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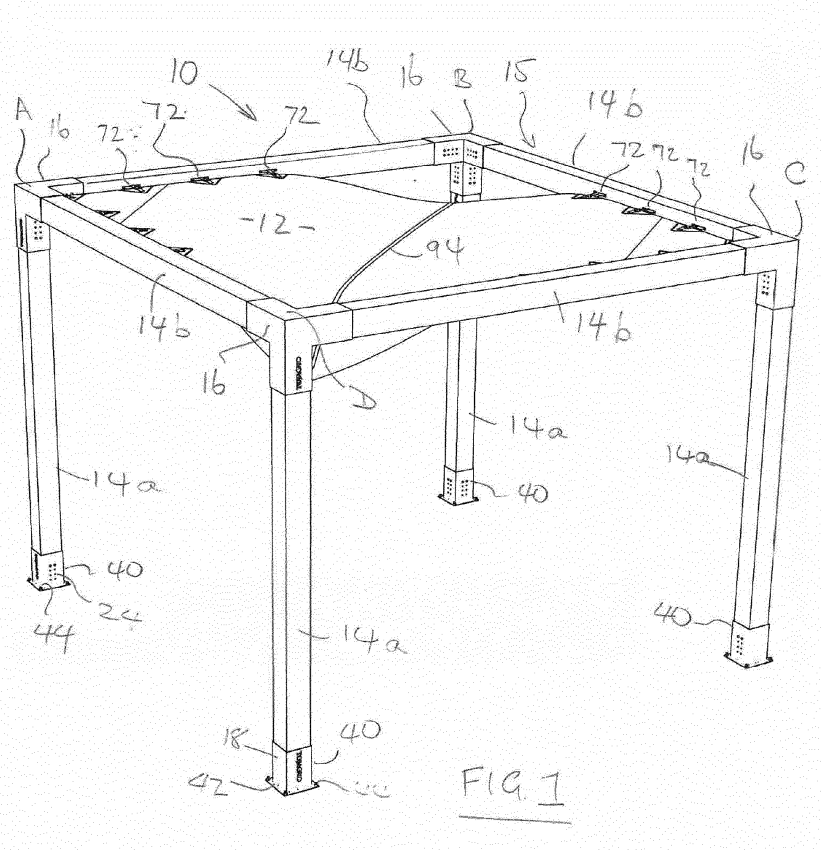
(54) **ROOF PANEL AND ROOF STRUCTURE**

(57) A roof structure is supported on legs and has a frame of interconnected structural members about the periphery. A flexible roof panel is connected to the structural members at a pair of opposed corners of the frame to lie in the plane of the structural members. A portion of the panel intermediate the opposed corners of the frame is connected to an adjacent leg below the plane of the structural members and tensioned to provide a curvature to the panel and thereby encourage shedding of water from the panel at the intermediate corner.



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a roof panel and a roof structure incorporating such a panel, primarily, though not exclusively for outdoor use.

DESCRIPTION OF THE PRIOR ART

[0002] The benefit of being able to spend time outdoors is well known but in a modern urban environment these benefits are not always readily available. It is recognised that excessive exposure to sun can be detrimental but natural shade is not always available.

[0003] Various attempts have been made to provide an enjoyable outdoor environment, such as pergolas to provide shade. These are effective but in the case of a pergola it is necessary to construct a dedicated structure that is not readily moved or stored. Whilst kits are available they consist of precut or prefabricated wooden components that require specialised tools and expertise to assemble.

[0004] In US patent 11,214,954 to Struck there is disclosed a modular structure that may be assembled in various configurations to provide shade. The structure utilises brackets with tubular sockets to connect structural members into the required configuration. Typically the brackets connect vertical posts to horizontal stringers to provide an elevated roof support. Shade panels are secured to the stringers with a connection to each bracket and connections along the stringers. The panels utilise a woven fabric which is translucent and porous and so provides shade and ventilation to the area beneath the panel.

[0005] The panels are effective to provide shade and a degree of protection from precipitation but if subjected to prolonged precipitation will collect water and allow it to drain through to area beneath. This of course is uncomfortable for anyone beneath the panel and will subject furniture located beneath the panel to adverse environmental conditions.

[0006] It is therefore an object of the present invention to obviate or mitigate the above disadvantages.

SUMMARY OF THE INVENTION

[0007] In general terms, the present invention provides a roof structure supported on posts and having a frame of interconnected structural members about the periphery. A flexible roof panel is connected to the structural members at a pair of opposed corners of the frame to lie in the plane of the structural members. A portion of the panel intermediate the opposed corners of the frame is connected to an adjacent post below the plane of the structural members and tensioned to provide a curvature to the panel and thereby encourage shedding of water from the panel at the intermediate corner.

[0008] Preferably, the panel is rectangular and a pair of intermediate portions are connected to diagonally opposed posts.

[0009] As a further preference, a plurality of connections is provided between the panel and the structural member extending from each of said opposed corners and partially along said structural members toward said intermediate corner.

[0010] As a further preference, a reinforcing tape extends across said panel between said intermediate portions.

[0011] In a further aspect, the invention comprises a polygonal flexible panel for attachment to a framework. The edges of the panel meet at vertices and a pair of opposed vertices have a plurality of connectors extending along edges from each of the opposed vertices. The connectors terminate prior to the adjacent vertex to provide an unencumbered portion of the edge remote from the opposed vertex. A reinforcing tape extends between a second pair of vertices located between the opposed vertices and terminate with connectors for securing to the framework.

[0012] Preferably the panel is rectangular to provide two pairs of diagonally opposed vertices with one pair of diagonally opposed vertices providing the pair of opposed vertices and the other pair of diagonally opposed vertices providing the second pair of vertices.

[0013] As a further preference the connectors extend halfway along the respective edges.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] An embodiment of the invention will now be described by way of example only with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of a frame work supporting a panel to provide shade

Figure 2 is a perspective view of the panel shown in Figure 1,

Figure 3 is a plan view of the panel of Figure 2,

Figure 4 is a perspective view of a corner of the framework of Figure 1,

Figure 5 is a perspective view similar to Figure 4 with a bracket attached,

Figure 6 is a schematic representation of initial stages of attachment of the panel of Figure 2 to the corner of Figure 4,

Figure 7 is a perspective view similar to figure 6 showing completion of the attachment of the panel,

Figure 8 is a perspective view of a hanger positioned

to be attached to a member of the framework of Figure 1,

Figure 9 is a perspective view similar to Figure 8 of the bracket secured to the frame member,

Figure 10 is a view of a different corner of the framework to that of Figure 4 with a bracket positioned for attachment,

Figure 11 is a view similar to Figure 10 with the bracket attached,

Figure 12 is a perspective view similar to Figure 11 showing initial attachment of the panel to the bracket,

Figure 13 is a view similar to Figure 12 showing completion of the attachment of the panel,

Figure 14 is a perspective view of the frame member of Figure 13 showing initial steps in securing the panel to the bracket,

Figure 15 is a perspective view similar to Figure 14 showing the completion of attachment of the panel,

Figure 16 is a section on the line A-A of Figure 1, and

Figure 17 is a section on the line B-B of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

[0015] Referring to Figure 1, a modular framework 10 is used to support a shade cloth 12 to provide a shaded area. The framework 10 consists of a plurality of elongate structural members 14 that are connected at the interstices of the framework 10 by brackets 16. The number of structural members 14 and their orientation will depend on the structure required, as illustrated in the alternative embodiments shown in prior US patent 11,214,954, the contents of which are incorporated herein by reference, and similarly the number and configuration of the brackets 16 will depend on the form of the structure 10.

[0016] Each of the structural members 14 is formed from a dimensional material, typically wood although other materials such as metal or plastics could be used. Preferably, the members 14 are a weather resistant wood in a readily available cross section such as a nominal 4"x4" pressure treated lumber or cedar. Alternative dimensions may be used, such as a nominal 6"x6" lumber or an extruded aluminum 2x2 or 3x3 section.

[0017] The brackets 16 are formed from metal and have different configurations depending on the number of members 14 to be connected. The brackets 16 have a socket 18 for each of the members to be connected. As can be seen in Figure 4, a corner bracket 16 to join three members orthogonally has three sockets 18 disposed along orthogonal axes, labelled X, Y, Z. Each of the sockets 18 has an internal dimension corresponding to the external dimension of the structural member 14. Thus, if the bracket 16 is to be used in a framework formed by nominal 4x4 lumber, the socket 18 will be a square cross section dimensioned to snugly receive the structural member 14.

[0018] Each of the sockets 18 is formed with 4 planar faces 20. Inwardly directed faces, that is those that are directed toward another face, as indicated at 20a, have an array 22 of holes 24 that extend through to the interior of the socket 18. The array 22 is formed by two rows of four holes 24 that are spaced from one another to provide a grid. It will be appreciated of course that other configurations of array could be used.

[0019] Referring again to Fig 1, the structural members 14 are inserted in to the sockets 18 to provide four vertical legs 14a and a roof frame 15 defined by four stringers 14b so the legs 14a are disposed at the corners of a rectangle designated A, B, C, and D. The members 14 are secured to the respective brackets 16 by screws passing through the distal holes 24 and in to the structural member 14, so that a rigid framework 10 is provided. It will be appreciated that the dimensions of the stringers 14b may be chosen to suit the area to be covered simply by cutting the stringers 14b to the required length. The stringers 14b provide a frame extending about the periphery of the framework and support the panel 12.

[0020] In the embodiment of Figure 1, the lower end of legs 14a is located on the substrate by feet 40. The feet 40 each have a socket 18 that is secured to a plate 42. The socket 18 has an array of holes 24 formed on one of its faces20 to allow the foot 40 to be secured to the leg 14a. The plate 40 has bolt holes 44 at each apex to allow the foot to be secured to the substrate if required.

[0021] The array 22 of holes 24 is also used to attach the shade cloth 12 to the framework 10 at a pair of diagonally opposed corners A and C. As can be seen in Figure 4 and 5, a hanger 26 extends between a pair of inwardly directed faces 20a. The hanger 26 has a central body 30 with a pair of end tabs 32 disposed at 45 degrees to the body 30. A hole 34 is formed in each of the end tabs 32. The spacing between the holes 34 is such that they align with holes 24 in adjacent faces 20a so that the hanger may be secured to each of the faces with a screw 36. The screw passes through the hole 24 and into the stringer 14b to effect a secure fastening. If preferred, the screws may be self-tapping and dimensioned to engage with the holes 24 as they are inserted to provide a further fastening, but generally the fastening into the stringer 14b is sufficient. The hanger 26 lies within the plane defined by the stringers 14b.

[0022] Mounting clips 72, shown in greater detail in Figure 8, are located on the inner face of the stringers 14 adjacent to each of the opposed corners A, C. The clip 72 is similar to the hanger 26 described above but tabs 74 are oriented parallel with the body 76. Screws 36 secure the clip 72 to the stringer 18.

[0023] The mounting clips 72 are spaced apart along

the stringer 14 from the socket 18 to the midpoint of the stringer 14. In practice it has been found that the midpoint +/- 10%, i.e between 40% and 60% of the length of the stringer is appropriate for the extent of the clips 72 with three clips 72 being sufficient to support the shade cloth 12.

[0024] A clip 76, identical to the clips 72, is installed at each of intermediate corners, B and D. The clips 76 are positioned on a leg 14a below the socket 18 of the bracket 16 in a vertical orientation. The clip 76 is thus offset from the plane defined by the stringers 14b, typically by 6 to 12 inches.

[0025] The shade cloth 12 is formed as a rectangular panel 80 similar in shape to the area defined by the stringers 14b and having corners denoted a, b, c, d for alignment with the frame corners A, B, C, D respectively. The outer free body dimensions of the panel 80 are less than the internal dimensions of the frame 15 to allow the panel to be stretched taut within the frame 15. The material is one of a number of monofilament woven materials used commercially for shade cloths that has a limited stretch in each direction and an open weave for air circulation.

[0026] The panel 80 is connected to the frame 15 by straps 84 and buckles 86 secured to the panel 80. The buckles 86 are of well known releasable construction having a female socket portion 88 and a male portion 90. The straps 84 are sewn to the underside of the panel 80 and terminate in the female socket portion 88. The female socket portion 88 is adjustable on the strap 84 to vary the effective length of the strap 84 and receives the resilient tangs of the male portion 90. The tangs 90 may be released from the female socket portion for detachment of the panel 80.

[0027] The straps 84 are secured to the panel 80 at the corners a, c, corresponding to corners A, C of the frame wrapping around the hangers 26. The straps 84 are also secured at locations corresponding to the placement of the clips 72 on the stringers 14b by threading through the clip 72. The panel 80 may be reinforced at these locations if necessary.

[0028] A local reinforcement is provided by a diagonal reinforcing tape 94 (Figs 1 to 3) that extends across the panel 80 between the corners b,d, corresponding to corners B, D of the frame 15 and terminates in buckles 96 which are similar to the buckles 86. The tape 94 is sewn to the panel 80 on one or both faces of the panel 80. Alternatively, the local reinforcement may be provided by a folding of the panel on itself across the diagonal to provide a triple layer of material which is then sewn through. The local reinforcement inhibits stretch of the panel 80 between the corners b,d.

[0029] To connect the panel 80 to the framework 10, the panel is positioned within the frame 15 with the corners a,b,c,d aligned with the frame corners A,B,C,D. The straps 84 are passed through the hanger 26 and clips 72 on the stringers 14b and the portions of the buckles 86 secured to one another, as shown in Fig. 14 and 15. The reinforcing tape 94 is passed through the clips 76 on the leg 14a and the buckle 96 secured.

[0030] The straps 84 and tape 94 are then adjusted in their respective buckles 86, 96 to tension the panel 80 and make it taut within the frame 15. The net effect of the straps 84 is to generate a tension between the corners A, C. The displacement of the clips 76 from the plane of the stringers 14b pulls the opposite corners of the panel 80 downward, which is opposed by the tension in the panel 80. By virtue of the elasticity of the panel 80, the panel 80 assumes a domed or saddled contour with the corners b,d at the lowest point.

[0031] The upper surface of the panel 80 sheds water from the body of the panel to the corners b, d, where it can fall to the ground at the periphery of the framework 10. In most circumstances, the area beneath the panel 80 will remain dry to protect furnishings and occupants. The contour of the panel may be adjusted by altering the length of the traps 84.

[0032] It will be apparent that the configuration of the framework may be varied to suit different circumstances, as described in US patent 11,214,954, and the extent of the clips 72 along the stringers may be varied to suit the different configurations.

Claims

1. A roof structure supported on legs and having a frame of interconnected structural members about the periphery, a flexible roof panel connected to the structural members at a pair of opposed corners of the frame to lie in the plane of the structural members, a portion of the panel intermediate the opposed corners of the frame being connected to an adjacent leg below the plane of the structural members and tensioned to provide a curvature to the panel and thereby encourage shedding of water from the panel at the intermediate corner.

2. The roof structure according to claim 1 wherein the panel is rectangular and a pair of intermediate portions are connected to diagonally opposed posts.

3. The roof structure according to claim 1 wherein a plurality of connections is provided between the panel and the structural member extending from each of said opposed corners and partially along said structural members toward said intermediate corner.

4. The roof structure according to claim 3 wherein said plurality of connections extend from each of the opposed corners between 40% and 60% of the distance to the intermediate portion.

5. The roof structure according to claim 4 wherein said plurality of connections extend to the midpoint between said opposed corners and said intermediate portion.

6. The roof structure according to claim 1 wherein a local reinforcement extends across said panel between said intermediate portions.

7. The roof structure according to claim 6 wherein said local reinforcement is a strap sewn to said panel.

8. The roof structure of claim 1 wherein said structural members are interconnected by brackets having sockets to receive said structural members, said roof panel being connected to brackets at said opposed corners by a hanger extending between opposed faces of adjacent sockets.

9. The roof structure of claim 8 wherein said intermediate portions are connected to a hanger disposed on a leg below said backets.

10. A polygonal flexible panel for attachment to a framework, the edges of the panel meeting at vertices and a pair of opposed vertices have a plurality of connectors extending along edges extending from each of the opposed vertices, the connectors terminating prior to the adjacent vertex to provide an unencumbered portion of the edge remote from the opposed vertex, and a local reinforcement extends between a second pair of vertices located between the opposed vertices and terminating with connectors for securing to the framework.

11. The panel of claim 10 wherein said local reinforcement is a tape sewn to said panel.

12. The panel of claim 10 wherein the panel is rectangular to provide two pairs of diagonally opposed vertices with one pair of diagonally opposed vertices providing the pair of opposed vertices and the other pair of diagonally opposed vertices providing the second pair of vertices.

13. The panel of claim 12 wherein the connectors extend between 40% and 60% of the distance along the respective edges.

14. The panel of claim 13 wherein said connectors extend to the midpoint of said edges.

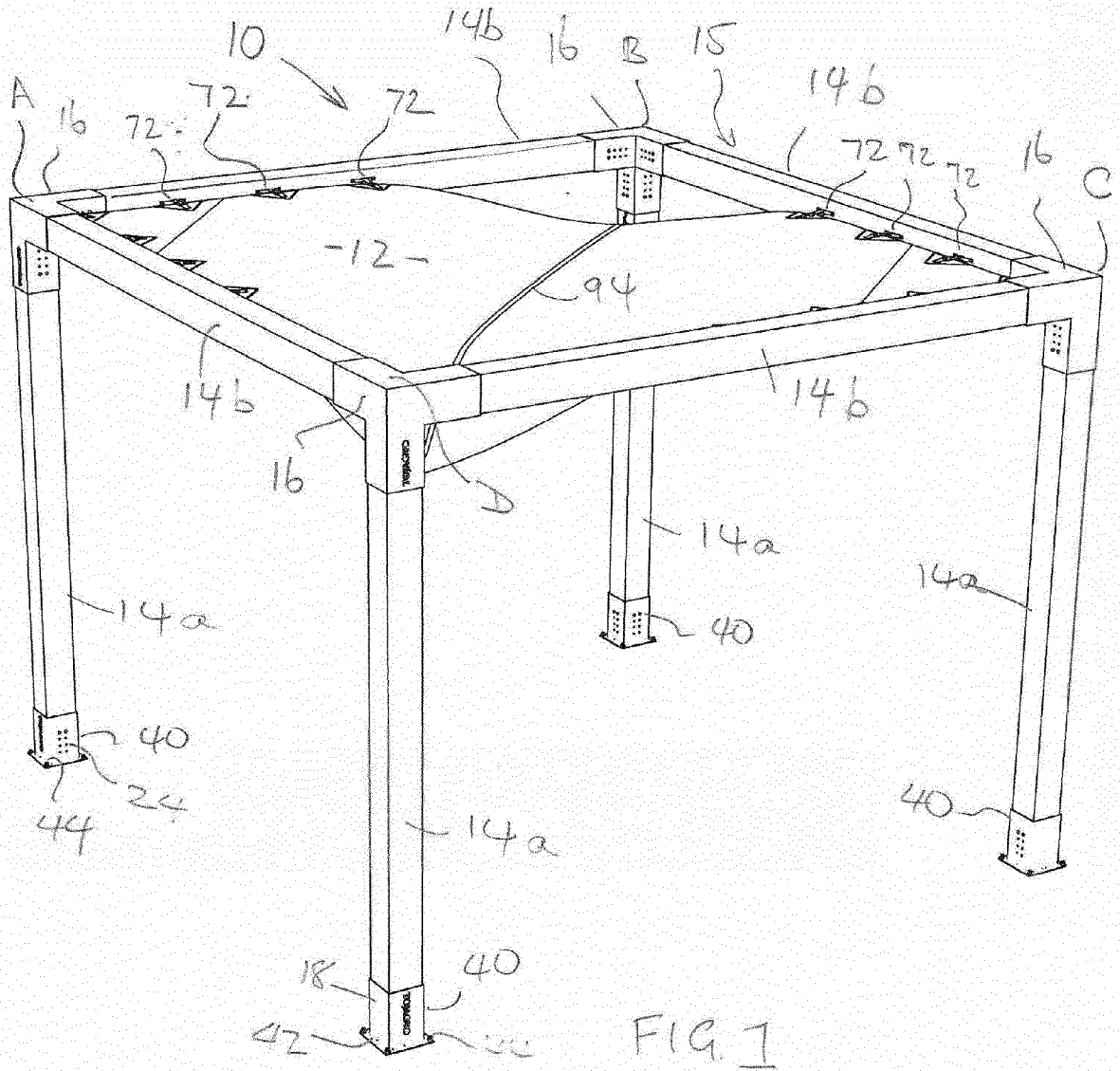
10
14b
16
B
15
A
16
72
72
72
72
72
72
72
16
C
12
94
14b
14b
16
D
14a
14a
14a
40
40
40
24
44
18
40
42

FIG. 1

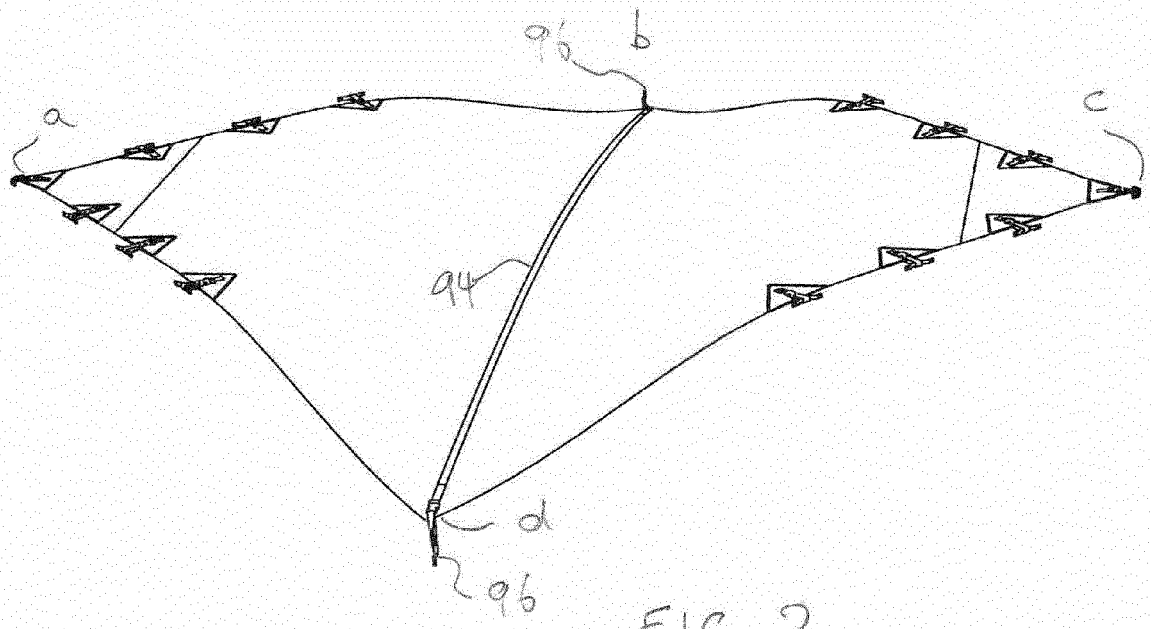

FIG 2.

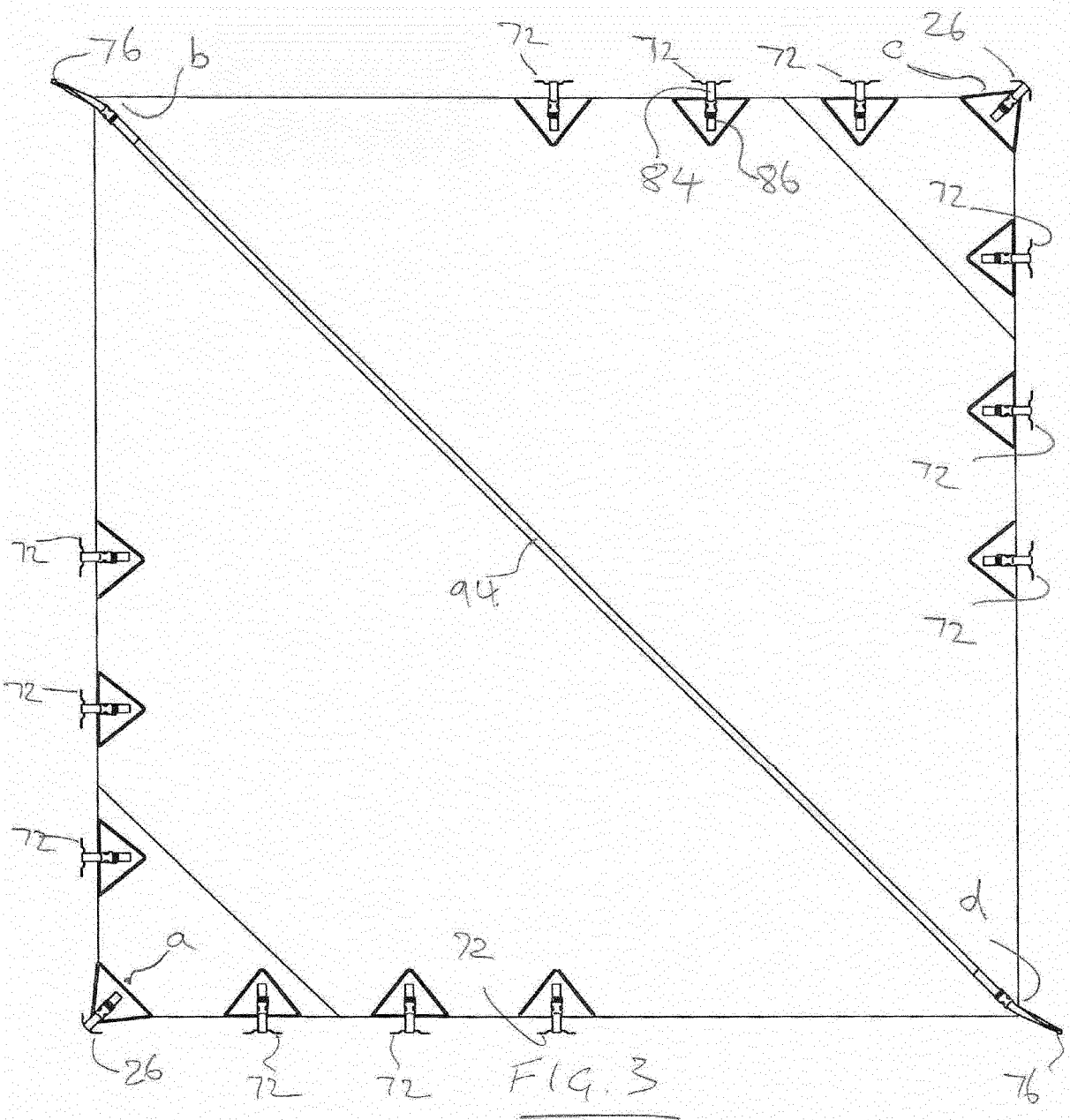

FIG. 3

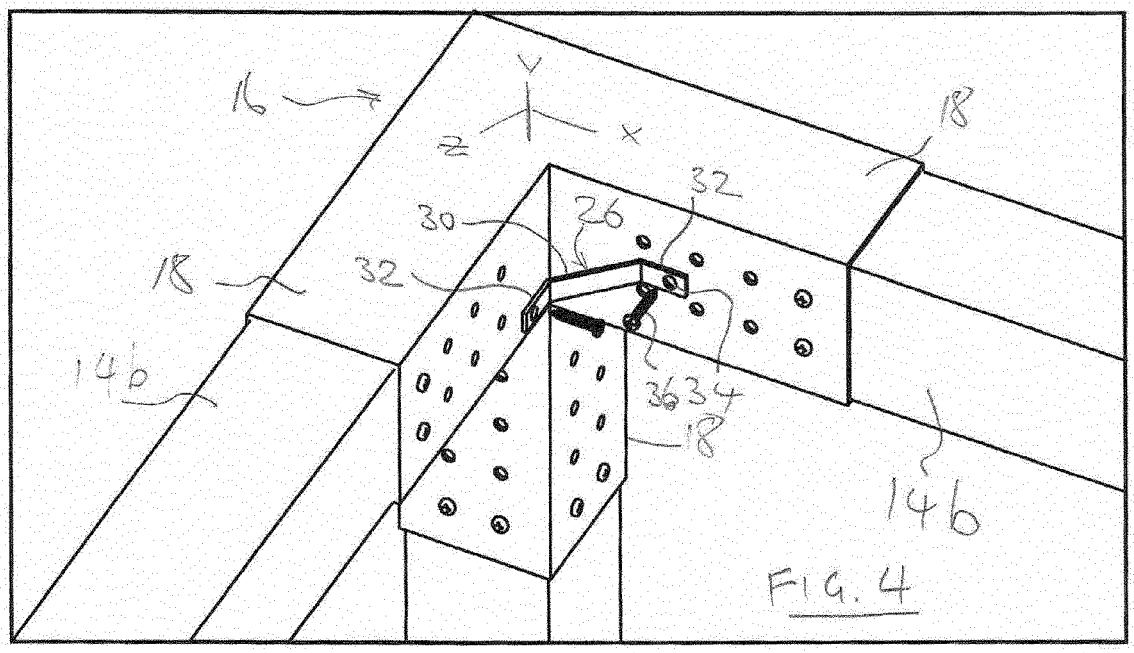
16
Y
Z
X
18
32
30
26
32
18
14b
36
34
18
14b

FIG. 4

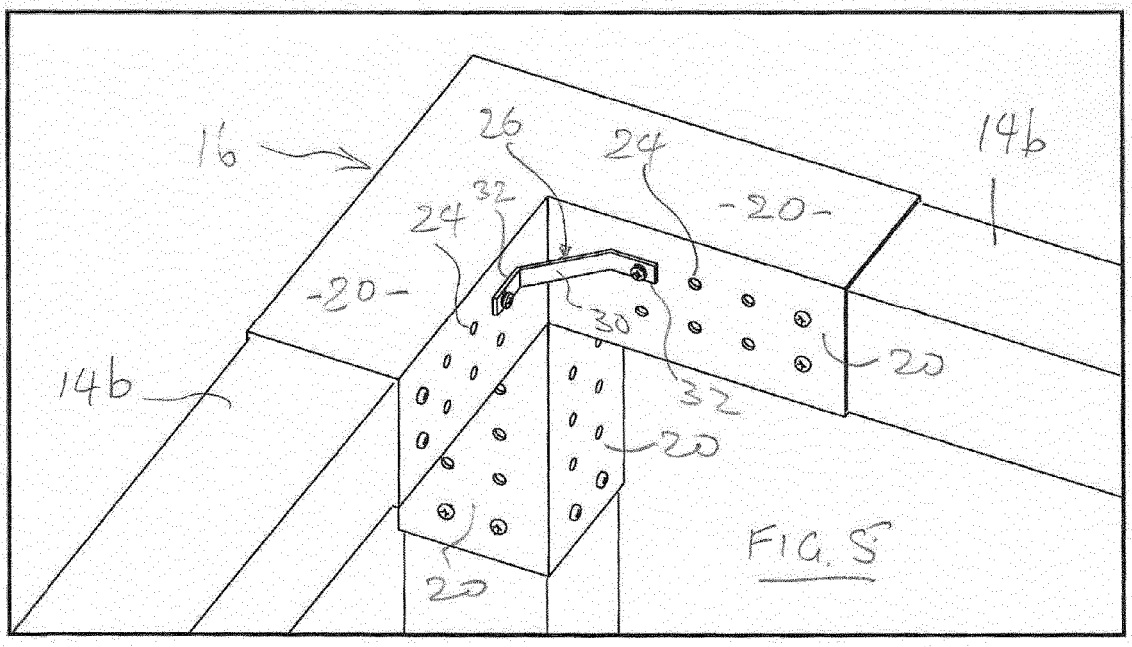
16
26
24
14b
24
32
-20-
-20-
30
14b
20
32
20
20

FIG. 5

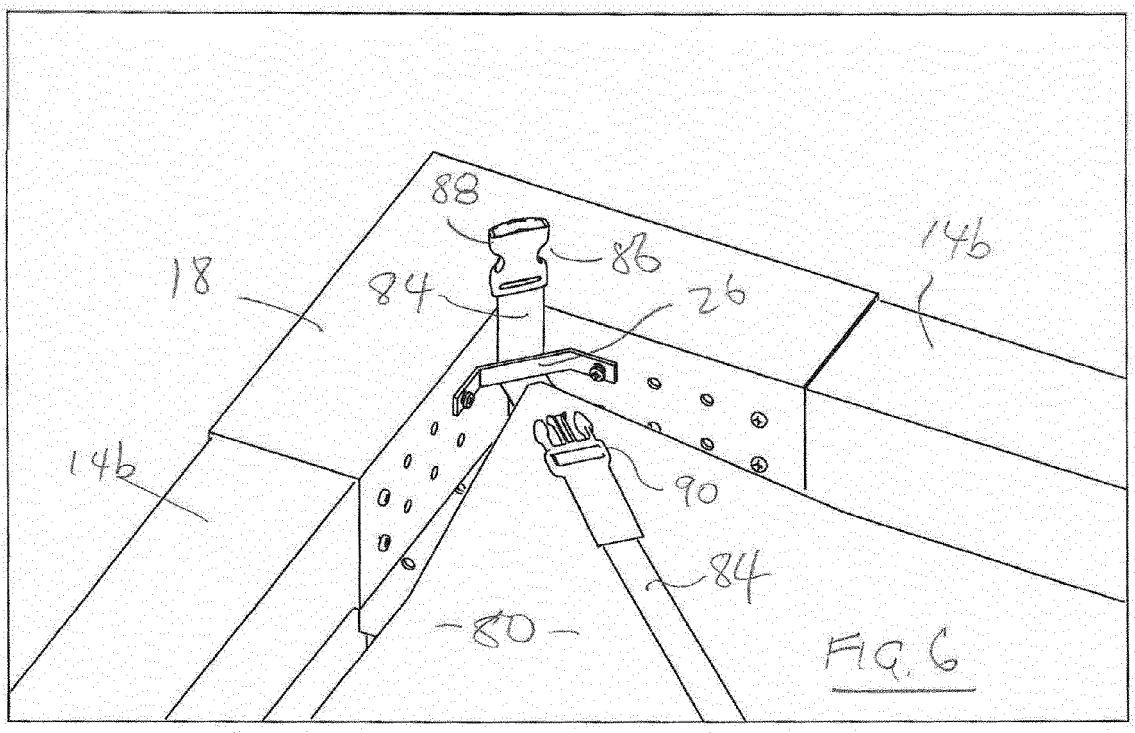

FIG. 6

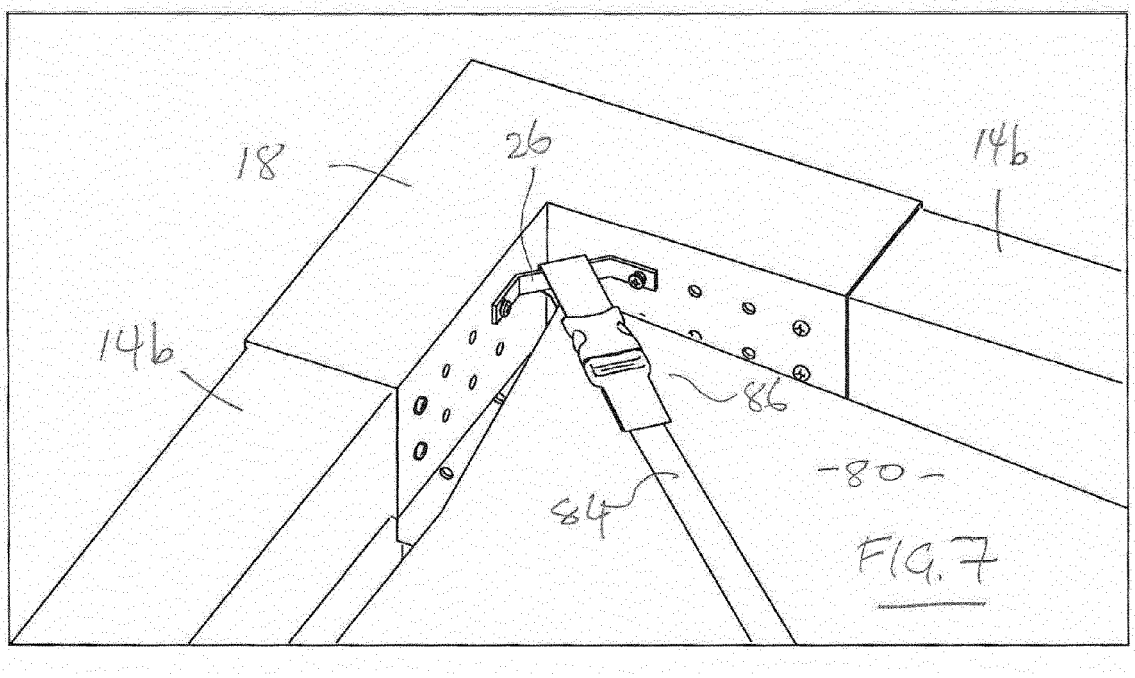

FIG. 7

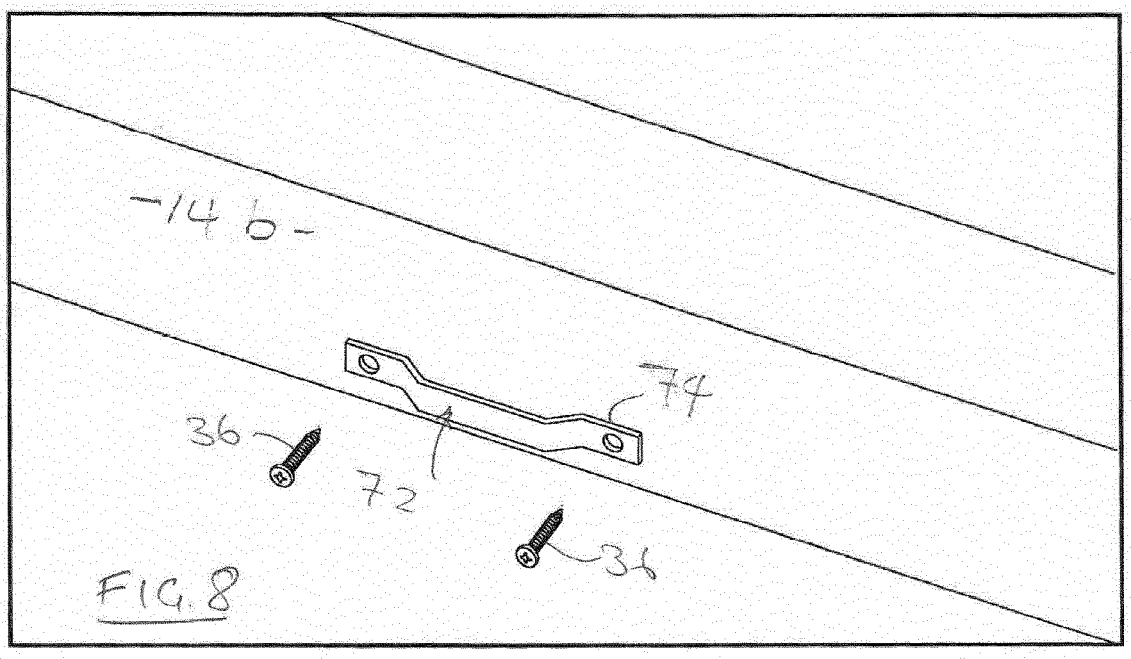

FIG. 8

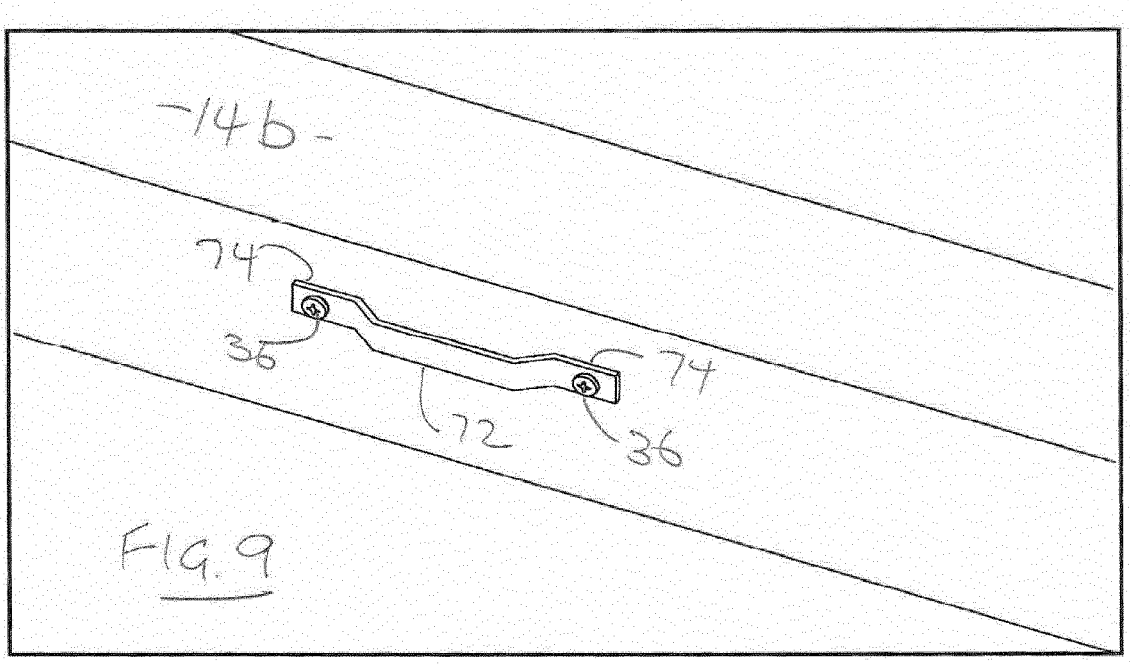

FIG. 9

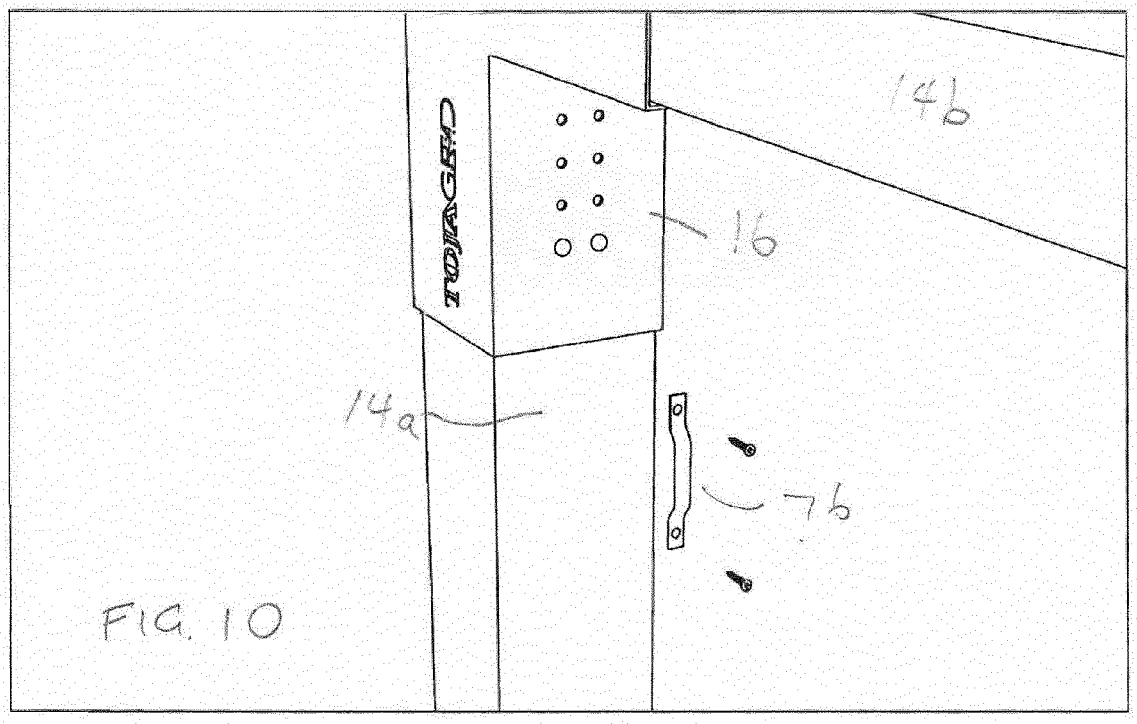

FIG. 10

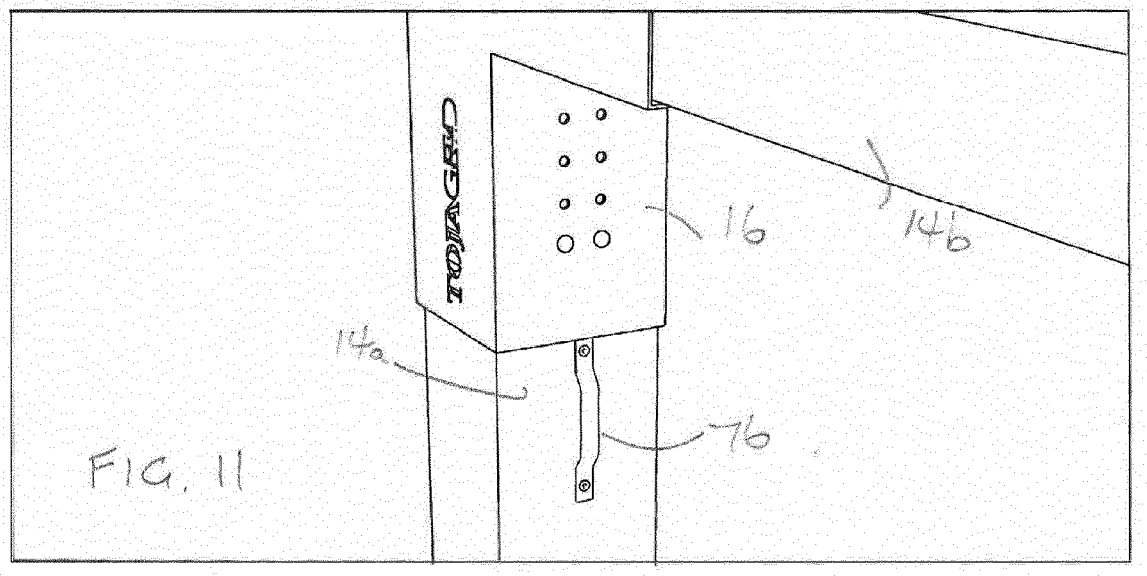

FIG. 11

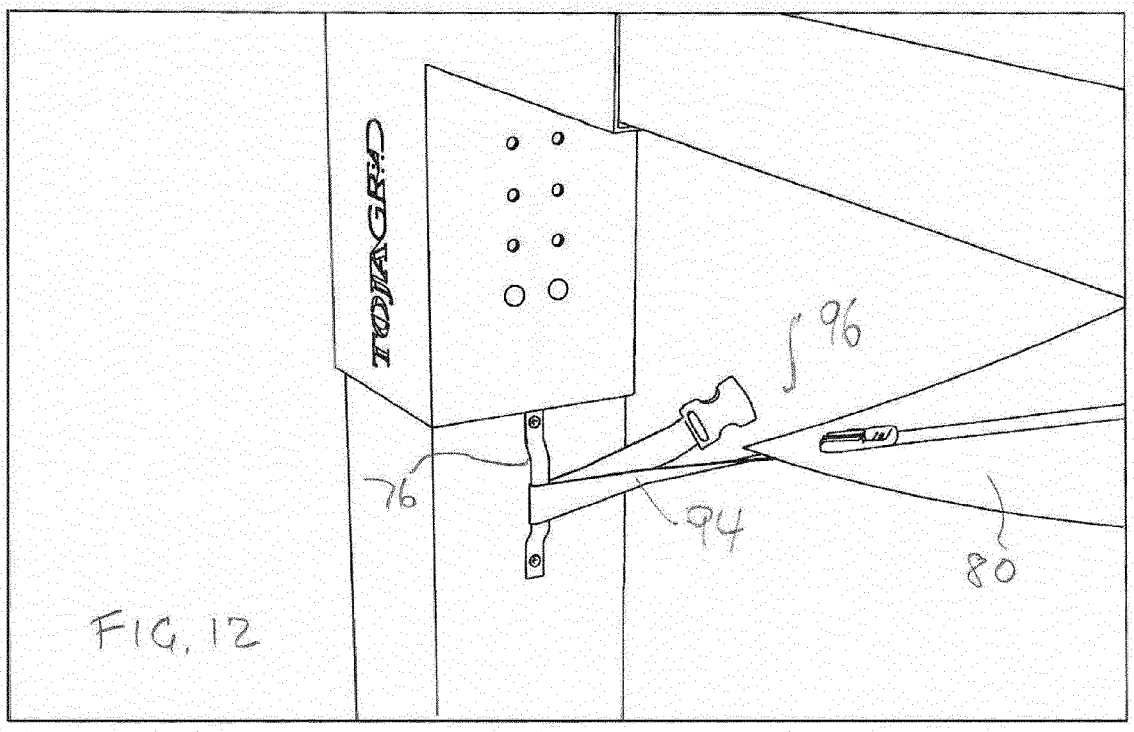

FIG. 12

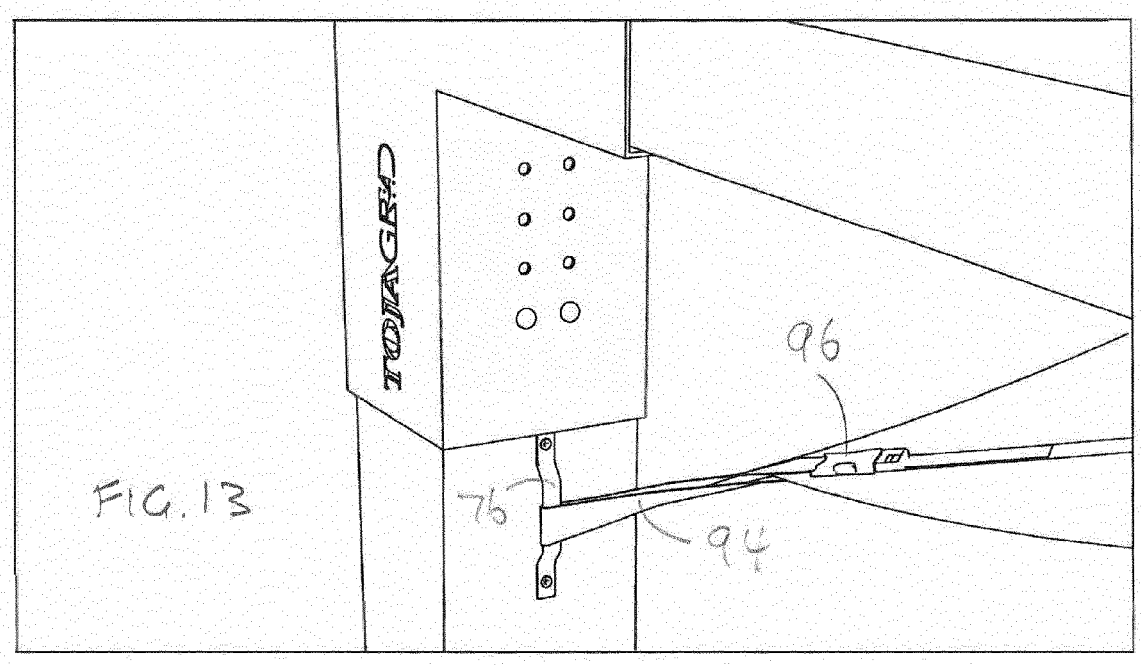

FIG. 13

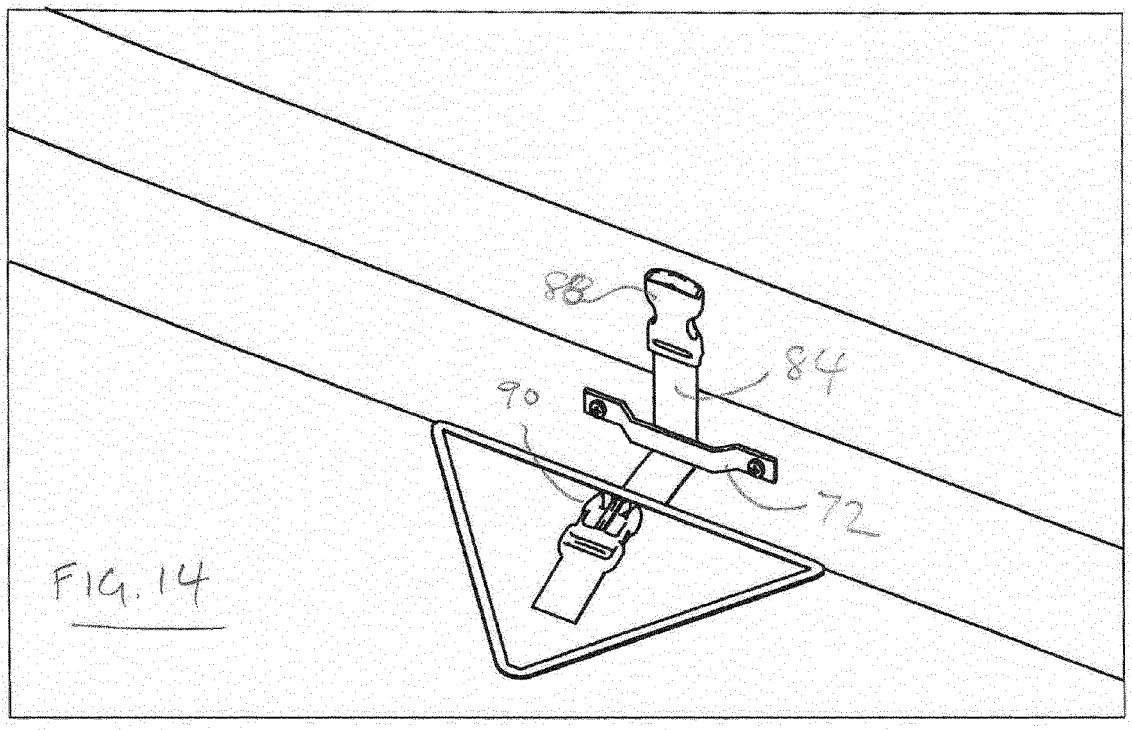

FIG. 14

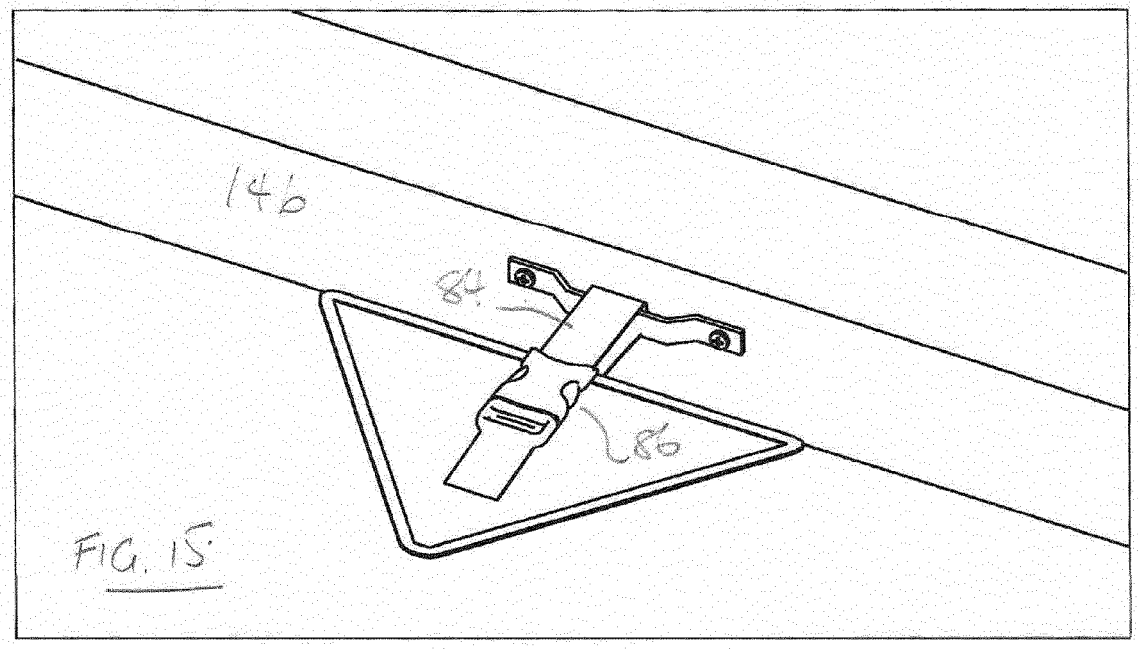

FIG. 15

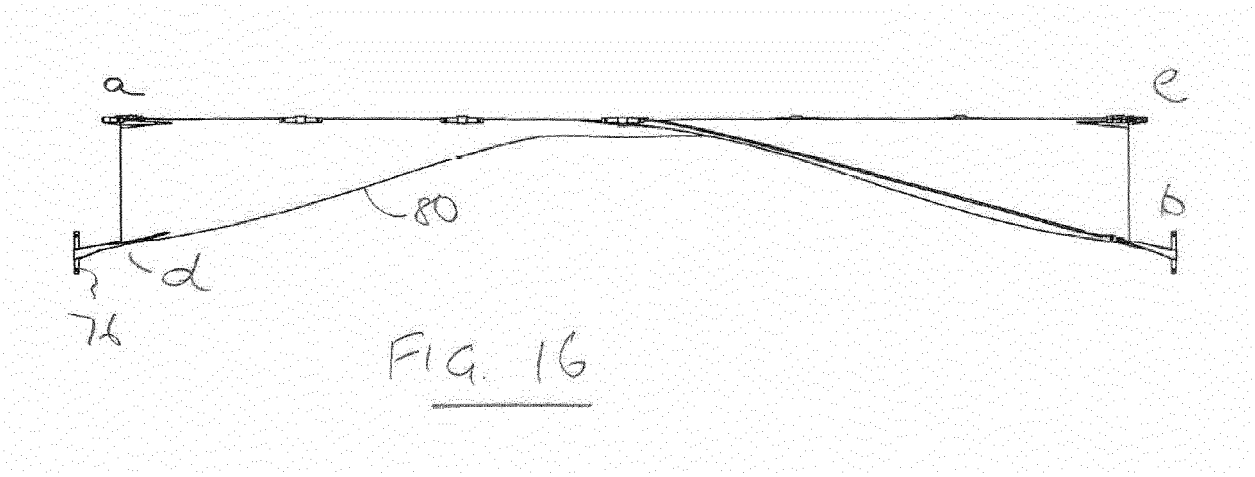

FIG. 16

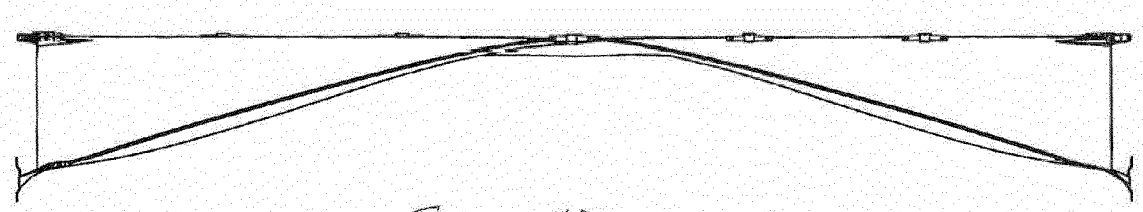

FIG. 17.

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EUROPEAN SEARCH REPORT

Application Number
EP 23 21 6174

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	US 11 214 954 B2 (2724889 ONTARIO INC [CA]) 4 January 2022 (2022-01-04) * column 2, line 27 - column 4, line 14; figure 1 *	1-14	INV. E04F10/02 E04H15/58 E04H15/64

TECHNICAL FIELDS SEARCHED (IPC)

E04F
E04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 May 2024	Kofoed, Peter

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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P : intermediate document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 21 6174

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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