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(54) A SUSPENDED CEILING

(57) A suspended ceiling having two or more ceiling tiles each including a tile mount; a node supporting adjacent vertices of the two ceiling tiles; and a fixing arrangement for fixing the tile mount of the ceiling tiles to the node. The node includes a suspension arrangement

for suspending the node from above; and a pivotable locating arrangement for locating at least one of the ceiling tiles in a non-coplanar relationship with the other ceiling tile, the non-coplanar relationship being within a pre-determined angular range.

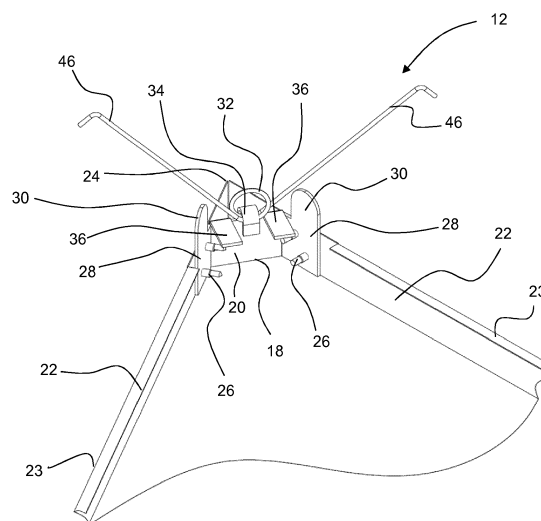


FIG. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a suspended ceiling, more specifically but not exclusively to a suspended ceiling comprising an adjustable node.

BACKGROUND OF THE INVENTION

[0002] Suspended ceiling systems, often referred to as a dropped or secondary ceiling, are known in the art and are typically provided a distance below a structural floor slab or roof of a building. Such ceiling systems are often provided in the form of a planar surface comprising a series of tiles supported by a grid or a series of nodes. The use of suspended ceiling results in a void being provided above for the provision of services such as air conditioning, lighting, wiring, piping etc. in said space, resulting in a more aesthetically pleasing appearance. Additionally the suspended ceiling may improve the acoustics and insulation of the space below. Usually such ceilings are planar, or adopt simple geometric forms.

[0003] In recent years, it has become desirable for suspended ceilings, particularly those of large public buildings, to have more "organic" forms that curve on one or two axes and are less regular. Typically, in order to provide for a curved or non-planar suspended ceiling surface, polygonal shapes having different sizes and/or different shapes are required to be individually located at a desired location in a particular arrangement to achieve a particular form. This results in increased cost and time of bespoke manufacturing and increases the complexity of constructing a non-planar suspended ceiling system due to the requirements of different sizes and shapes of tiles.

[0004] The present invention aims to overcome or at least mitigate one or more of the problems associated with the prior art.

SUMMARY OF THE INVENTION

[0005] A first aspect of the invention provides for a suspended ceiling comprising: two ceiling tiles each comprising a tile mount; a node supporting adjacent vertices of the two ceiling tiles; and a fixing arrangement for fixing the tile mount of the ceiling tiles to the node, wherein the node comprises a suspension arrangement for suspending the node from above; and a pivotable locating arrangement for locating at least one of the ceiling tiles in a non-coplanar relationship with the other ceiling tile, the non-coplanar relationship being within a pre-determined angular range.

[0006] Advantageously, this arrangement enables a non-planar suspended ceiling to be fitted which are more "organic" in its form and that is able to curve on one or two axes about the node.

[0007] Each tile mount may comprise a tile bracket co-

operable with the locating arrangement for pivotably mounting the ceiling to the node.

[0008] Advantageously, this engagement between the bracket and the locating arrangement maintains the orientation of the ceiling tile with respect to the node.

[0009] The tile bracket may comprise a rounded region engageable with the locating arrangement.

[0010] The tile bracket may be separate from the ceiling tile and securable thereto.

[0011] The locating arrangement may comprise an alignment member configured for aligning a first edge of one ceiling tile substantially flush with an adjacent edge of the other ceiling tile. The alignment member may be in the form of a recessed region. The recessed region may be arranged radially on the node.

[0012] Advantageously, the provision of an alignment member enables adjacent tiles to be located flush with each other so as to improve the overall appearance of the suspended ceiling.

[0013] The fixing arrangement may comprise a resilient element for flexibly retaining the ceiling tile on the locating arrangement.

[0014] Advantageously, this provides an easy way of securing the ceiling tile to the node while ensuring that the ceiling tile can pivot with respect to the node.

[0015] The resilient element may releasably fix or secure the ceiling tile on the locating arrangement.

[0016] The resilient element may be a spring, preferably maybe a torsion spring. The spring may be associated with the tile bracket.

[0017] Preferably, the tile bracket may comprise a hook and the spring is mounted on said hook.

[0018] The fixing arrangement may comprise an elongate slot in the node for receiving the spring therethrough.

[0019] Preferably, the elongate slot is arranged substantially tangentially on the node.

[0020] Advantageously, providing an elongate slot that is tangential enables a spring to be positioned perpendicular to the plane through the node and allows the node plate to be more compact whilst preventing the arms of springs of adjacent ceiling tiles from interfering and entangling with each other.

[0021] The node may be provided in the form of a plate.

[0022] Preferably, the suspension arrangement is pivotable with respect to the node.

[0023] More preferably, the suspension arrangement is rotatable with respect to the node.

[0024] Yet more preferably, the tile mount is slidably fixed to the locating arrangement.

[0025] A second aspect of the invention provides for a node for a suspended ceiling, the node comprising: a suspension arrangement for suspending the node from above; a fixing arrangement for fixing two ceiling tiles to the node; and a pivotable locating arrangement for locating a ceiling tile in a non-coplanar relationship with the another ceiling tile, the non-coplanar relationship being within a pre-determined angular range.

[0026] The node may be provided in the form of a plate.

[0027] The locating arrangement may comprise an alignment member, optionally in the form of a recessed region of the plate. The recessed region may be in the form of a slot.

[0028] Optionally the alignment member is arranged radially on the plate.

[0029] The node may comprise an elongate slot for receiving a fixing arrangement.

[0030] Preferably, the elongate slot is arranged substantially tangentially on the node.

[0031] A third aspect of the invention provides for a ceiling tile for a suspended ceiling, the ceiling tile comprising: a tile mount for pivotably mounting the ceiling to a node.

[0032] Preferably the tile mount is a tile bracket.

[0033] The tile bracket may comprise a rounded region for engaging a node.

[0034] The tile bracket may be separate from the ceiling tile and secured thereto.

[0035] Preferably the tile bracket further comprises two opposing flanges wherein the tile bracket is secured to the two opposing flanges and defining a central region extending therebetween.

[0036] The ceiling tile may comprise a spring for biasing the ceiling tile onto a node. Preferably the spring is associated with the central region of the tile bracket.

[0037] The tile bracket may comprise a hook and the spring is mounted on said hook. Preferably the spring is a torsion spring.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is an isometric view viewed from below of a suspended ceiling according to an embodiment of the present invention comprising ceiling tiles and nodes;

Figure 2 is an enlarged isometric view viewed from above of a ceiling tile of the suspended ceiling of Figure 1;

Figure 3 is an isometric view of a node of the suspended ceiling of Figure 1;

Figure 4 is an enlarged isometric underside view of the suspended ceiling of Figure 1 with two tiles removed for clarity;

Figure 5 is an enlarged isometric top view of the suspended ceiling of Figure 1;

Figure 6 is a side cross-sectional view of suspended ceiling comprising two ceiling tiles mounted to a node in a co-planar state;

Figure 7 is a side cross-sectional view of the suspended ceiling of Figure 6 in a retracted co-planar state;

Figure 8 is a side cross-sectional view of the suspended ceiling of Figure 6 in a first articulated state;

Figure 9 is a side cross-sectional view of the suspended ceiling of Figure 6 in a second articulated state;

Figure 10 is an isometric top view of a suspended ceiling according to an embodiment of the invention comprising ceiling tiles and a node;

Figure 11 is an isometric view viewed from below of the suspended ceiling of Figure 10, with two tiles removed for clarity;

Figure 12 is an isometric view of the suspended ceiling of Figure 10 with five of the ceiling tiles removed for clarity;

Figure 13 is an isometric view of a ceiling tile of the suspended ceiling of Figure 10;

Figure 14 is an isometric view of a tile bracket of the suspended ceiling of Figure 10;

Figures 15A to 15D are side views of the suspended ceiling of Figure 13 in an extended co-planar state, a retracted co-planar state, a first articulated state, and a second articulated state, respectively; and

Figures 16A to 16C are end views of the bracket and node of the suspended ceiling of Figure 13, with the ceiling tile removed for clarity, in a co-planar state, a first articulated state, and a second articulated state, respectively.

DETAILED DESCRIPTION OF EMBODIMENT(S)

[0039] Referring firstly to Figure 1, a suspended ceiling according to an embodiment of the present invention is indicated generally at 10. The suspended ceiling 10 comprises a plurality of ceiling tiles 12 positioned around a node 14. In the illustrated embodiment, there are six ceiling tiles 12 provided in the form of triangles that are positioned around and secured to each node 14. In alternative embodiments, it will be appreciated that a different shaped or sized ceiling tile 12 may be used. For example, square or pentagonal ceiling tiles 12 would result in four or five ceiling tiles 12 being positioned around each node 14, and that any suitable number of tiles may be used in a suspended ceiling 10 according to the present invention. In a further alternative embodiment, the corners or edges of the node plate 16 may be smoothed or rounded. This would avoid the eye being drawn to any misalign-

ments of ceiling tiles, if present, and would also reduce handling risks.

[0040] Further, whilst each tile is shown as being identical in this embodiment, in other embodiments, the suspended ceiling may be formed from a limited number (e.g. two) different shapes and/or sizes of tile. Whilst the tiles in this embodiment have been shown as forming a substantially uninterrupted tessellating form, in other embodiments non-uniform gaps may be provided between tiles (e.g. if the tiles are circular).

[0041] Additionally, it will be appreciated that nodes 14 which are provided at the sides or at corners of a suspended ceiling 10 may only comprise one or two ceiling tiles 12 secured thereto.

[0042] Referring now to Figure 2, a ceiling tile is indicated generally at 12. The ceiling tile 12 comprises a flange member 22 extending around its periphery and converging at a point at each apex 24 thereof. A stiffening lip 23 of the flange is omitted adjacent to each apex 24 so as to accommodate a tile bracket 18. In the illustrated embodiment, the tile mount is provided in the form of a tile bracket 18. The tile bracket 18 is provided proximate to the apex 24 of the ceiling tile 12 and is secured to the two opposing flanges via a plurality of fasteners 26, (e.g. self-tapping screws in this embodiment), or alternatively by spot welding, gluing etc..

[0043] The tile bracket 18 is formed from a central region 20 and two wings 28 which are provided at opposing sides of the central region 20 and are angled with respect to the central region. The angle of the wings 28 is selected so as to conform to the opposing flanges 22 of the ceiling tile 12, which results in the central region 20 of the tile bracket 18 extending linearly, e.g. transversely, between the two flange members 22. In the illustrated embodiment, the tile bracket 18 is a separate component to the ceiling tile 12, and is secured thereto via the fasteners 26. However, in alternate arrangements, the tile bracket may be formed integrally with the ceiling tile 12. The wings 28 of the tile bracket 18 are further provided with two pivot points 30, which protrude upwardly from the flange members 22 when the tile bracket 18 is secured to the ceiling tile 12. In the illustrated embodiment, the pivot points are provided in the form of curved regions 30, but it will be appreciated that the pivot points may be pointed (e.g. triangular), or any other suitable shape.

[0044] A fixing arrangement, in the form of a flexible retaining element 32 is further provided on the ceiling tile 12 for fixing the tile bracket 18 to the node plate 16 when assembled. In the illustrated embodiment, the flexible retaining element 32 is provided in the form of a torsion spring, although any suitable element may be used. The spring 32 is positioned on the central region 20 of the tile bracket 18, extending transversely across the apex, and is secured to the bracket by a hook 34 provided on the central region 20 of the bracket. However, it will be appreciated that any suitable attachment means may be used. The spring 32 is held on the hook by supporting members 36 provided on opposing sides of the hook 34.

It will be appreciated that the tile bracket 18 may also be manufactured from a sheet metal stamping that is folded to form the features described above.

[0045] With reference to Figure 3, the node 14 is provided with a substantially flat plate 16, for example a sheet metal stamping. In the illustrated embodiment, the plate 16, is in the form of a hexagonal plate corresponding to the six ceiling tiles 12 secured thereto. If three ceiling tiles 12 are provided for each node 14 the plate 16 may be provided in the form of a triangle. However, it will be appreciated that any other suitable shapes of the node plate 16 may be used and that the plate 16 need not be limited to a polygonal shape that has the same number of sides as there are ceiling tiles 12 secured thereto.

[0046] The node plate 16 is provided with a pivotable locating arrangement 42 for locating a ceiling tile in a non-coplanar relationship with another ceiling tile and with the node plate, the non-coplanar relationship being within a pre-determined angular range. In this embodiment, the range with respect to the node plate 16 is approximately 80°, being around +60° and -20° before contact with the node plate inhibits further rotation. It will be readily envisaged that in other embodiments the arrangement may be reconfigured to achieve a range of up to 180°, 270°, or even full rotational freedom.

[0047] In the illustrated embodiment, the pivotable locating arrangement is in the form of an alignment member which is provided as elongate recesses in the underside of the node plate 16, which may be formed as part of the stamping process. In alternative embodiments, the locating arrangement could be in the form of perforations in the node plate 16, or may be in the form of a separate component which is secured to the node plate. The recesses 42 are arranged generally radially on the node plate 16 and are configured to receive and locate the curved regions 30 of the tile bracket 18 when the suspended ceiling 10 is assembled. As such, the recesses 42 have been found to inhibit the node plate rotating about its vertical axis and causing the adjacent tiles 12 to clash. The ceiling tiles may be permitted a degree of rotational offset from a true radial position. In this embodiment, the ceiling tiles are permitted a maximum offset within an angular range of $\pm 2.5^\circ$, although the angular range may be greater or less than this in other embodiments. It will be appreciated that in alternative arrangements, the node plate may not be provided with a pivotable locating arrangement.

[0048] The node plate 16 is also provided with a fixing arrangement 44 for fixing the ceiling tile 12 to the node. In the illustrated embodiment, the fixing arrangement is provided in the form of a series of apertures or longitudinal slots 44 which are arranged tangentially around the node plate 16 intermediate corresponding to pairs of recesses 42. More specifically, the orientation of the elongate slots 44 are tangential to a circle described about the centre of the node plate 16. The elongate slots 44 are configured to receive the spring 32 therethrough when the suspended ceiling 10 is assembled.

[0049] The node 14 is further provided with a suspension arrangement 38 provided in the form of a bracket for suspending the node 14 from above. The bracket 38 is secured to the node plate 16 via a fastener 40 which enabled the node plate to rotate with respect to the bracket to further improve the freedom of movement of the adjustable node. Additionally, the bracket 38 is provided in two sections which are able to pivot so as to enable the node plate 16 to pivot with respect to the suspension means (e.g. a wire, a rod or the like, not shown).

[0050] Referring now to Figures 4 and 5, the assembled node 14 and ceiling tiles 12 are illustrated in more detail from above and below, and in Figure 5 two of the assembled ceiling tiles 12 have been omitted so as to improve clarity. The tile brackets 18 of the two omitted ceiling tiles are incorporated so as to illustrate the interaction with the node plate 16.

[0051] Prior to assembly of the suspended ceiling system, a complex surface of a required suspended surface will be designed using CAD and a desired shape and size of ceiling tile and node will be selected, e.g. six triangular ceiling tiles per hexagonal node as is illustrated.

[0052] Firstly, a suspension means, e.g. a rod, is suspended from a structural slab, roof or ceiling of a room or space. Each rod is then secured to a corresponding node, where the length of the rod provided for each node may be different from those adjacent thereto. This arrangement results in an array of nodes suspended from a ceiling by varying distances, so as to define the required suspended ceiling profile.

[0053] The torsion spring is depressed laterally inwards and is inserted through the elongate aperture in the node plate. The depressive force is released and the torsion spring expands laterally so as to engage with the opposing ends of the aperture. The connection of the ceiling tile to the node via a spring is able to maintain tension and hold the ceiling tile up throughout the specified range of articulation. The force from the spring urges the curved regions 30 into contact with the pivotable locating regions 42 so as to align the ceiling tile with the node. This process is then repeated for the remaining ceiling tiles which are to be secured to the node. Due to the orientation of the elongate slots, and hence the springs, the arms of the springs of adjacent ceiling tiles will overlap in a manner that allows the node plate to be more compact without the springs 32 of the adjacent ceiling tiles 12 interfering and entangling with each other. This arrangement urges the curved regions of the tile bracket into cooperation with the recesses of the plate so as to provide the required pivotal connection. The ability to adapt is important as it allows a standard system to meet a vast range of surface configurations. The arrangement of the tile bracket and the recess also enables the ceiling tile to move towards or away from the centre of the node as required within a specified range.

[0054] A preferred application of this adaptive system is by mapping a standard system design onto a complex surface, typically provided by an architect designed using

CAD. The standard system can be manipulated by adjustment of node position to generate the desired surface without having to design a bespoke framework. This system may also greatly improve the transition from architects design to manufacture and installation. It may be possible to provide a software plug in for popular architectural programs such as 'Revit' ^{RTM} and 'Rhino' ^{RTM}. Such a plug-in could allow the architect to generate the final details themselves with a bill of materials being produced by the software, ready to manufacture and install, greatly reducing design time required to generate complex surfaces.

[0055] When constructed, the tile bracket 18 of each ceiling tile 12 is cooperable with the node plate 16 so as to pivotally secure the ceiling tile thereto. More specifically, the curved portions 30 of the wings 28 of the tile bracket 18 engage with the recessed regions 42 of the node plate 16. The curved regions 30 enable the tile bracket 18 and hence the ceiling tile 12 to pivot with respect to node member 16.

[0056] Referring to Figures 6 to 9, a node 14 having two ceiling tiles 12 assembled thereon is illustrated showing different working positions of the suspended ceiling 10. As can be seen in Figure 8, the curved regions 30 of the tile bracket 18 are able to slide along the recesses 42. The variation of the separation between the vertices 24 of the ceiling tiles 12 enables a greater space to be provided between the ceiling tiles 12 so as to further increase the adjustability of the suspended ceiling system 10.

[0057] Figure 7 illustrates a node 14 of the suspended ceiling 10 where the ceiling tiles 12 are substantially coplanar. When a node 14 is raised via the suspension arrangement 38 with respect to surrounding nodes of the suspended ceiling system 10, the ceiling tiles 12 coupled to the node 14 pivot with respect to each other, as is illustrated in Figure 8. Alternatively, if the node 14 is lowered with respect to surrounding nodes of the suspended ceiling system 10, the ceiling tiles 12 coupled to the node 14 pivot with respect to each other, as is illustrated in Figure 10.

[0058] Referring now to Figures 10 to 13, a suspended ceiling according to an embodiment of the present invention is indicated generally at 110. Corresponding components of this embodiment are labelled 100 higher with respect to the embodiment of Figures 1 to 9, and only differences are discussed in more detail.

[0059] Referring firstly to Figures 10 and 11, the suspended ceiling 110 comprises a plurality of ceiling tiles 112 positioned around a node 114. The tile bracket 118 is provided proximate to the apex 124 of the ceiling tile 112 and is secured to the two opposing flanges 122 via two self-tapping screws 126. It will be appreciated that the bracket 118 may be secured to the tile 112 by spot welding, gluing, or any other suitable arrangement. It will further be appreciated that the tile bracket 118 may alternatively be integrally formed with the ceiling tile 112, e.g. by being stamped from the same blank as the flanges

122.

[0060] The node 114 is further provided with a suspension arrangement 138 provided in the form of a bracket for suspending the node 114 from above. The bracket 138 is secured to the node plate 116 via a fastener 140, which enables the node plate to rotate with respect to the bracket 138 to further improve the freedom of movement of the adjustable node 114. Additionally, the bracket 138 is provided in two sections, which are able to pivot so as to enable the node plate 116 to pivot with respect to the suspension means 139 (e.g. a wire, a rod or the like).

[0061] Referring now to Figure 12, the node 114 and ceiling tile 122 are illustrated in more detail. The node 114 is provided with a substantially flat plate 116, for example a sheet metal stamping. In the illustrated embodiment, the plate 116 is in the form of a dodecagonal plate corresponding to the six ceiling tiles 112 secured thereto. Such an arrangement improves the appearance of the node plate 116 when viewed from below, through the gaps between the ceiling tiles 122 forming the ceiling 110. However, it will be appreciated that the shaped of the node plate 116 may be adjusted to any suitable shape to suit the application/installation.

[0062] The node plate 116 is further provided with a pivotable locating arrangement 142 for locating a ceiling tile 112 in a non-coplanar relationship with another ceiling tile 112 and with the node plate 116, the non-coplanar relationship being within a pre-determined angular range. In the illustrated embodiment, the pivotable locating arrangement 142 is in the form of an alignment member, which is provided as an elongate locating slot 142 in the node plate 116. The slots 142 are arranged generally radially on the node plate 116, and are configured to pivotally engage the tile bracket 118 to the node 114.

[0063] Referring to Figures 13 and 14, the ceiling tile 112 and tile bracket 118 are illustrated in more detail. The tile bracket 118 is formed from a central region 120 and two wings 128, which are provided at opposing sides of the central region 120, and are angled with respect to the central region. The angle of the wings 128 is selected so as to conform to the angles of the opposing flanges 122 of the ceiling tile 112, which results in the central region 120 of the tile bracket 118 extending linearly, e.g. transversely, between the two flange members 122. In order to accommodate the bracket 118, the flanges 122 terminate short of the apex 124. To secure the tile bracket 118 to the ceiling tile 112, the wings 128 are provided with upper regions 129 that are folded over to substantially conform to the underside of the flanges 122. A screw 126 is then used to secure the flanges 122 and the wing regions 129 together, to secure the tile bracket 118 to the ceiling tile 112.

[0064] The ceiling tile 112 is mounted to the node 114 via a resilient member, as has been described for Figures 1 to 9. The spring 132 is positioned on the central region 120 of the tile bracket 118, extending transversely across the apex 124, and is secured to the bracket by a hook

134 provided on the central region 120 of the bracket. However, it will be appreciated that any suitable attachment means may be used.

[0065] As is illustrated in Figure 14, the spring 132 is mounted over the hook 134, and the hook is then bent so as to secure the spring 132 on the hook 134. Each of the upper regions 129 of the tile bracket 118 is provided with a notch 131. The notch 131 is provided on an inward facing edge 133 of the regions 129. When mounting the spring 132 to the bracket 118, the spring is depressed laterally inwards and is inserted through the elongate spacing between the edges 133 and the hook 143. The depressive force is released and the arms of the spring 132 expand laterally so as to engage with the notches 131. The notches 131 work to keep the spring 132 in a generally fixed position during tile assembly and after installation of the suspended ceiling.

[0066] The central region 120 includes a pivoting member 146 that protrudes upwardly from the central region 120 of the tile bracket 118. The pivoting member 146 protrudes upwardly from the flange members 122, when the tile bracket 118 is secured to the ceiling tile 112. The pivoting member 146 is provided with a central section 148, having a shoulder portion 150 on each side thereof. In the illustrated embodiment, the pivoting member 146 is curved on the upper surface thereof, i.e. it includes a curved central section 150 and curved shoulder portions 152. Specifically, the upper surface of the central portion 148 is curved towards the shoulder portion, i.e. substantially downwardly, and the shoulder portions 150 are curved towards the respective wing portion 128 of the bracket 118. However, it will be appreciated that the pivoting member 146 may be pointed (e.g. triangular), or any other suitable shape. The central section 148 of the pivoting member 146 also functions as an alignment feature, and this is discussed in more detail below.

[0067] The tile bracket 118 arrangement provides similar degrees of freedom as the embodiment illustrated in Figures 1 to 9. However, the tile bracket 118 provides a pivot point between the ceiling tile 112 and the node 114 that is located closer to the apex 124 of the ceiling tile 112. Such an arrangement has been found to provide improved alignment between adjacent ceiling tiles 112 when they are not orientated in the same plane (e.g. as is illustrated in Figures 15C, 15D, 16B and 16C). Furthermore, with this arrangement of tile bracket 118, the lip of the flange 122 is able to extend closer to the apex 124, due to the pivot point being provided on the central section 120 of the tile bracket 118, and hence closer to the apex 124 of the ceiling tile 112.

[0068] The radial slots 142 are configured to receive and locate the central section 148 of the pivoting member 146 of the bracket 118, when the suspended ceiling 110 is assembled (as discussed below). The width of the slots 142 are configured to substantially conform to the width of the central section 148, and the arrangement has been found to limit or prevent the node plate 116 rotating about its vertical axis and causing the adjacent tiles 112 to

clash. The node plate 116 is also provided with a fixing arrangement 144 for fixing the ceiling tile 112 to the node plate, similar to that described for Figures 1 to 9. The fixing arrangement is provided in the form of an elongate slot 144, which is configured to receive the spring 132 therethrough, when the suspended ceiling 110 is assembled. When constructed, the pivoting member 146 of the tile bracket 118 of each ceiling tile 112 is cooperable with the node plate 116, so as to pivotally secure the ceiling tile thereto. More specifically, the central section 148 of the pivoting member 146 engages with the slot 142 of the node plate 116 to pivotally secure the ceiling tile thereto. Accordingly, the central section 148 of the pivoting member 146 acts as both the pivot point and the alignment guide between the ceiling tile 112 and the node 116.

[0069] The torsion spring 132 is depressed laterally inwards and is inserted through the elongate aperture 144 in the node plate 116. The depressive force is released and the torsion spring 132 expands laterally so as to engage with the opposing ends of the aperture 144. The connection of the ceiling tile 112 to the node 116 via a spring 132 is able to maintain tension and hold the ceiling tile 112 up throughout the specified range of articulation. The force from the spring 132 urges the pivoting member 146 into contact with the slot 142 such that the central section 148 extends into said slot 142 to align the ceiling tile with the node. This arrangement of the tile bracket 118 and the slot 142 also enables the ceiling tile 112 to be moved towards or away from the centre of the node 116 as required within a specified range defined by the length of the slot 142. That is, the ceiling tile 112 is able to be moved between an extended orientation (as illustrated in Figure 15A) and a retracted orientation (as illustrated in Figure 15B), by sliding of the pivoting member 146 along the slot 144.

[0070] The elongate slots 142 are located between the fixing arrangements 144 and the centre of the node plate 116. Such an arrangement, which results from locating the pivoting member 146 of the tile bracket 118 proximate to the apex 124 of the ceiling tile 112, enables the overall size of the node plate 116 to be reduced. Furthermore, providing the locating arrangement in the form of a slot simplifies production of the node plate 116 as manufacture is a simple stamping operation. In alternative embodiments, the locating arrangement could be in the form of a separate component which is secured to the node plate.

[0071] Referring now to Figures 15A to 15D, the node 114 having a ceiling tile 112 assembled thereon is illustrated showing different working positions of the suspended ceiling 110. As discussed above, Figures 15A and 15B illustrate that the pivoting member 146 of the tile bracket 118 is able to slide along the slot 142 of the node plate 116 in a radial direction. The variation of the separation between the vertices 124 of the ceiling tiles 112 enables a greater space to be provided between the ceiling tiles 112 so as to further increase the adjustability of the suspended ceiling system 110. Both Figures 15A

and 15B illustrate an orientation where the node 114 and ceiling tile 112 are arranged in a substantially coplanar orientation.

[0072] Figure 15C illustrates an embodiment where the node 114 is lowered via the suspension arrangement 138 with respect to surrounding nodes 114 of the suspended ceiling system 110. That is, Figure 15C illustrates an embodiment where the ceiling tile 112 is angled downwardly towards the node 116. Conversely, Figure 15D illustrates an embodiment where a node 114 is raised via the suspension arrangement 120 with respect to surrounding nodes 114 of the suspended ceiling system 110, such that the ceiling tile 112 is angled upwardly towards the node 116.

[0073] When the ceiling tile 112 is urged into pivotal connection with node 114, the relative dimensions of the slot 142 combined with the central section 148 and the shoulders 150 permit the ceiling tiles to be rotationally offset from a true radial position. That is, the arrangement of the slot 142 and the central section 148 enables the ceiling tile to rotate about an axis defined by the longitudinal length of the slot 142. In this embodiment, the ceiling tiles are permitted a maximum offset within an angular range of $\pm 2.5^\circ$, although the angular range may be greater or less than this in other embodiments. Referring to Figures 16A to 16C, a node plate 116 with a tile bracket 118 assembled thereon is illustrated in various rotational orientations. The tile bracket 118, and hence the ceiling tile 112, is able to be adjusted/rotated from a substantially co-planar orientation (Figures 16A) to either of a first or second rotational state (as illustrated in Figures 16B and 16C). Such an arrangement enables a ceiling tile to be arranged in a non-coplanar relationship with another ceiling tile, within a pre-determined angular range.

[0074] Although the invention has been described above with reference to one or more preferred embodiments, it will be appreciated that various changes or modifications may be made without departing from the scope of the invention as defined in the appended claims.

[0075] Alternative fixing arrangements to those described above may be provided. For example, the ceiling tiles may hook into slots provided in the node. Such slots would be positioned and sized so as to allow directional movement towards and away from the centre of the node. The hooks may be provided with location features which provide a similar pivoting arrangement to that described with reference to the Figures.

[0076] The ceiling tiles may be releasably secured, e.g. bolted, to the node using a coil spring, or any other suitable spring may be used.

[0077] The tile mounts, e.g. tile brackets, may be provided with a linkage arrangement so as to provide the flexibility required. Adjacent ceiling tiles could then be pivotably attached to ceiling tiles without the need of a node plate.

[0078] The node plate may be replaced with a series of sprung profiles to enable the ceiling tile to be attached, e.g. clipped, onto a sprung profile which may be retained

by a recess on the ceiling tile. The shape of the recess and the sprung profile would allow the sliding and pivoting flexibility required.

[0079] The node plate may not be a pressed metal plate, and for example may be a plastics material which is thermoformed or injection moulded. Although, it will be appreciated that any suitable material and method of manufacture may be used to produce a node plate.

[0080] The spacing between adjacent ceiling tiles may be substantially covered by laterally extended flanges extending from the flange 22. Alternatively, the spacing between adjacent ceiling tiles may be covered by a separate component which is secured to one or both ceiling tiles. This would provide the appearance of on uninterrupted surface from a suitable distance.

Claims

1. A node for a suspended ceiling, the node comprising:

a suspension arrangement for suspending the node from above;
a fixing arrangement for fixing two ceiling tiles to the node; and
a pivotable locating arrangement for locating a ceiling tile in a non-coplanar relationship with another ceiling tile, the non-coplanar relationship being within a pre-determined angular range.

2. A node according to claim 1, wherein the node comprises a plate.

3. A node according to claim 1 or claim 2, wherein the locating arrangement comprises an alignment member, optionally wherein the alignment member is a recess, optionally wherein the alignment member is arranged radially on the node.

4. A node according to claim 3 wherein the recess is an elongate locating slot.

5. A node according to any preceding claim, wherein the fixing arrangement comprises an elongate slot for receiving a fixing arrangement of a ceiling tile.

6. A node according to any preceding claim wherein the fixing arrangement is arranged substantially tangentially on the node plate.

7. A node according to any preceding claim, wherein the suspension arrangement is pivotable and/or rotatable with respect to the fixing arrangement.

8. A ceiling tile for a suspended ceiling, the ceiling tile comprising:

a tile mount for pivotably mounting the ceiling tile to a node of a suspended ceiling, wherein the tile mount is a tile bracket, and the tile bracket comprises a pivoting member for pivotally engaging a node of a suspended ceiling.

9. A ceiling tile according to claim 6, wherein the pivoting member comprises a rounded region.

10. A ceiling tile according to any one of claims 8 or claim 9, further comprising two opposing flanges, wherein the tile bracket is secured to the two opposing flanges and defines a central region extending therebetween, preferably wherein the central region comprises the pivoting member.

11. A ceiling tile according to any one of claims 8 to 10, wherein the pivoting member is provided proximate an apex of the ceiling tile.

12. A ceiling tile according to any one of claims 8 to 11, wherein the ceiling tile comprises a fixing element, preferably a resilient element for biasing the ceiling tile onto a node.

13. A ceiling tile according to claim 11, wherein the fixing element comprises a spring, preferably wherein the spring is a torsion spring.

14. A suspended ceiling comprising:

a node according to any one of claims 1 to 7; and two ceiling tiles according to any one of claims 8 to 13,

wherein the node supports adjacent vertices of the two ceiling tiles.

15. A suspended ceiling according to claim 14, wherein the tile bracket is slideably mounted to the locating arrangement.

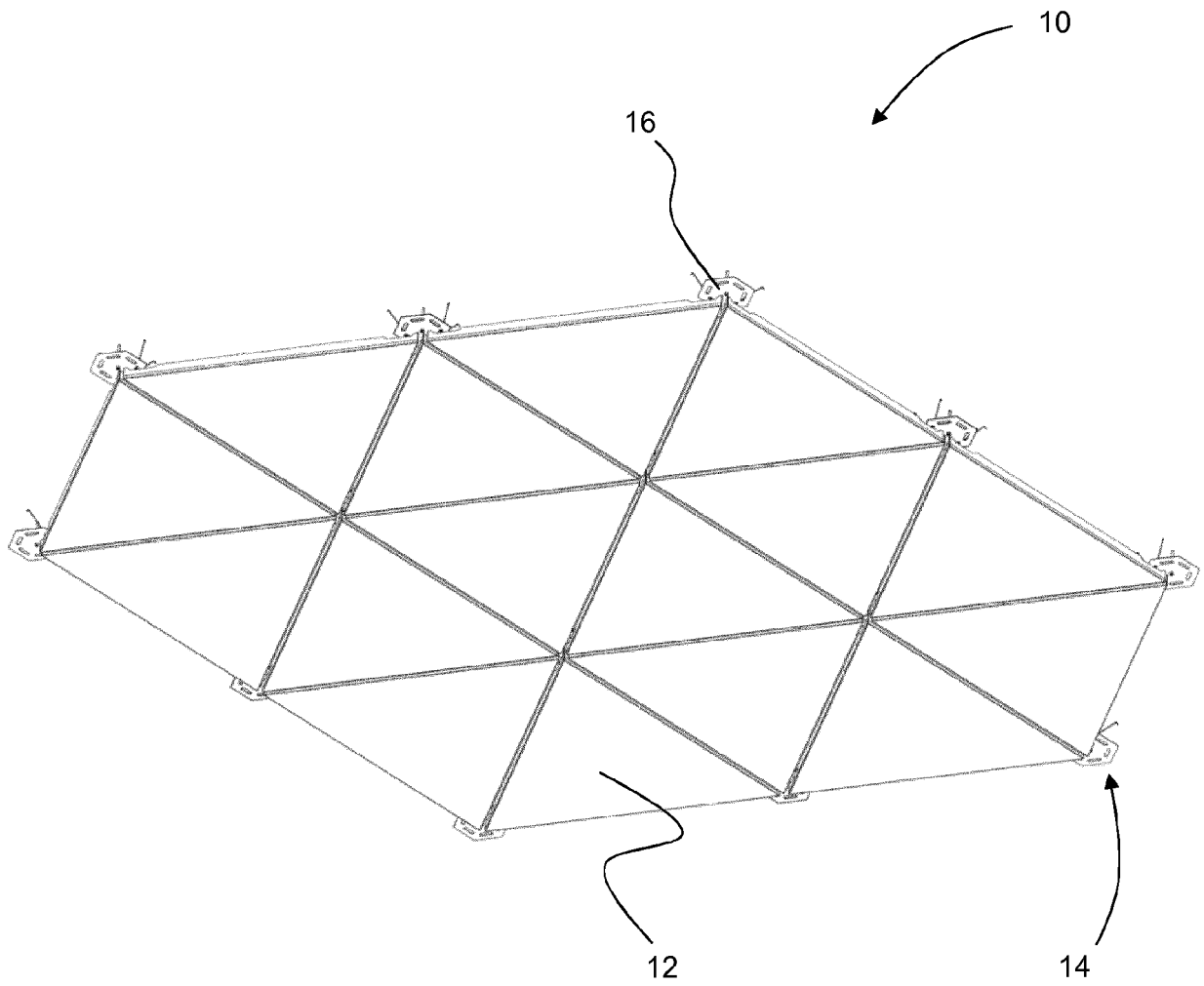


FIG. 1

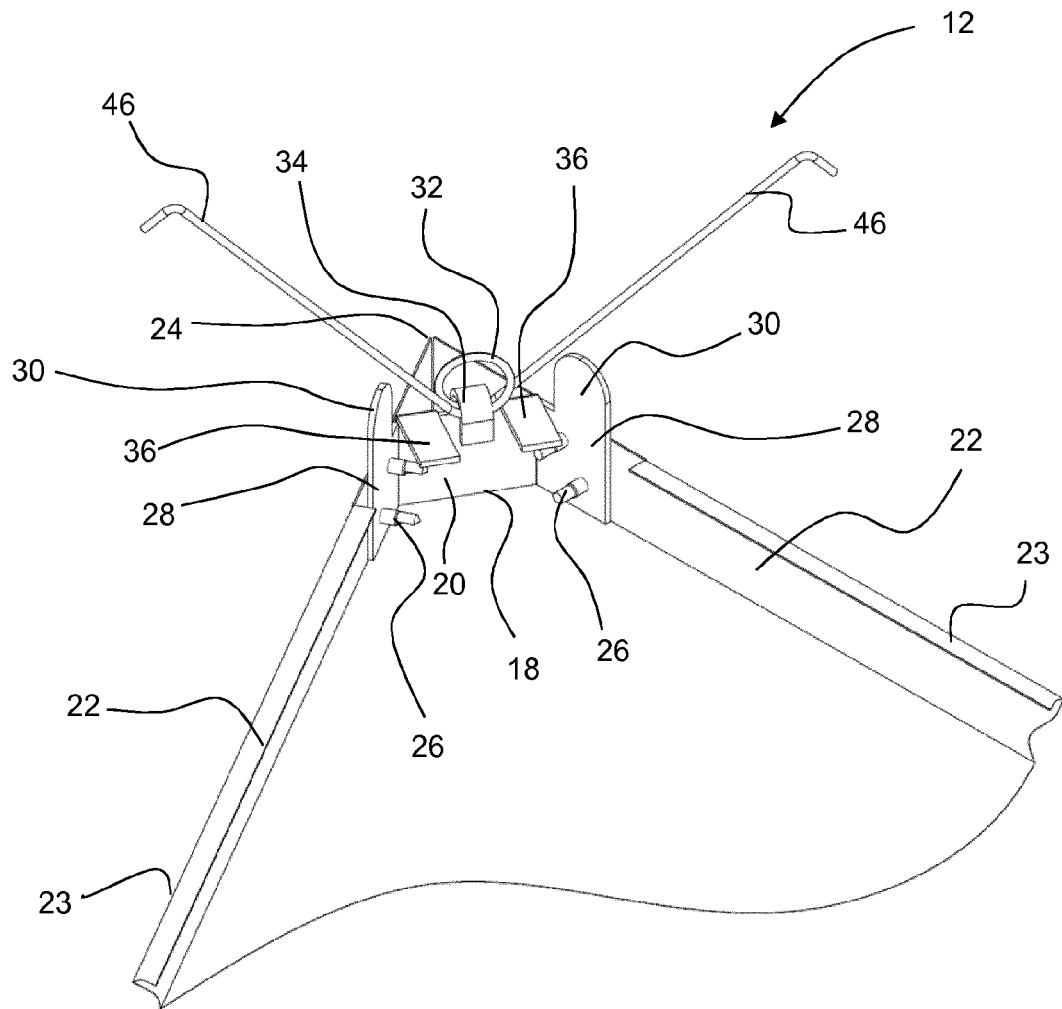


FIG. 2

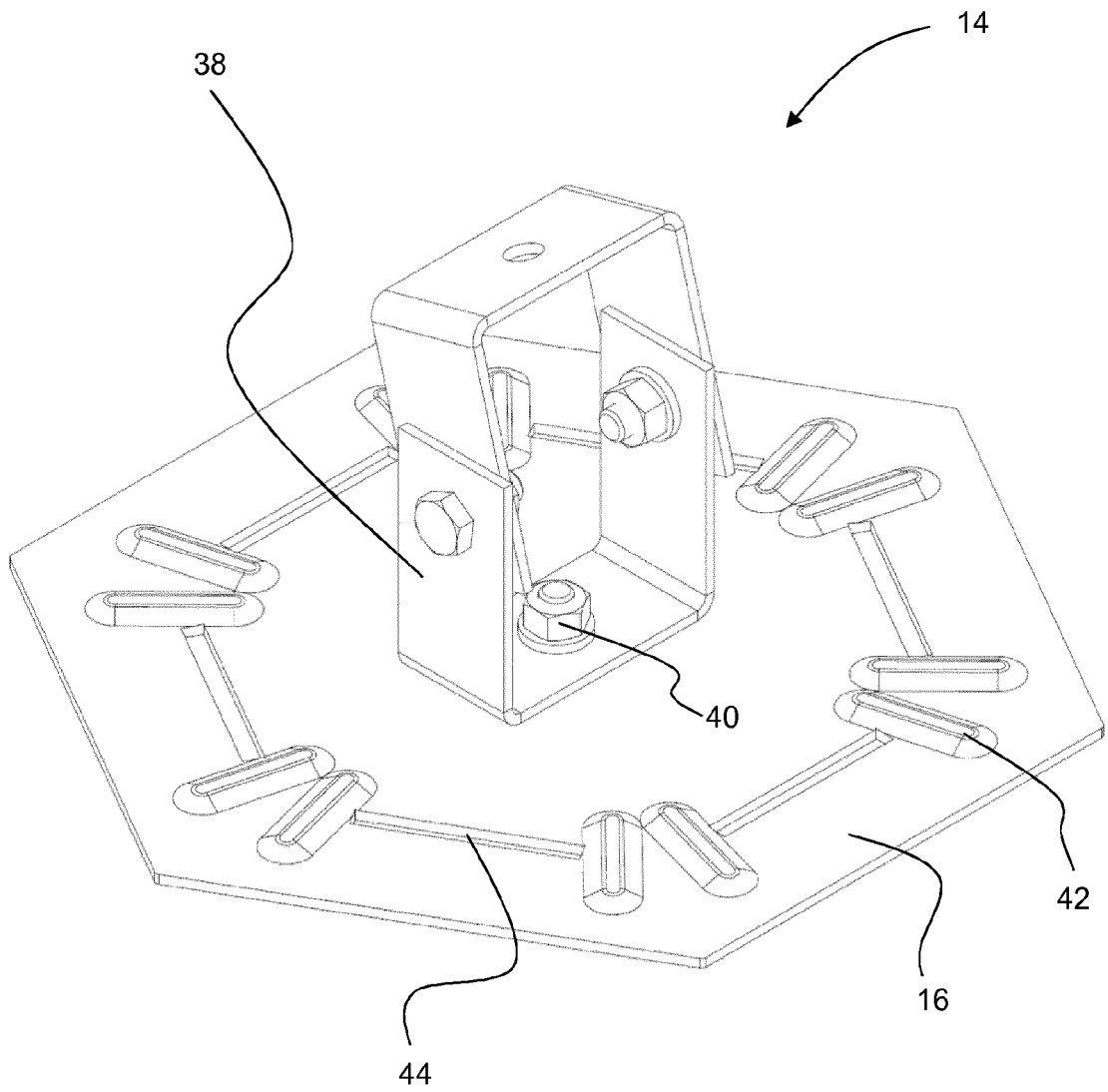


FIG. 3

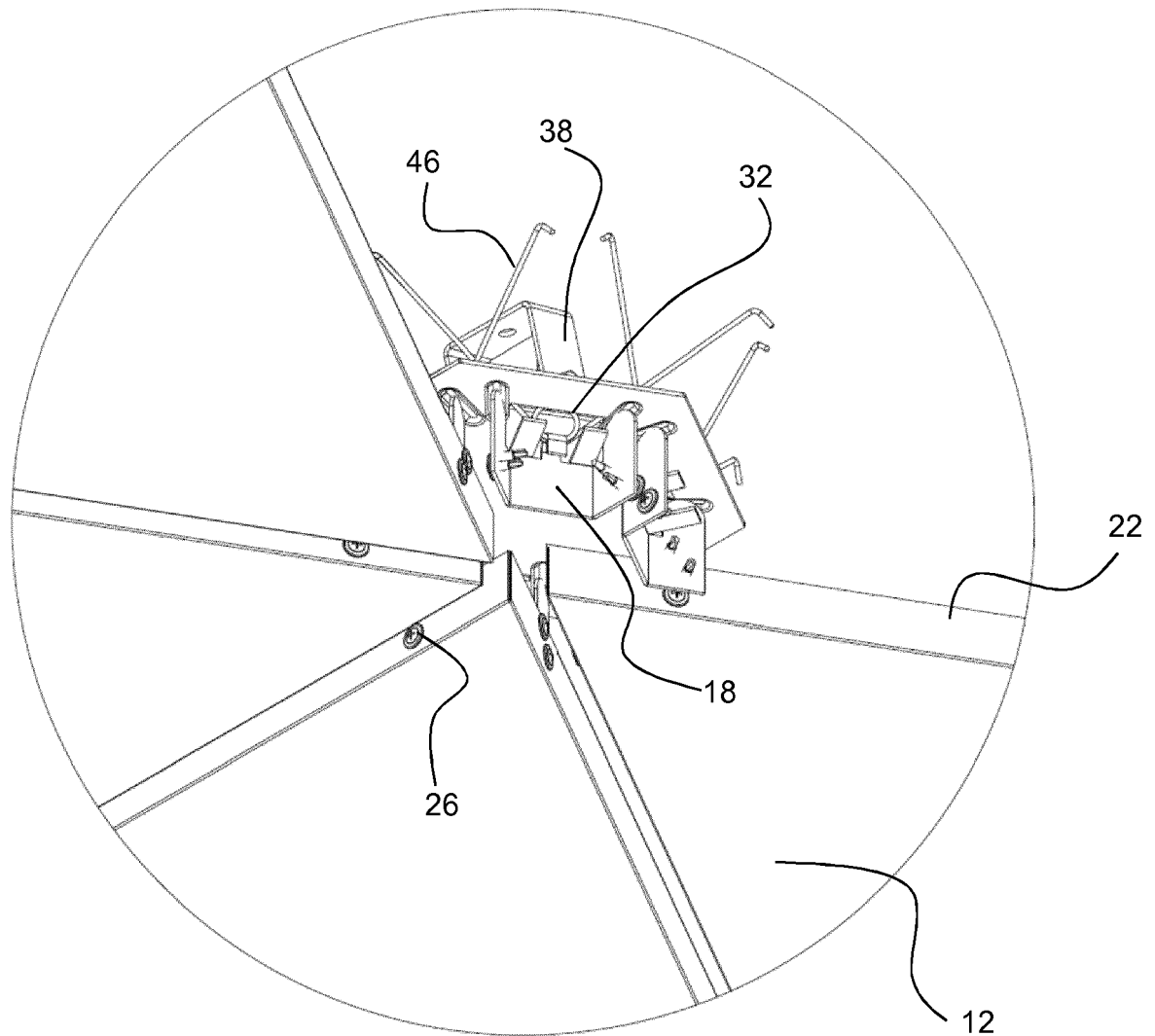
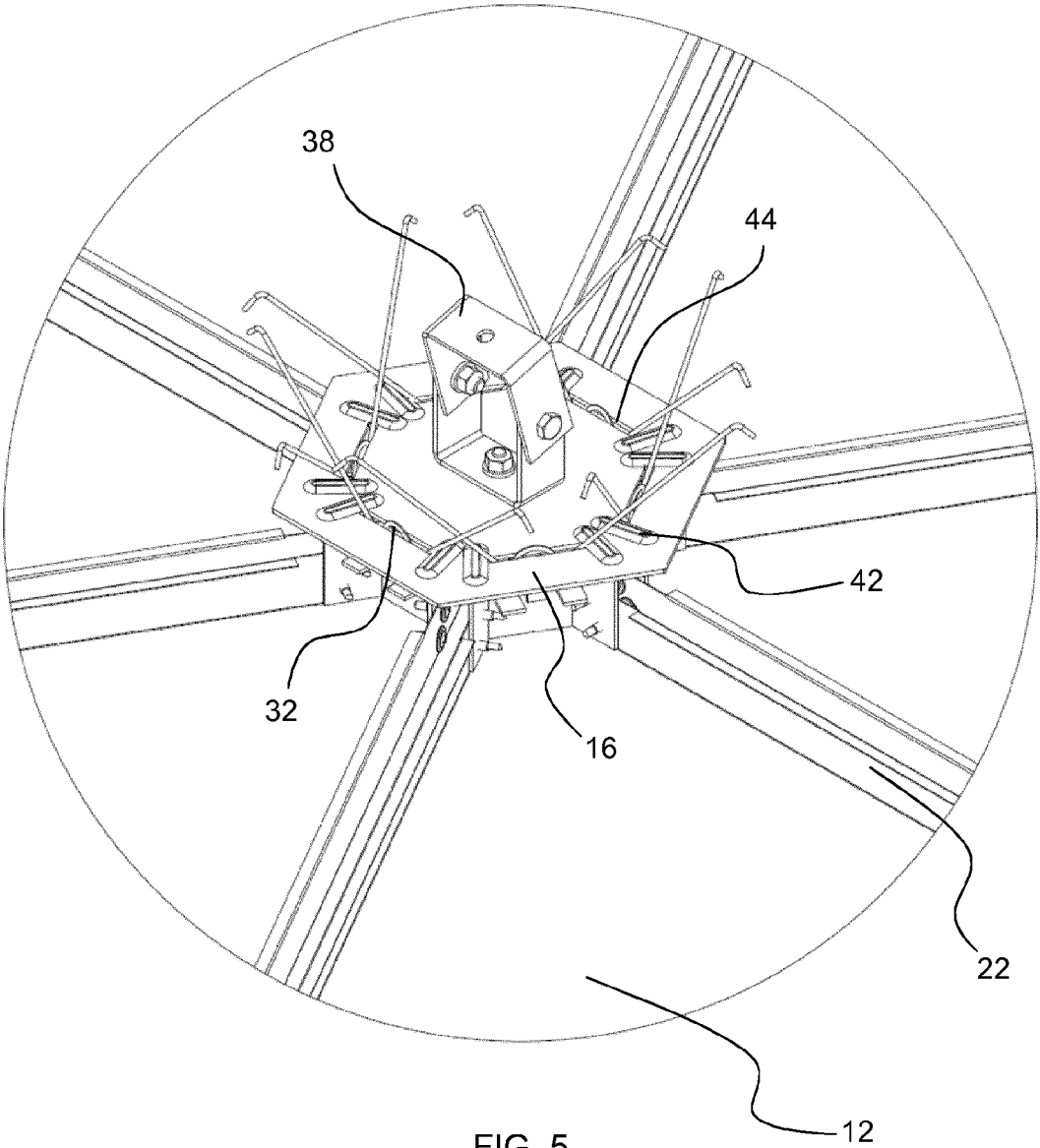


FIG. 4



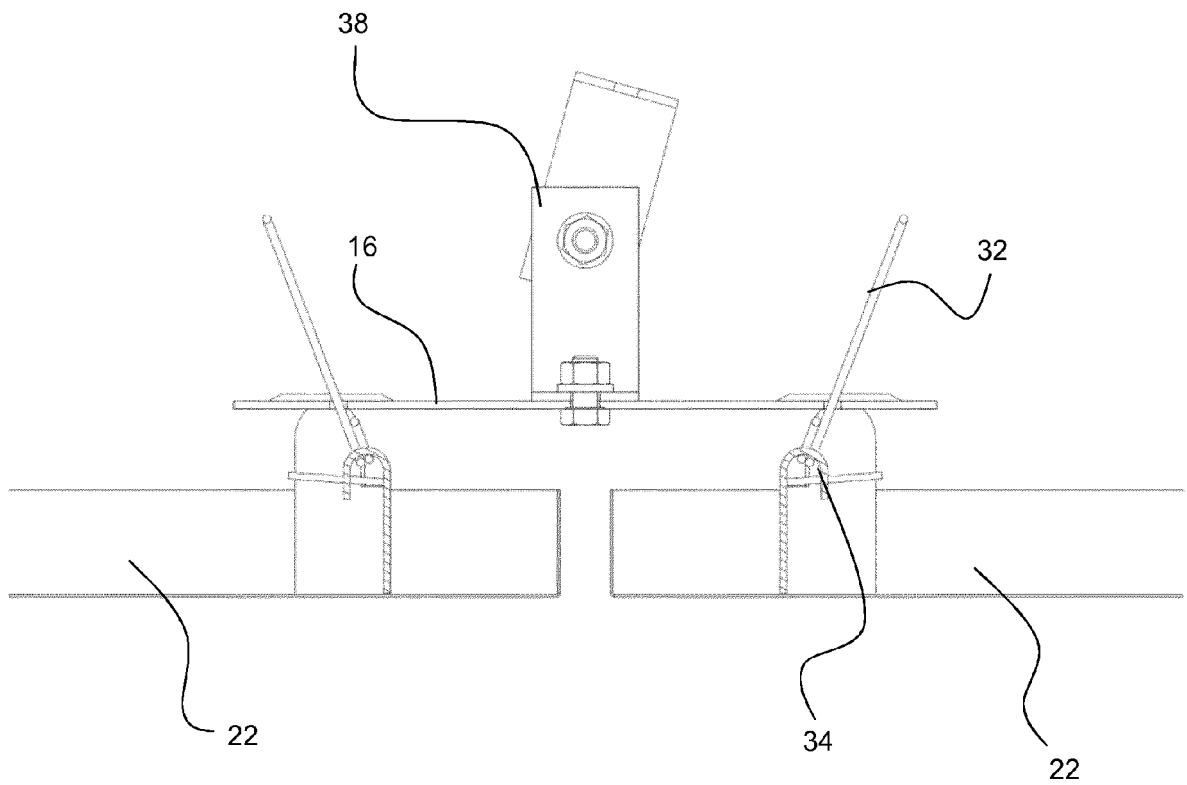


FIG. 6

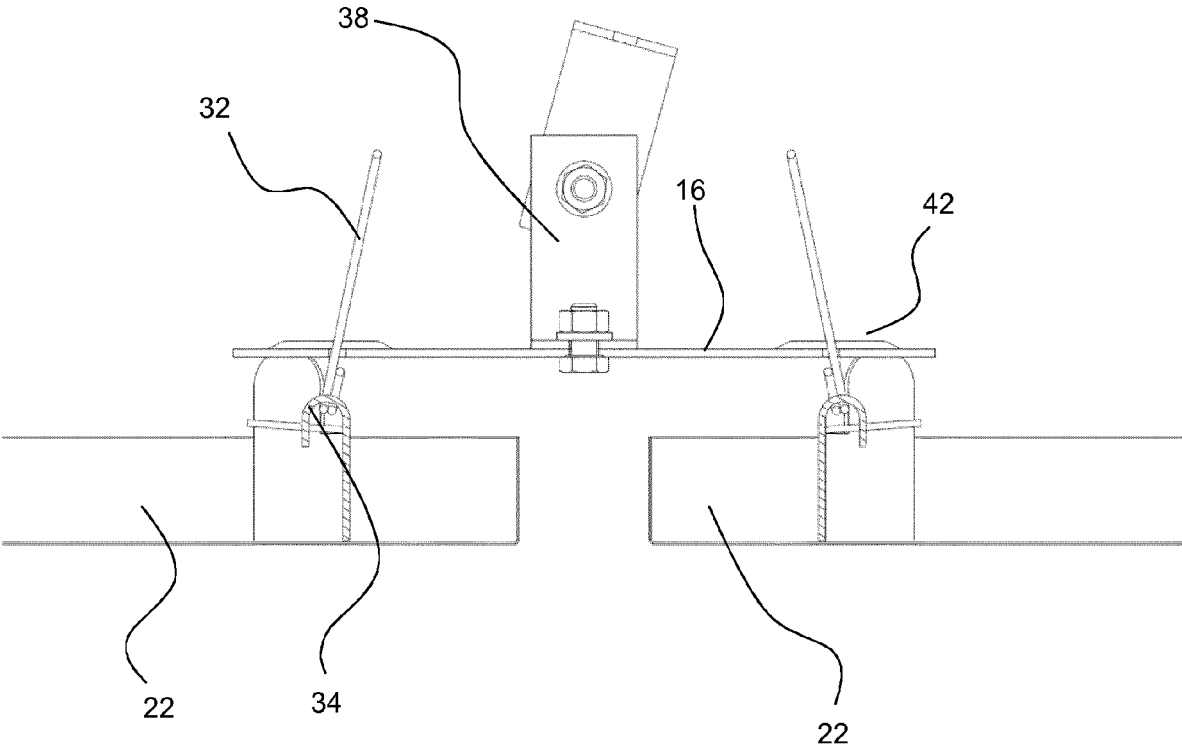


FIG. 7

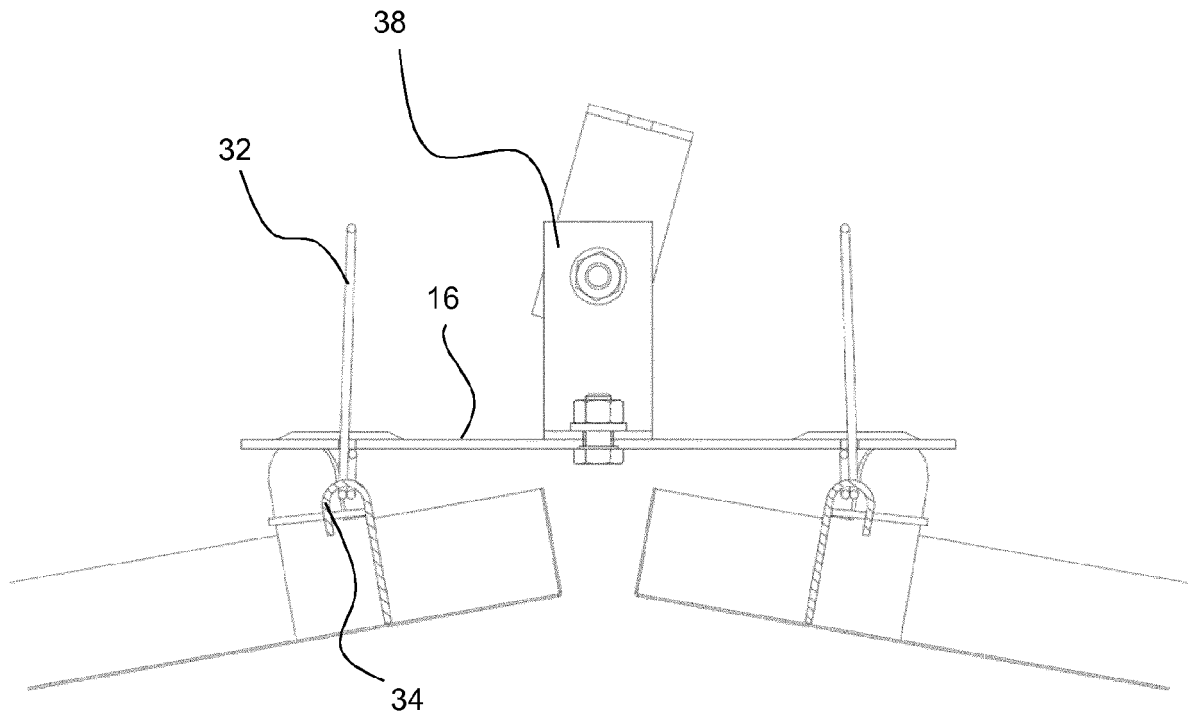


FIG. 8

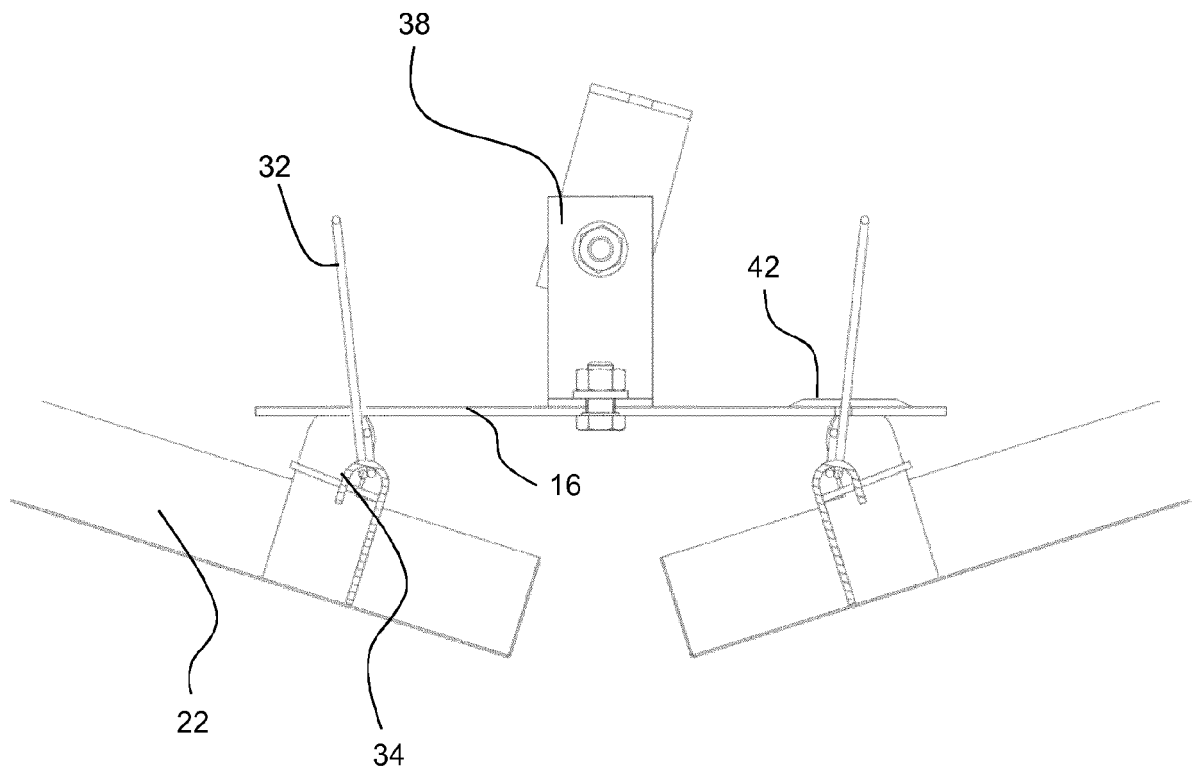


FIG. 9

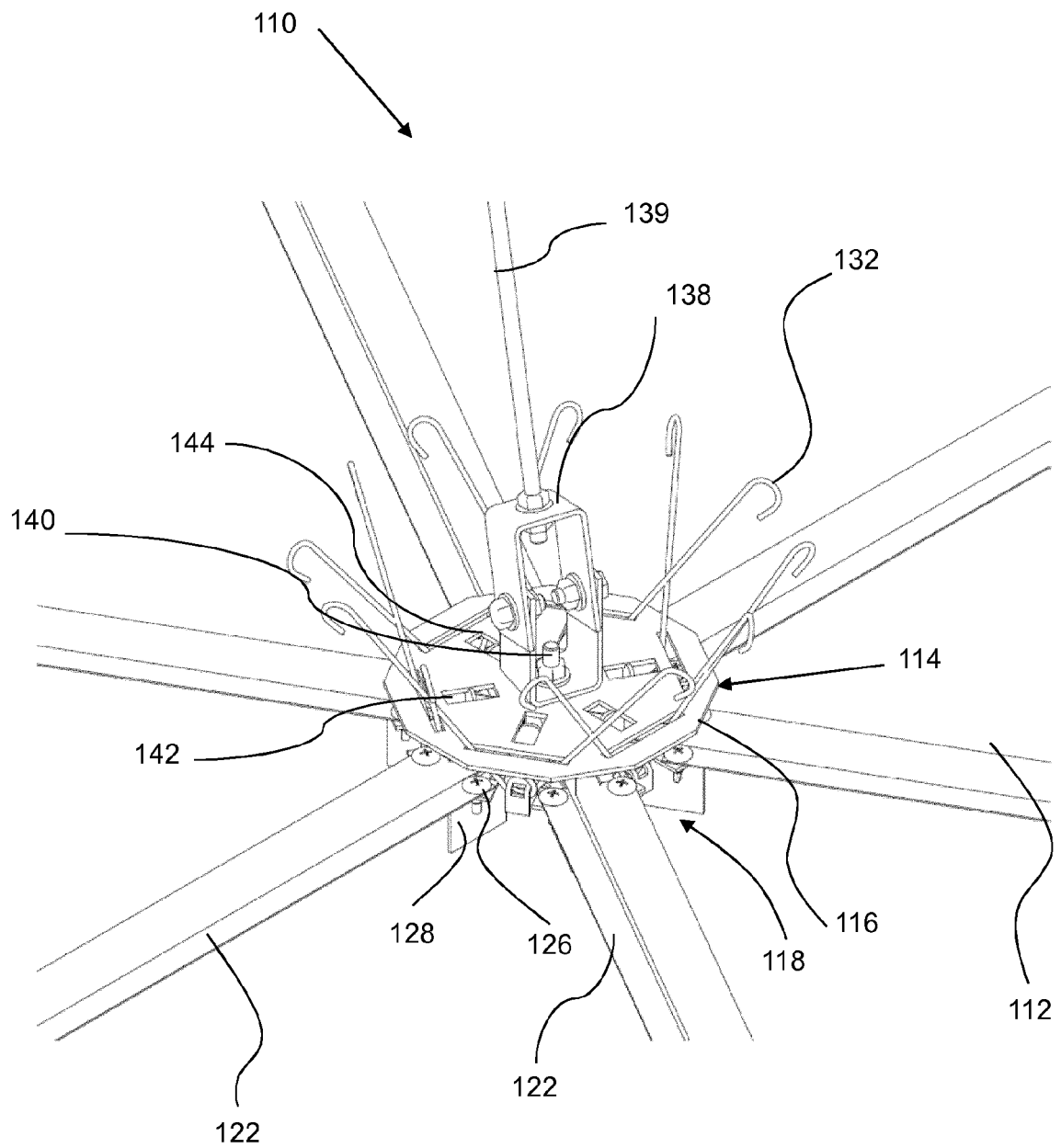


FIG. 10

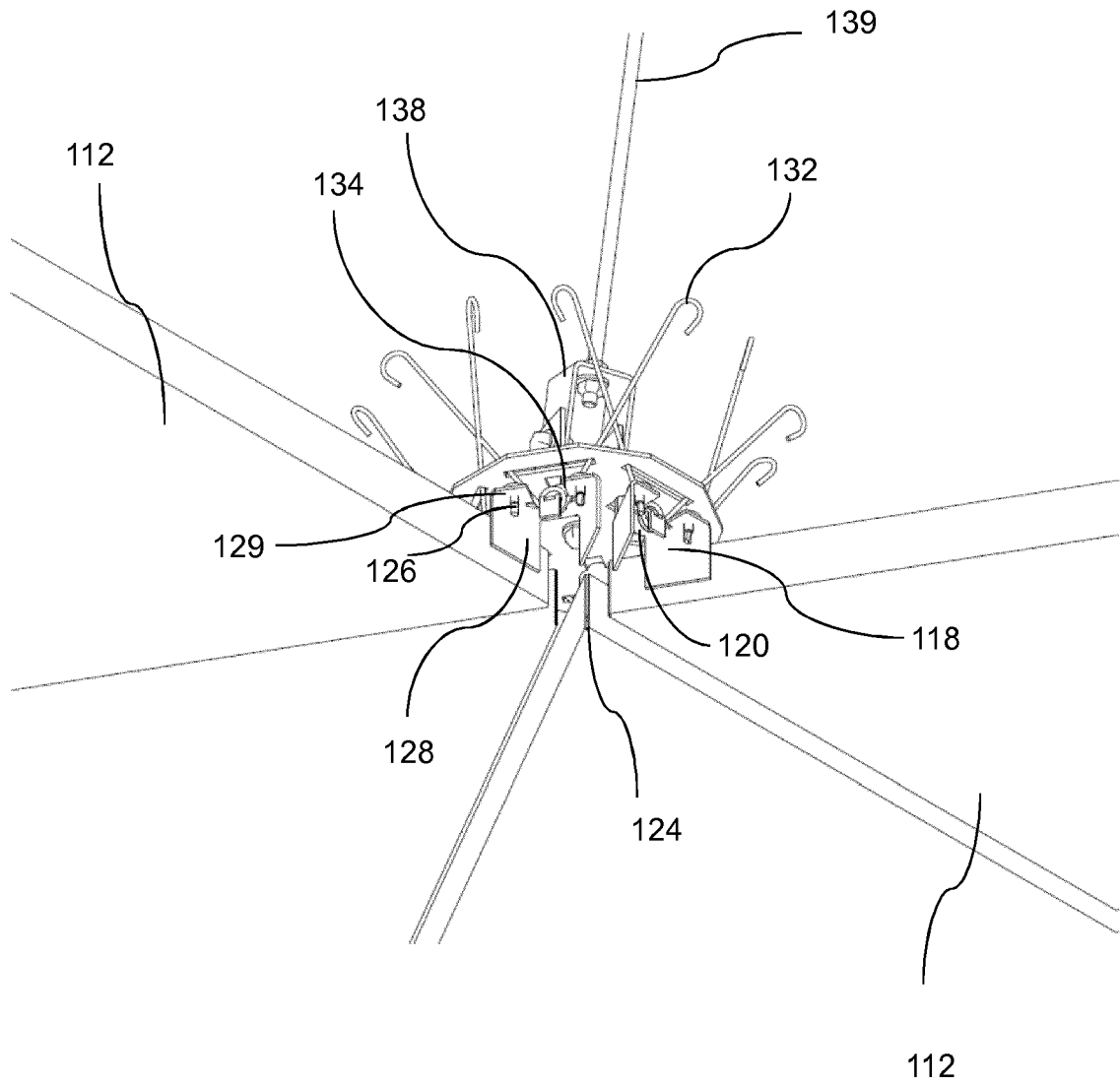


FIG. 11

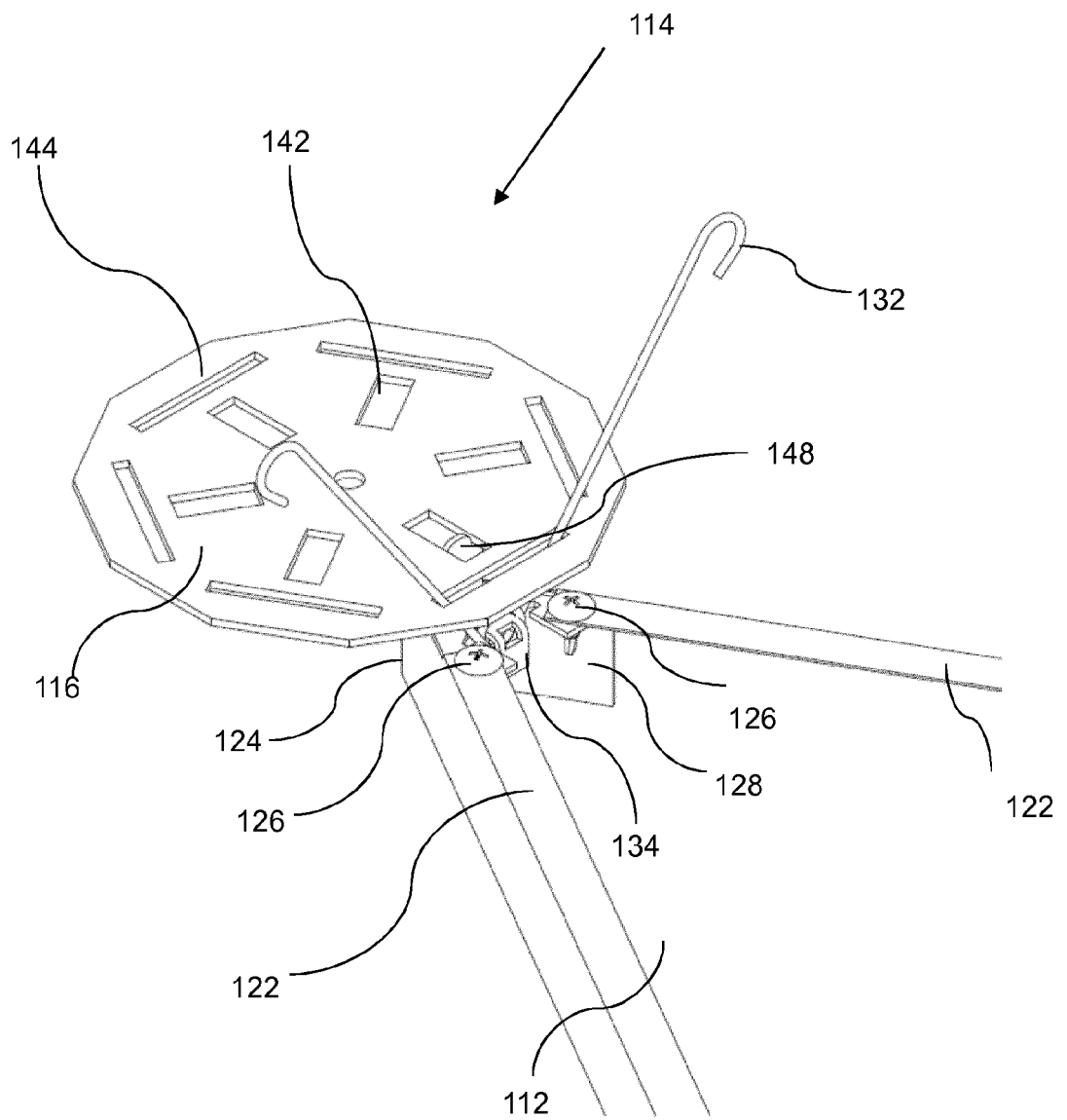


FIG. 12

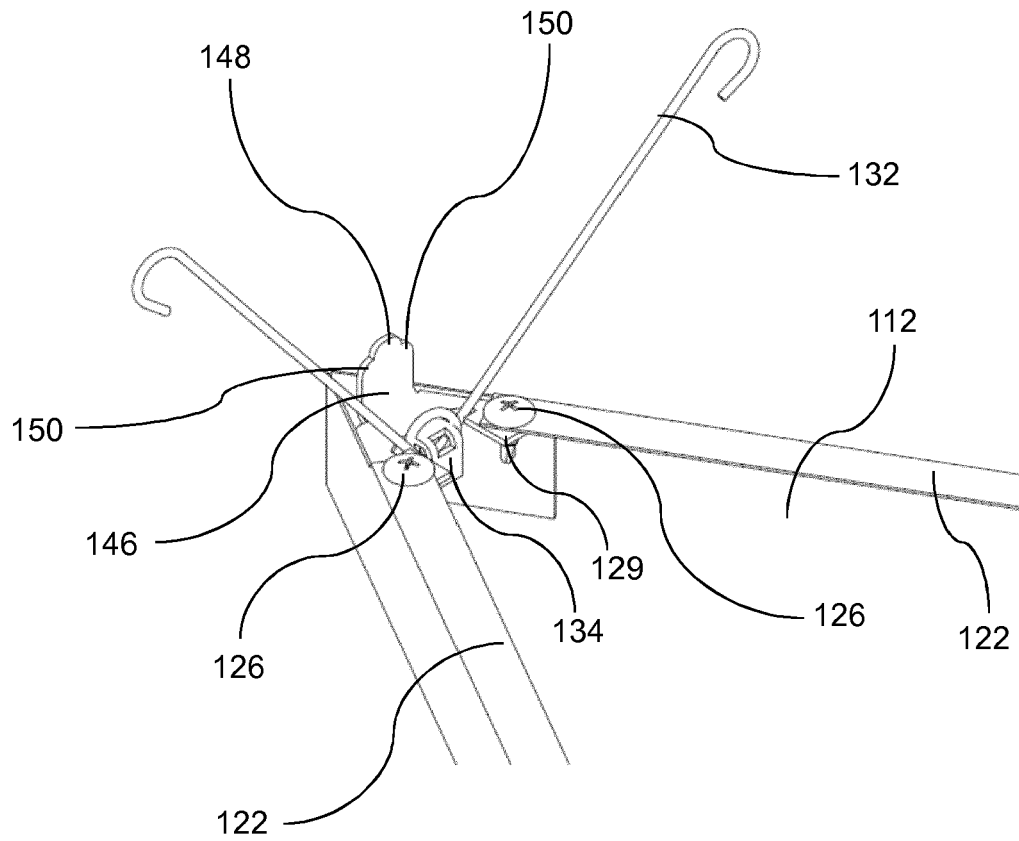


FIG. 13

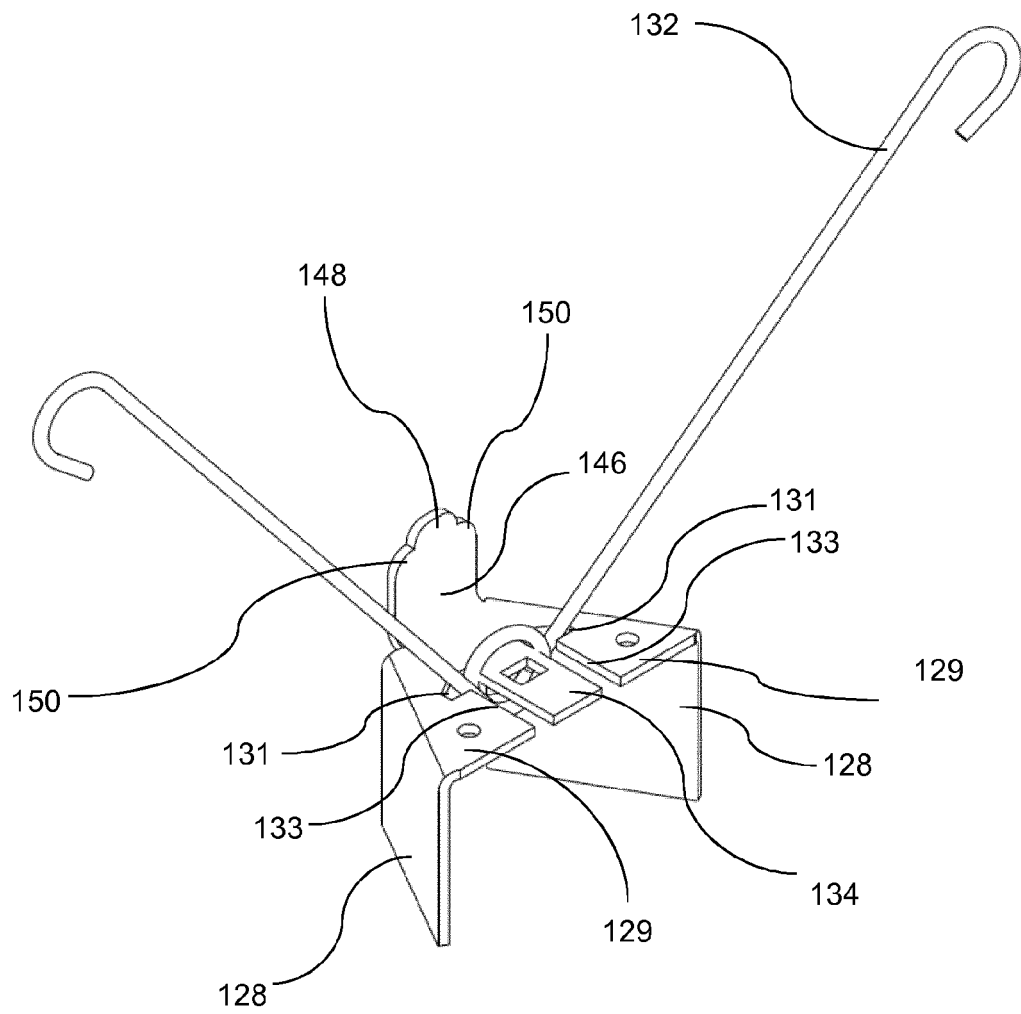


FIG. 14

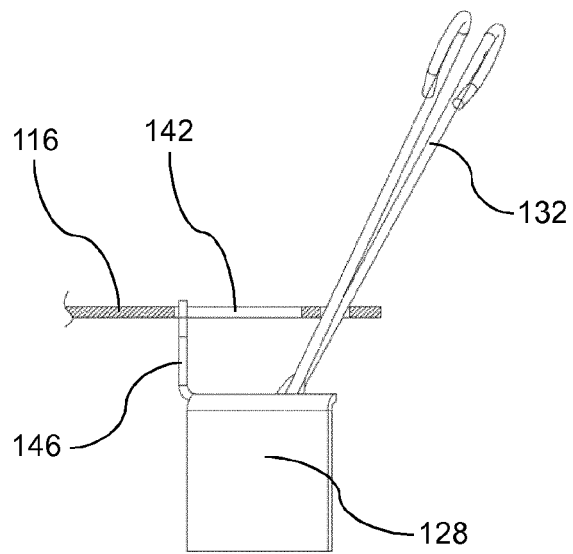


FIG. 15A

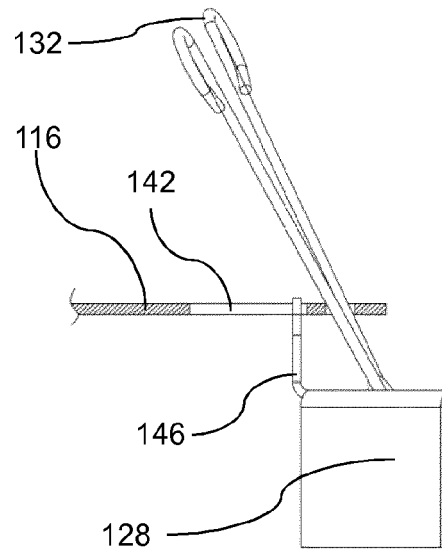


FIG. 15B

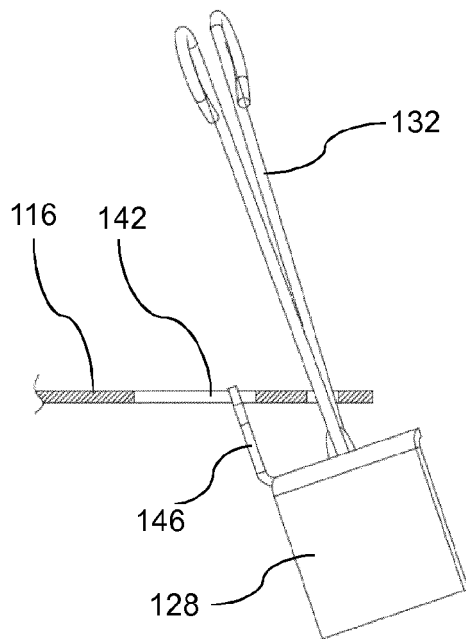


FIG. 15C

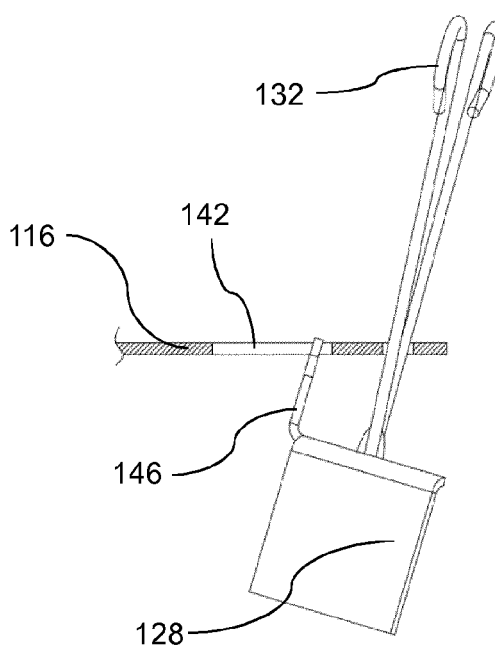


FIG. 15D

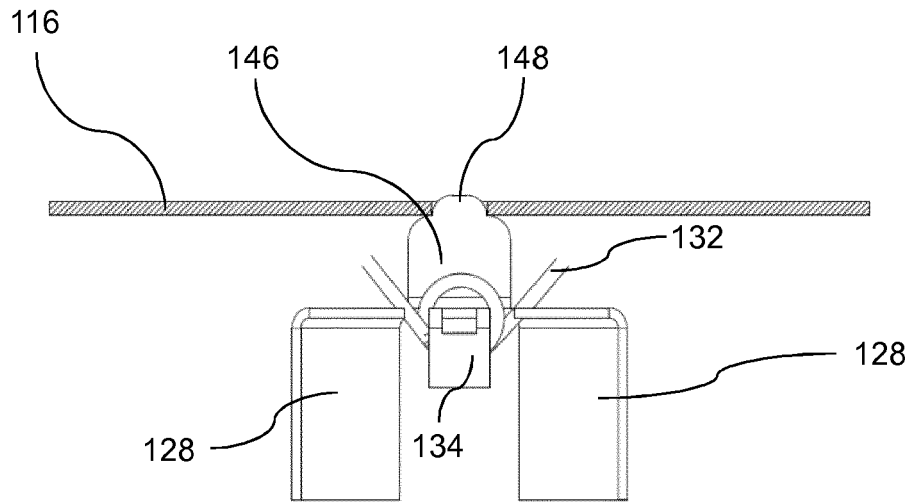


FIG. 16A

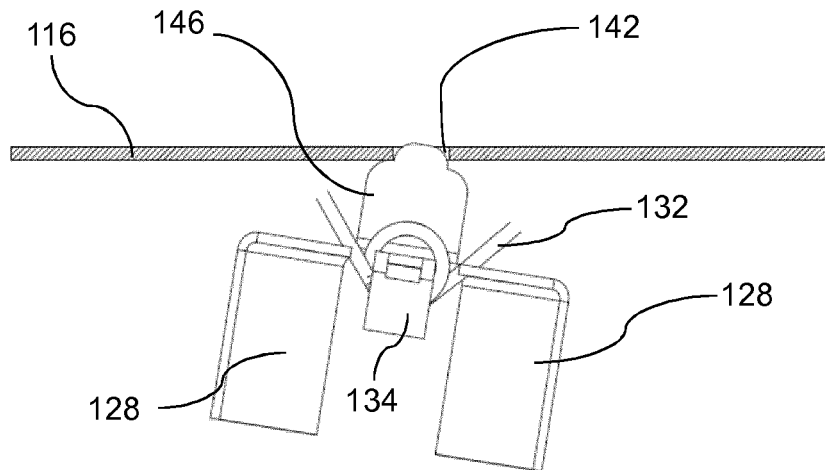


FIG. 16B

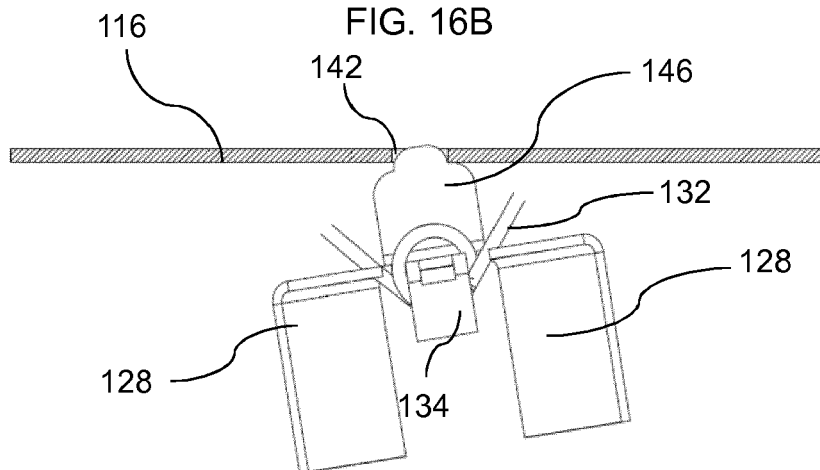


FIG. 16C



EUROPEAN SEARCH REPORT

Application Number
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X	US 4 548 010 A (HINTSA) 22 October 1985 (1985-10-22) * abstract; figures 1-4,10-12 *	1-9, 11-15 10	
A	CA 1 184 010 A (HINTSA) 19 March 1985 (1985-03-19) * figures 1-6,14-16 *	1-9, 11-15 10	
X	DE 203 04 506 U1 (ODENWALD FASERPLATTENWERK) 28 August 2003 (2003-08-28) * abstract; figures 1,2,9,17-20 *	1,3-9, 12,14,15	
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 December 2016	Examiner Righetti, Roberto
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