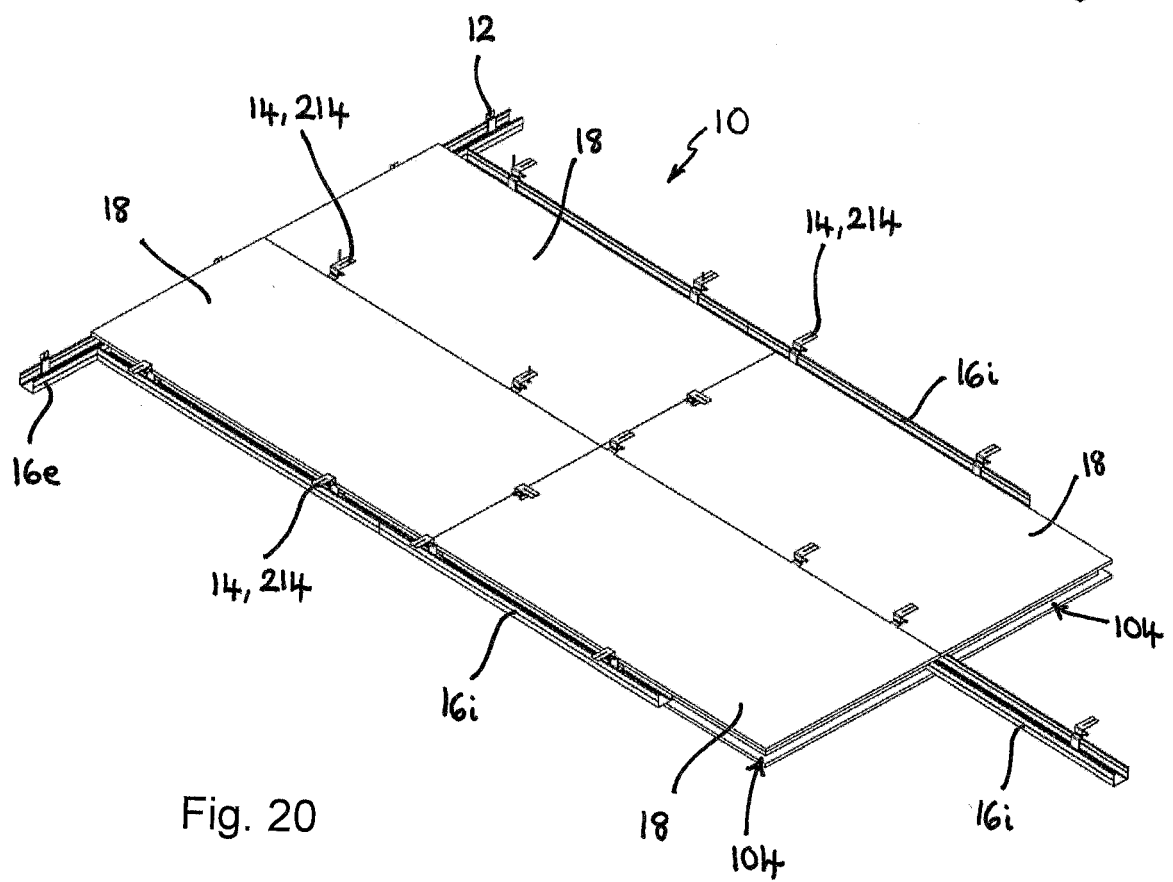
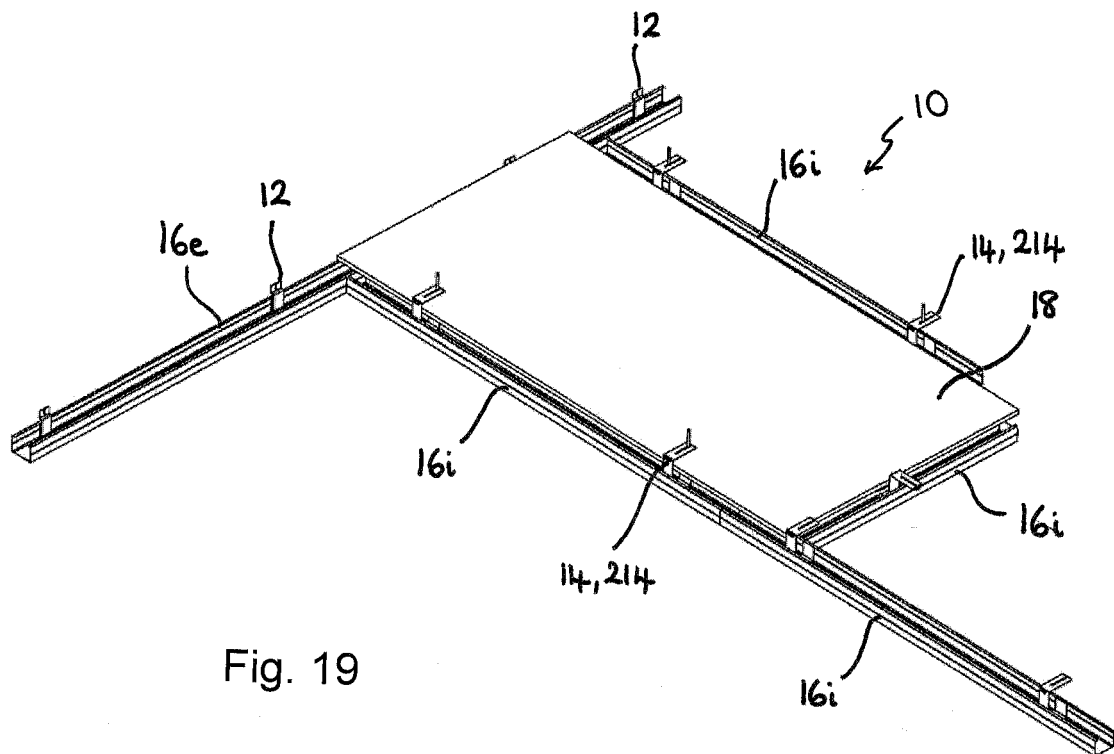


Fig. 10







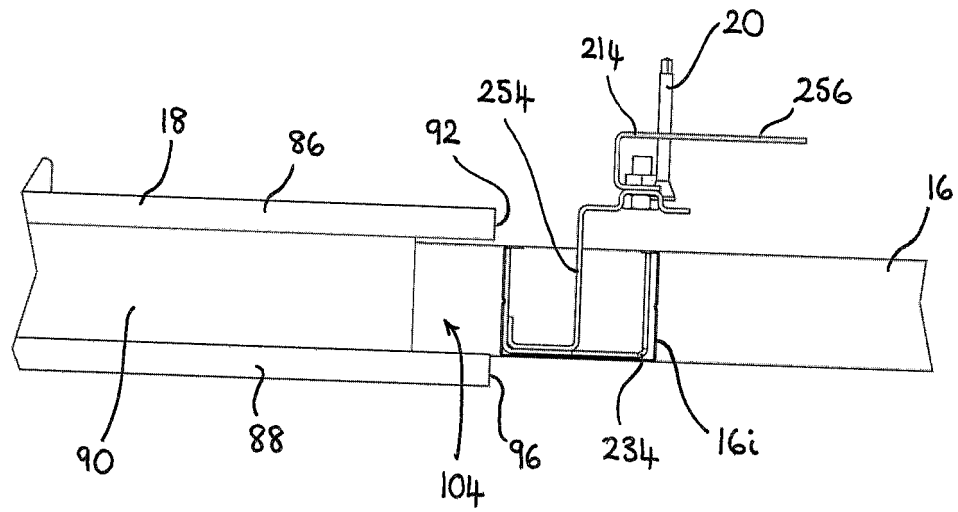


Fig. 21

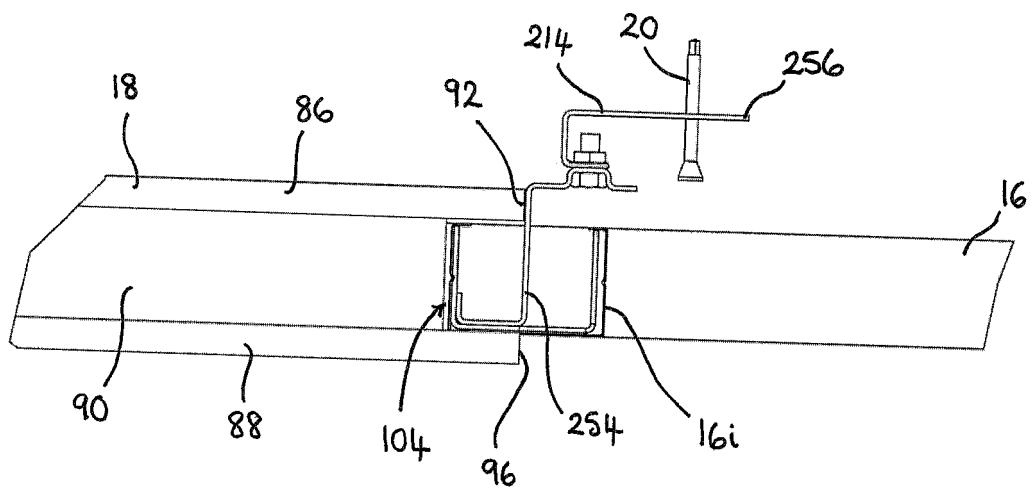


Fig. 22

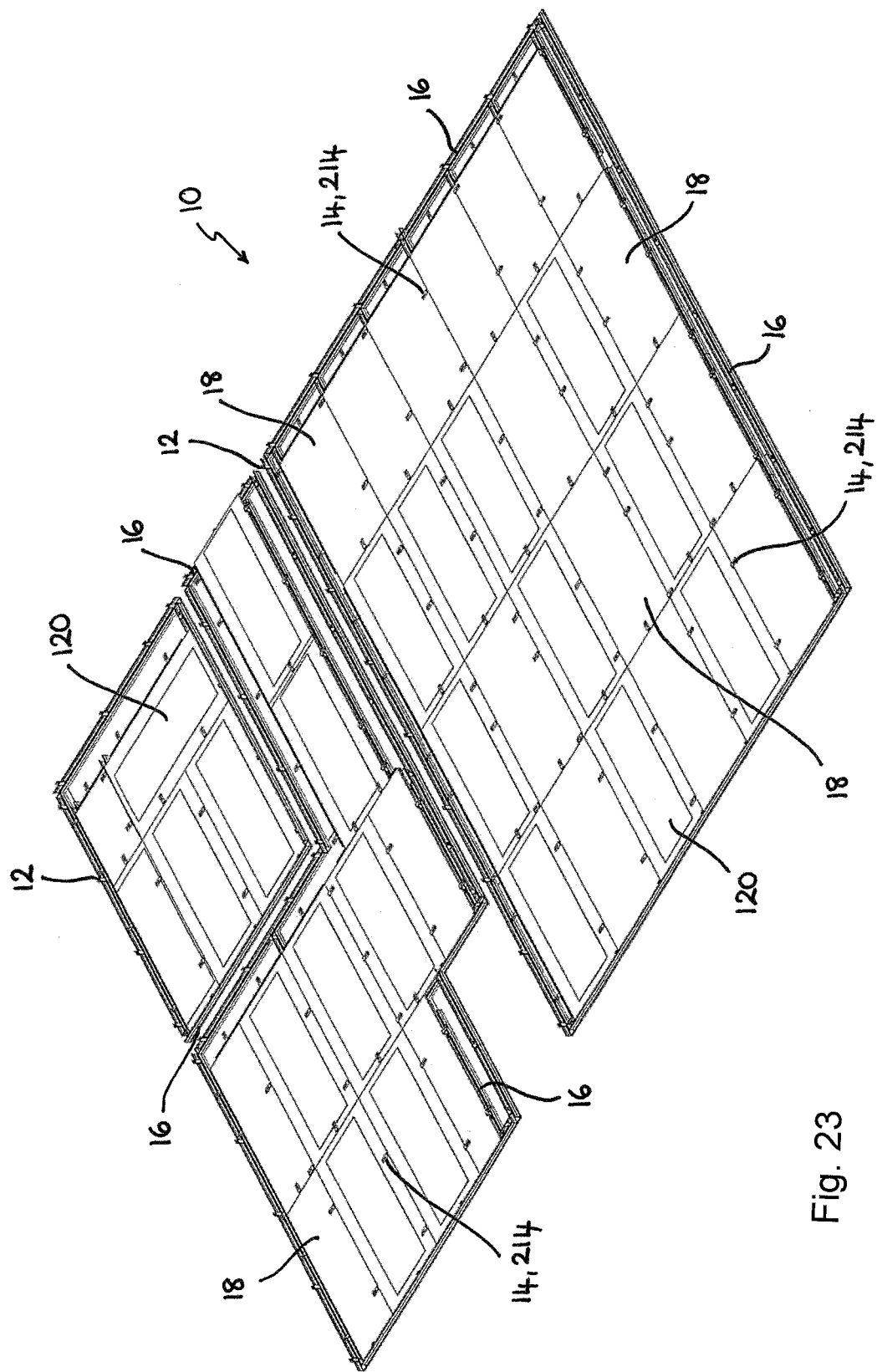
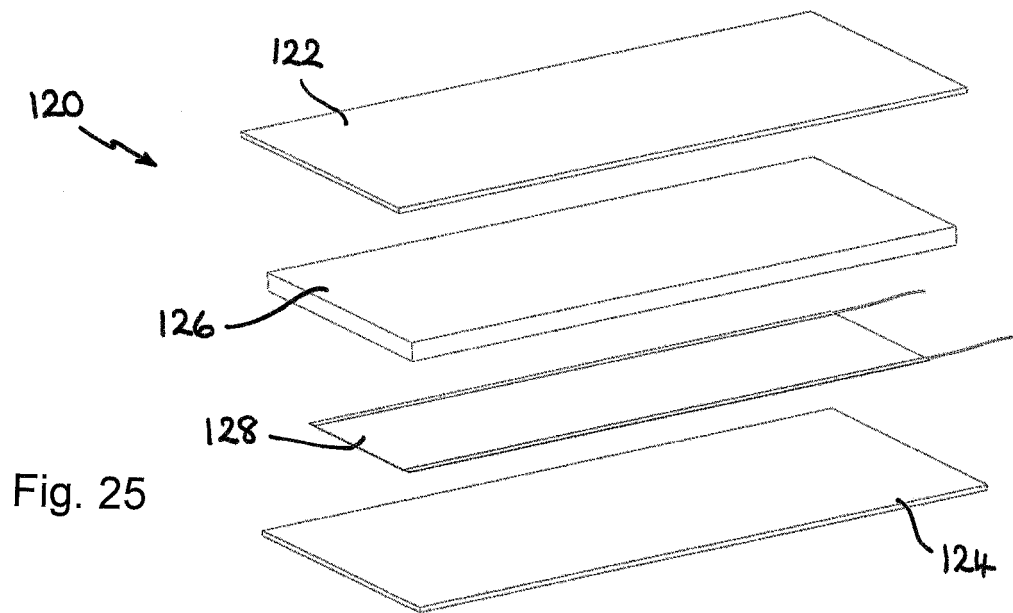
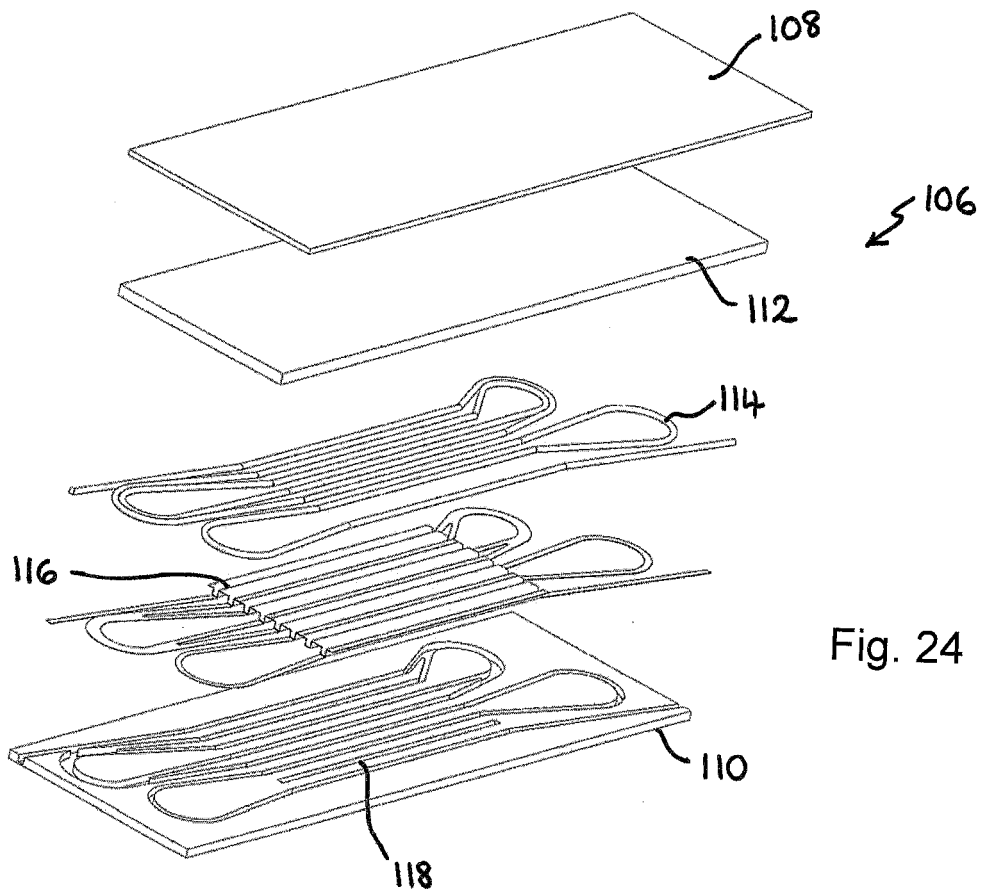


Fig. 23



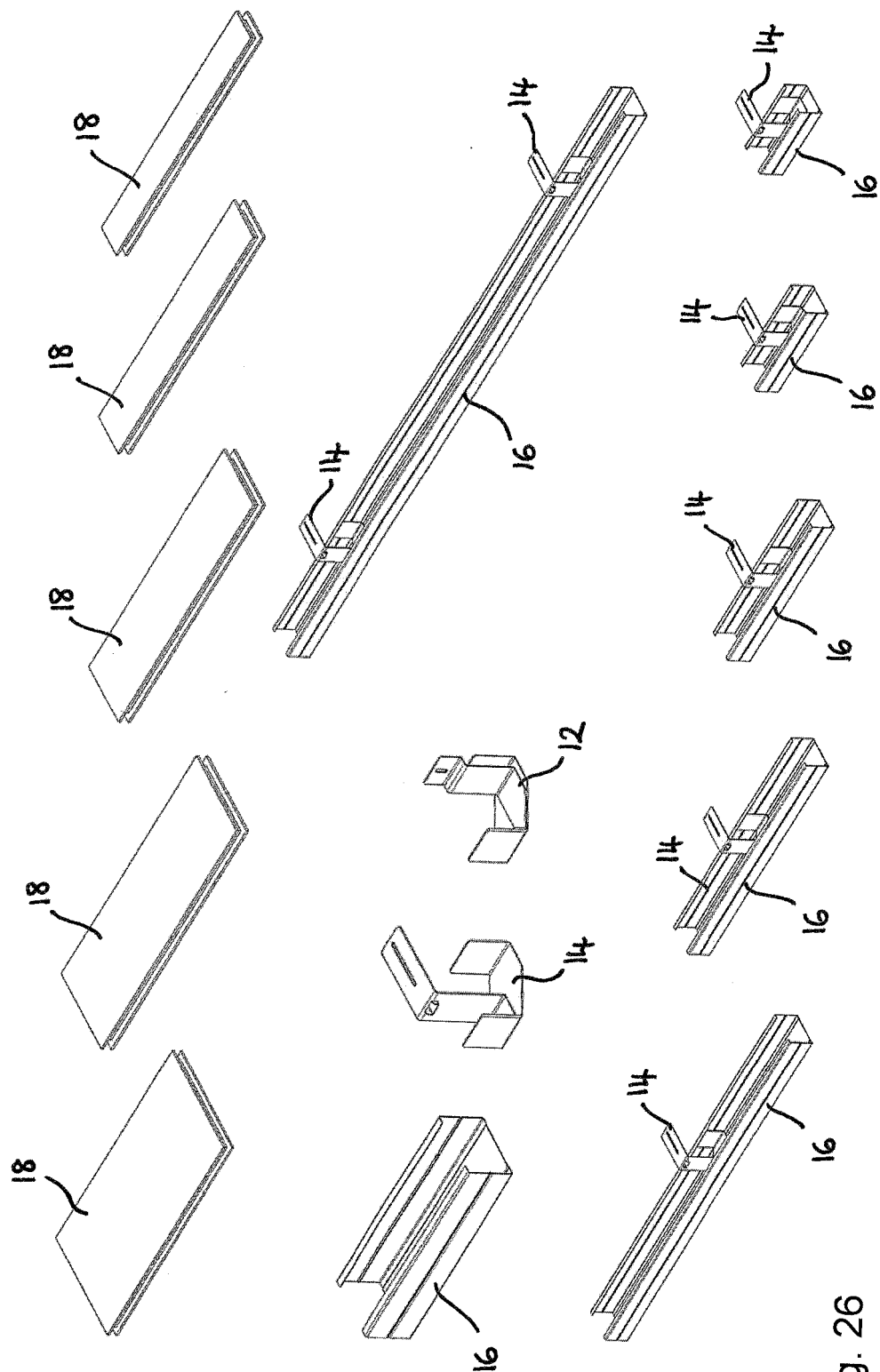


Fig. 26