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(54) **STRUCTURAL SOFFIT RESTRAINT ARRANGEMENTS**

(71) Applicant: **Sasan Saidian**, West Pennant Hills (AU)

(72) Inventor: **Sasan Saidian**, West Pennant Hills (AU)

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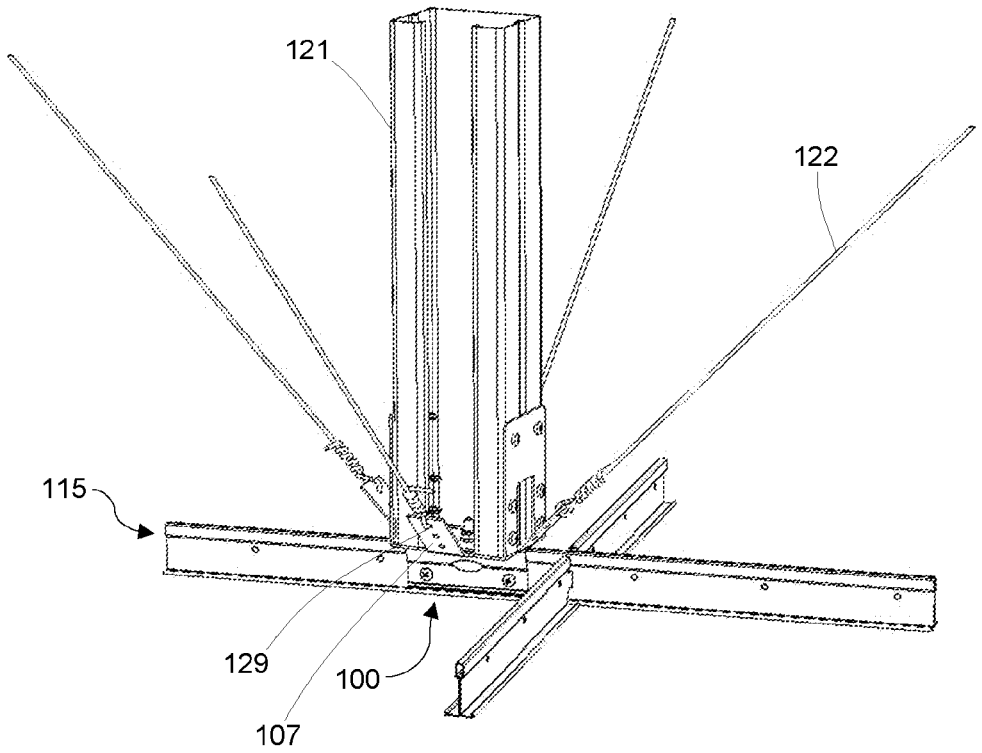
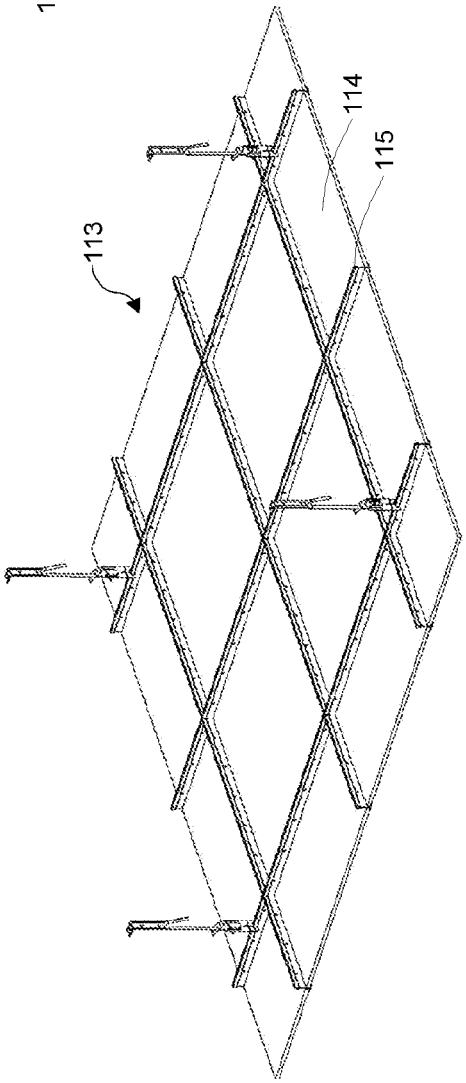
(57) **ABSTRACT**

An arrangement for restraining a structure from a structural soffit has a connector (**100**) for connecting the structure to at least one of a vertical restraining post (**121**), angled bracing strut (**123**) and angled bracing tie (**122**). The connector (**100**) has a horizontal midsection (**104**) an upper bracing bracket (**105**) extending up from the horizontal midsection (**104**), the upper bracing bracket (**105**) having a pair of upright parallel restraining post-engaging flanges (**106**) extending from opposite sides of the horizontal midsection (**104**). A quadrant of angled brace-engaging tabs (**107**) extending upwardly and outwardly respectively from four sides of the horizontal midsection (**104**). A lower structure joiner (**108**) engages the structure.





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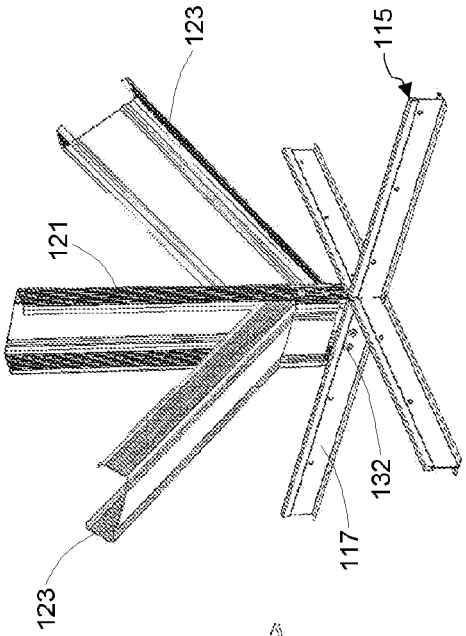

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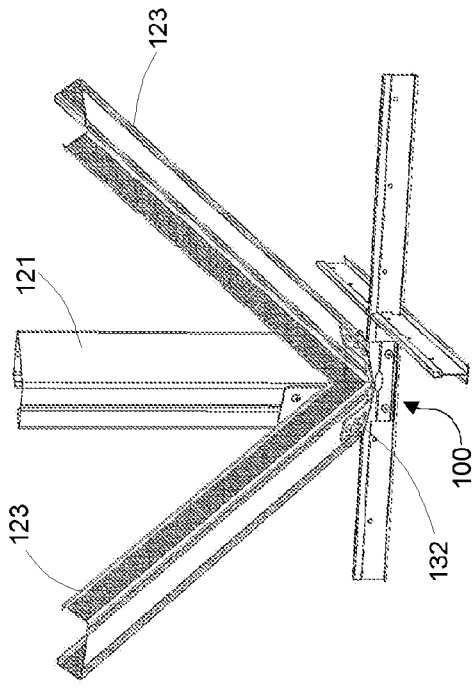

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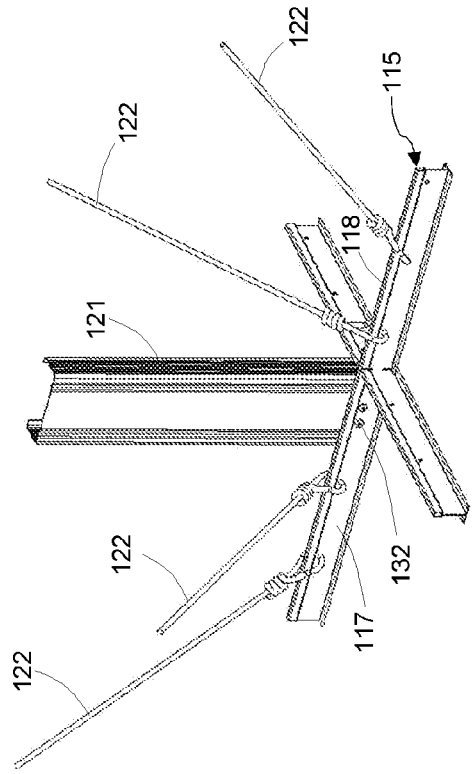

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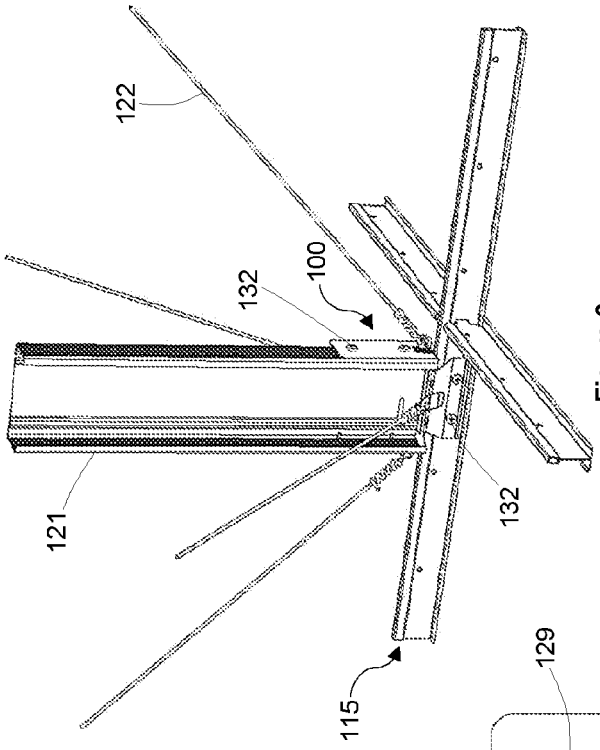

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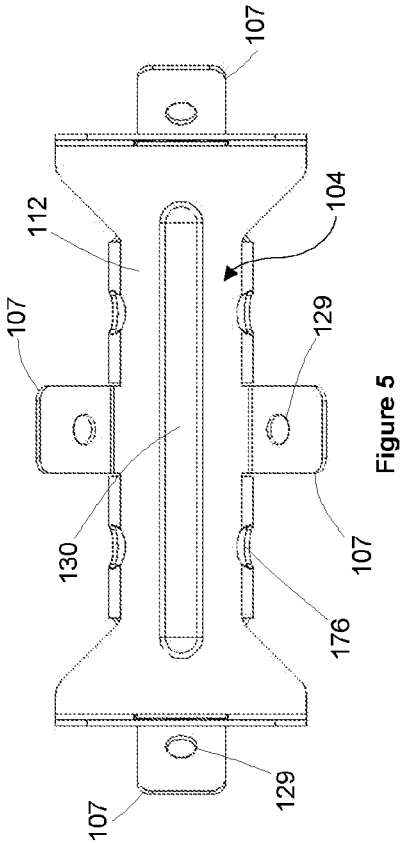

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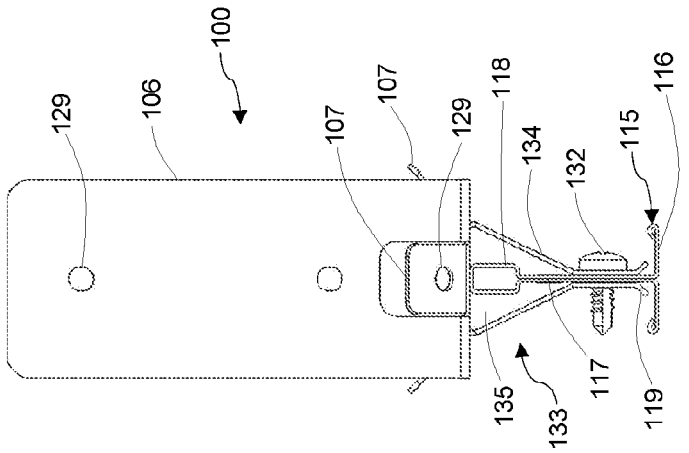

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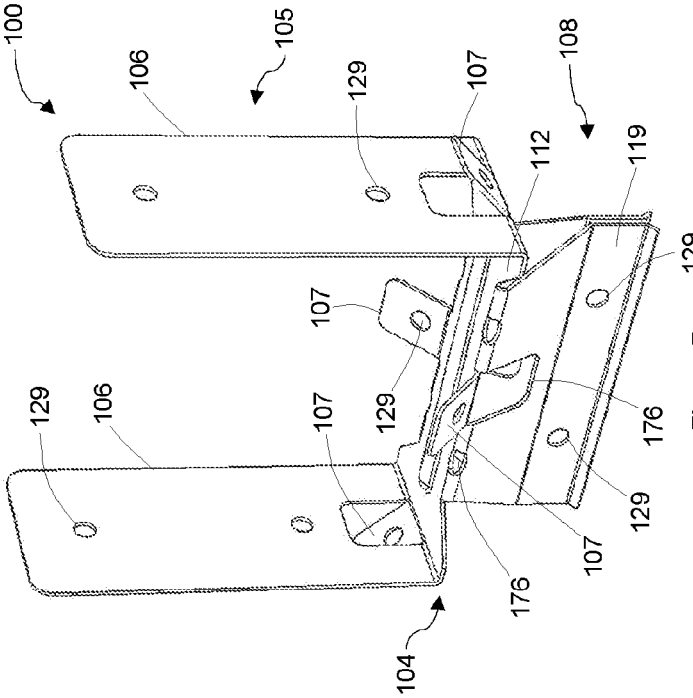

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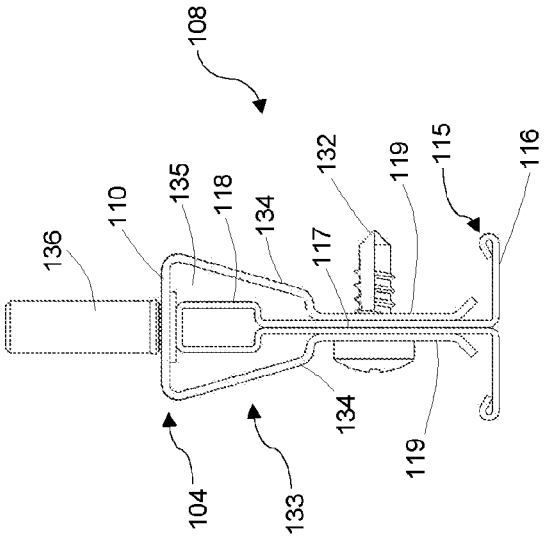

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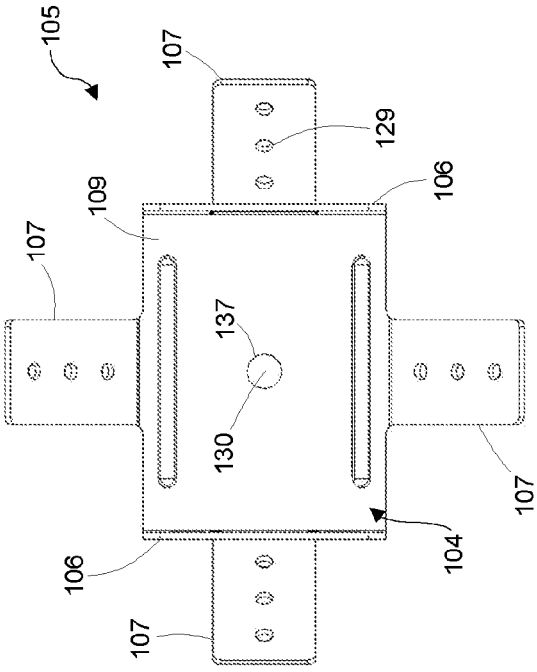

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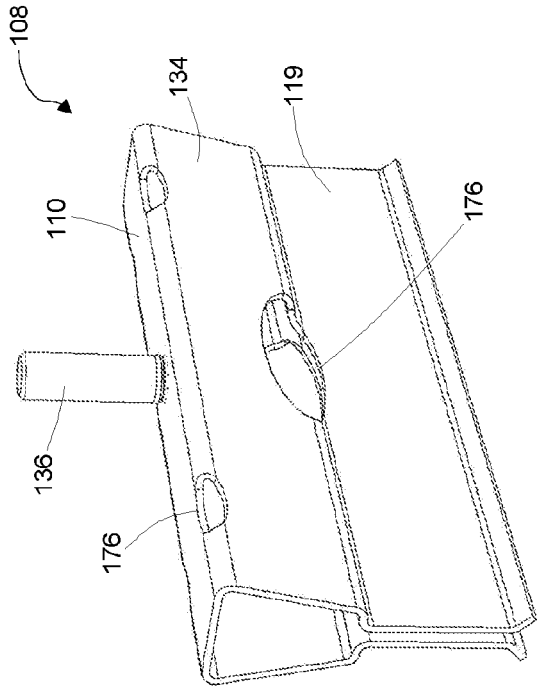

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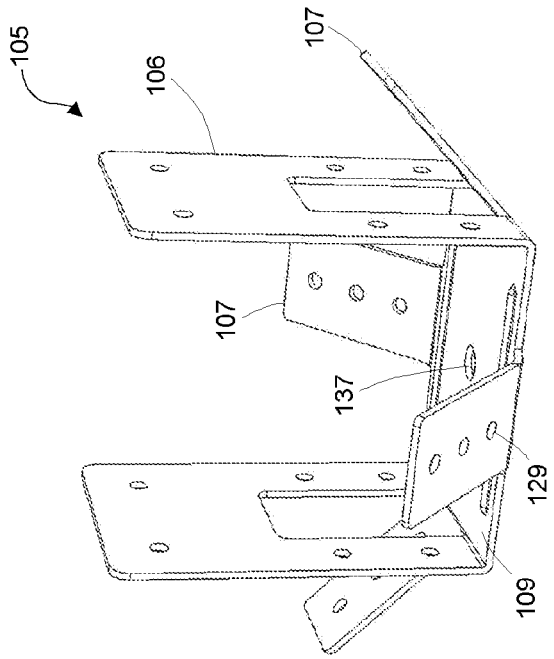

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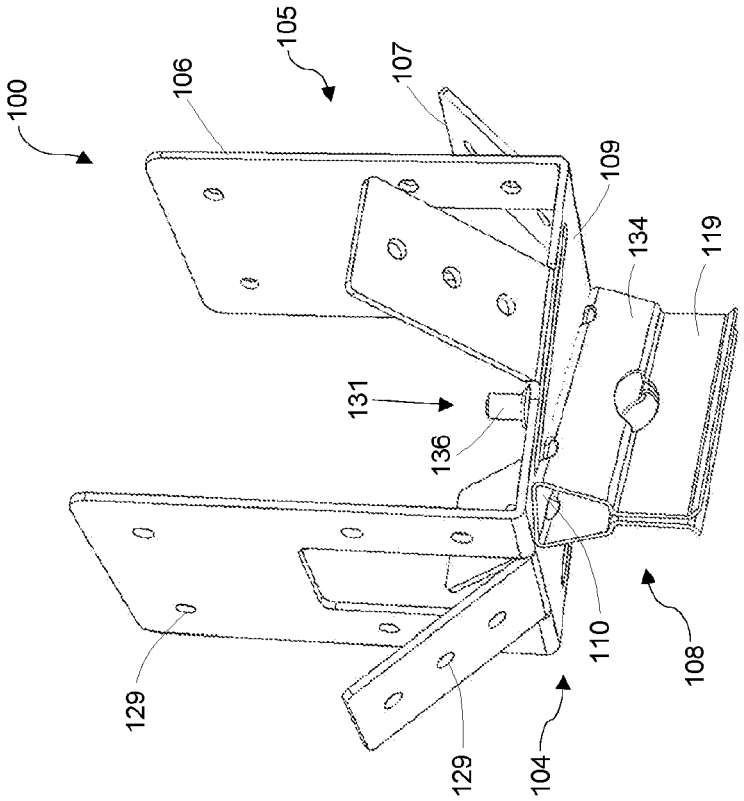

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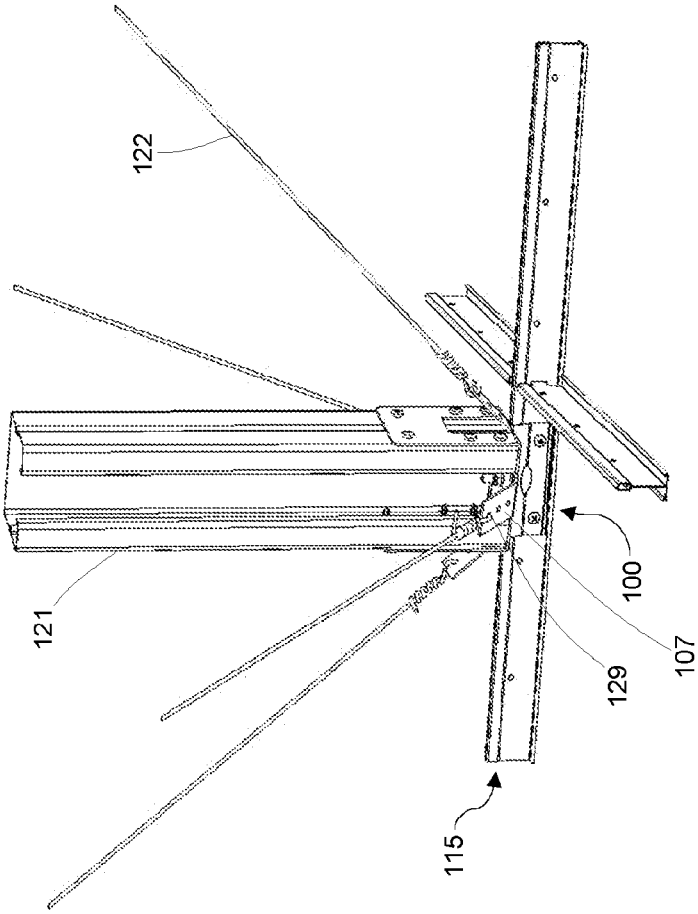

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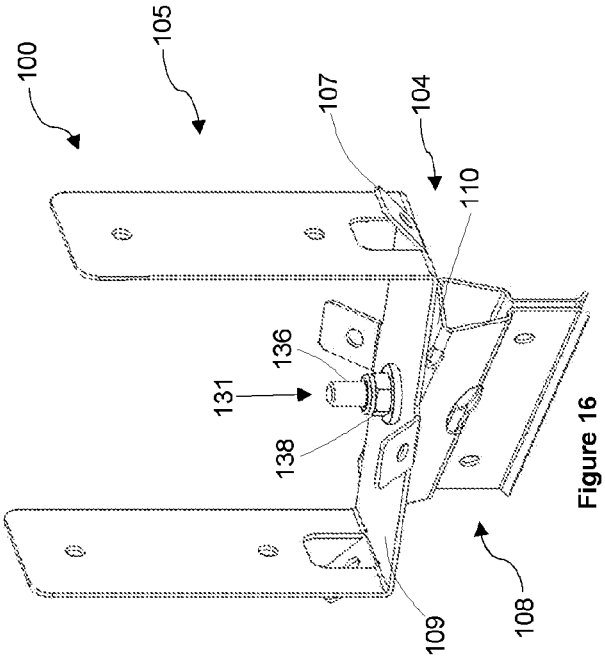

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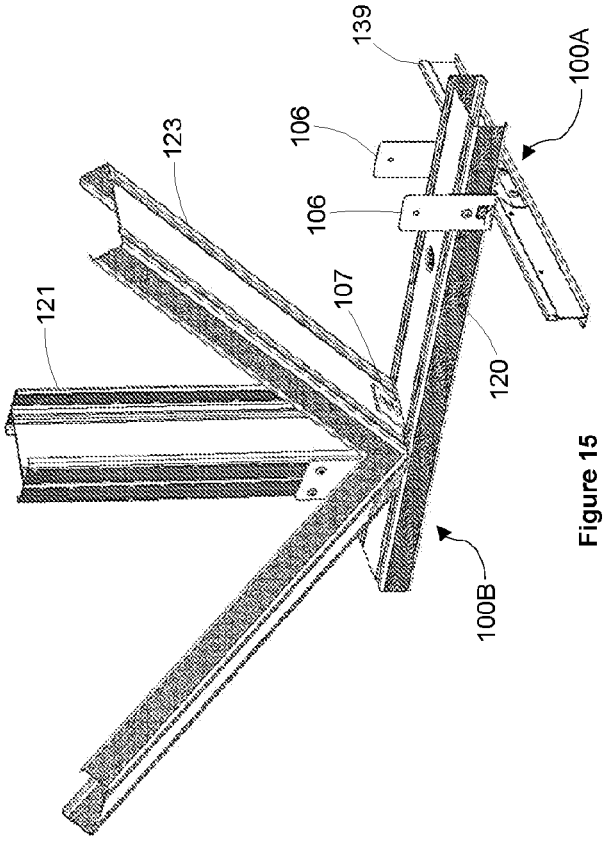

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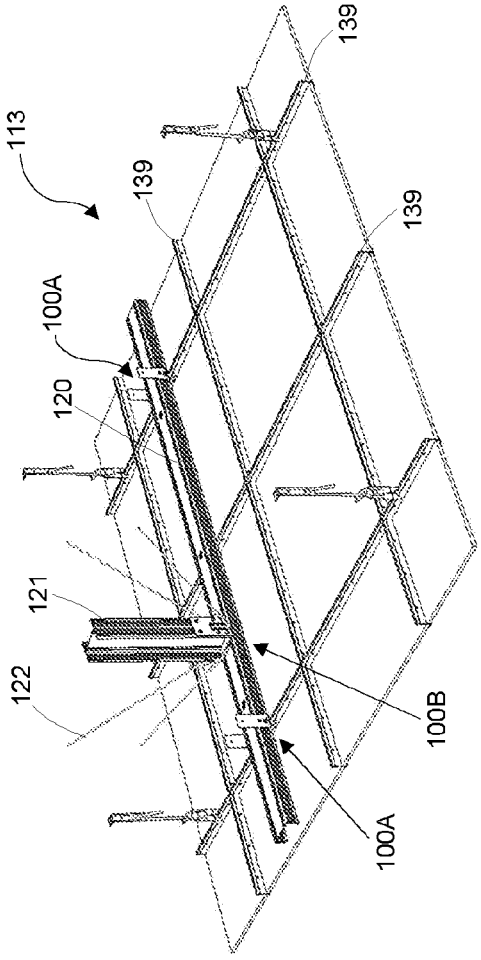

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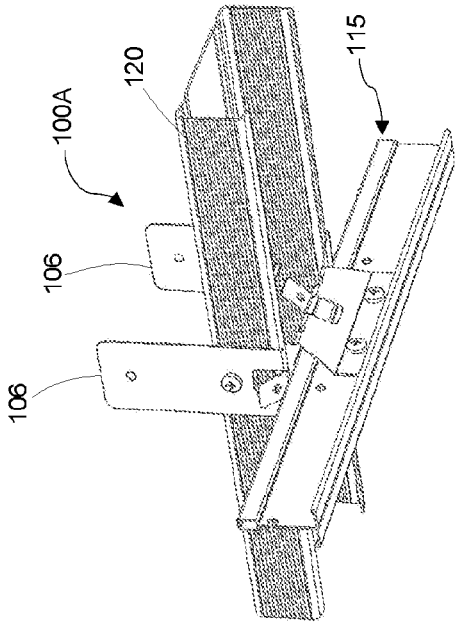

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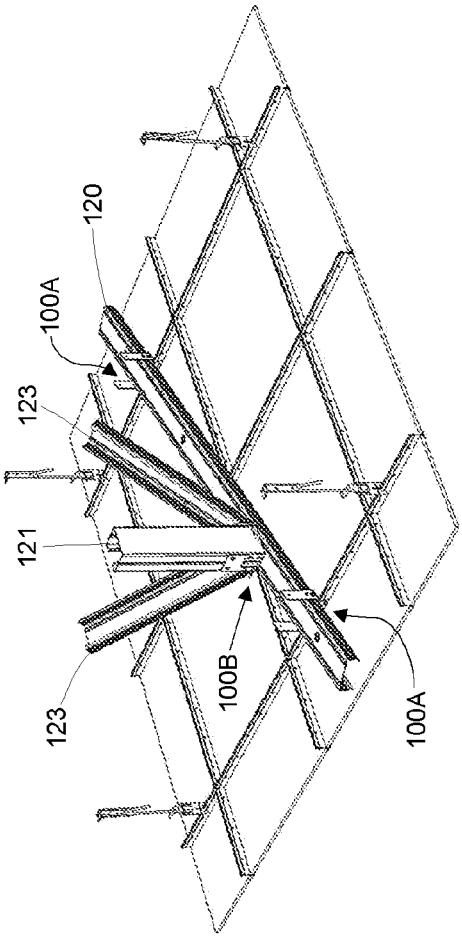

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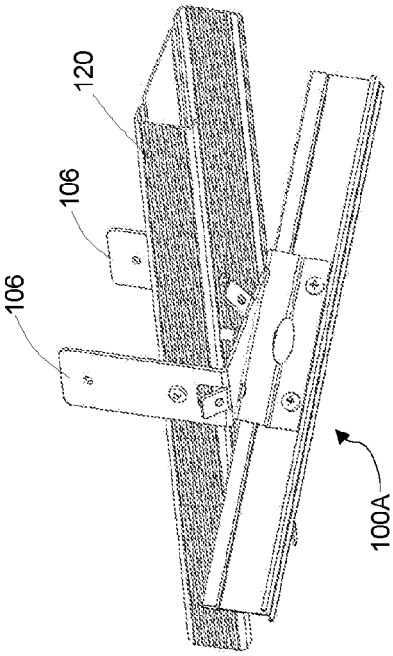

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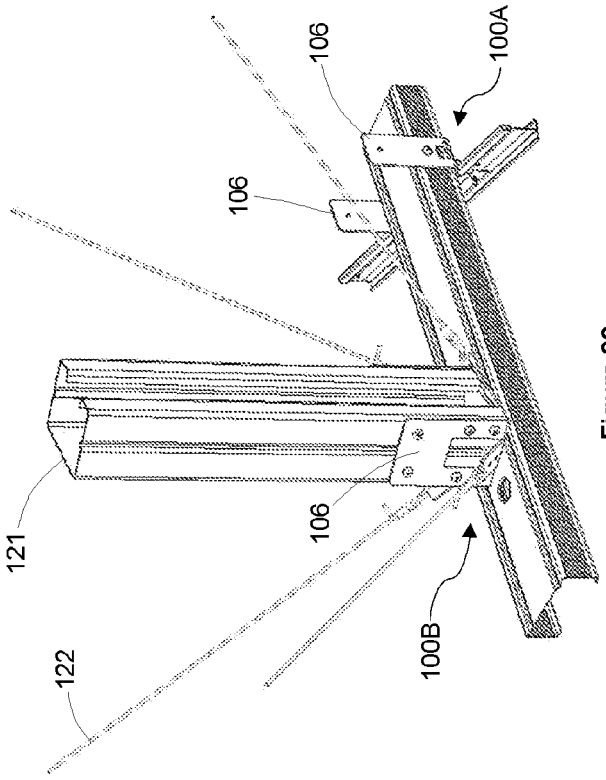

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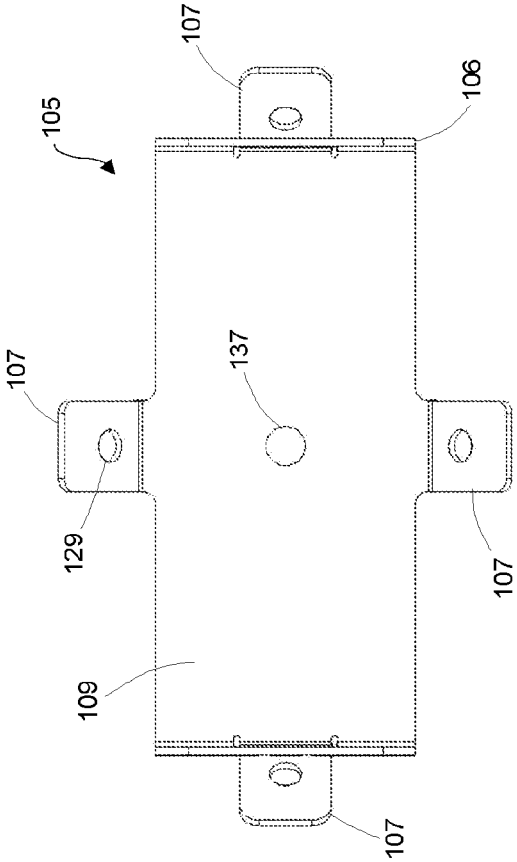

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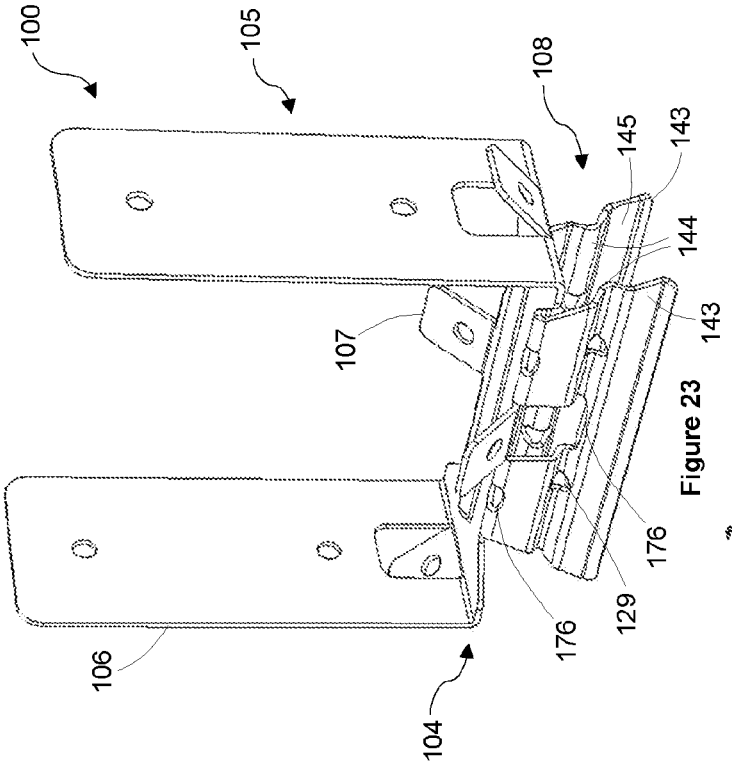

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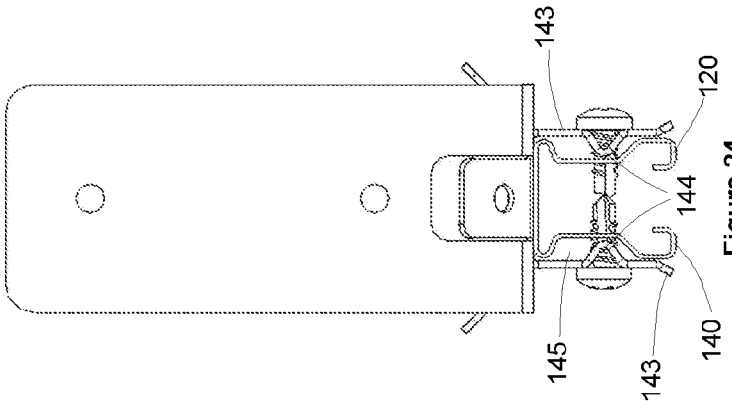

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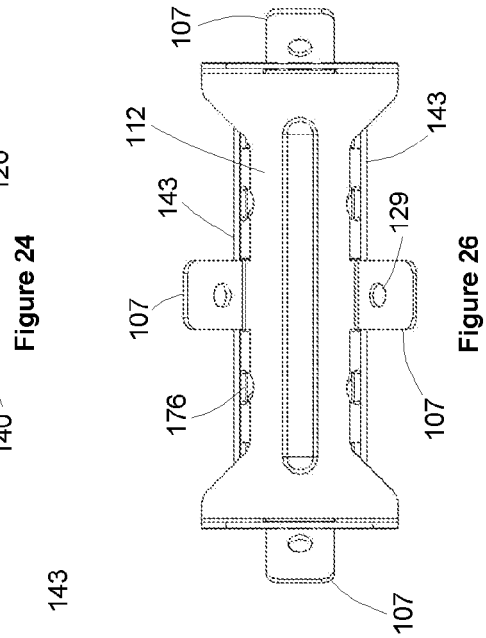

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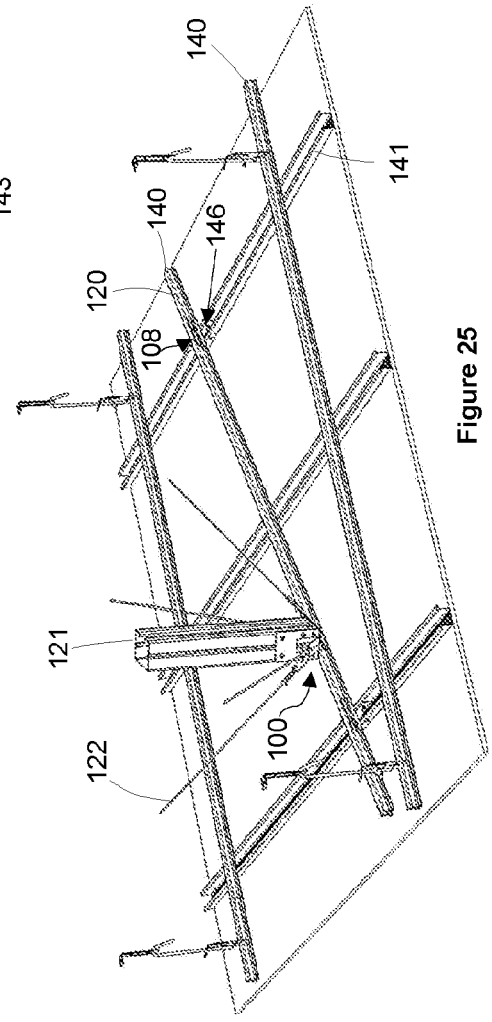

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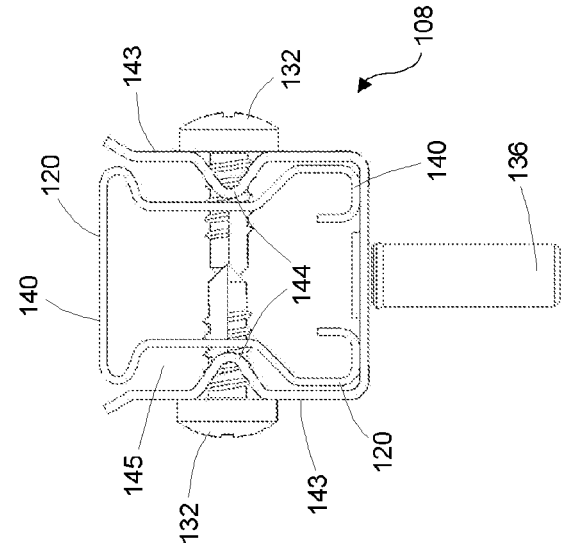

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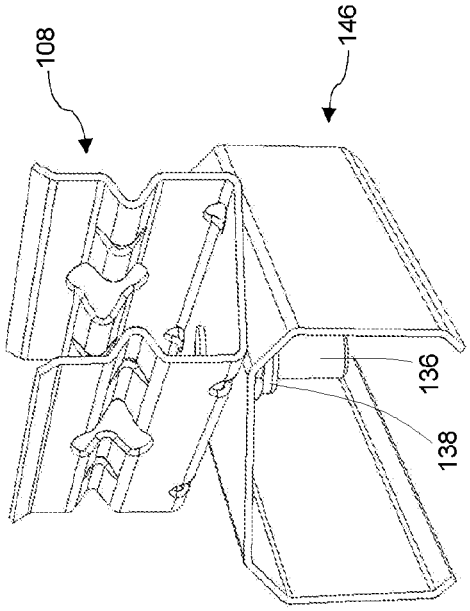

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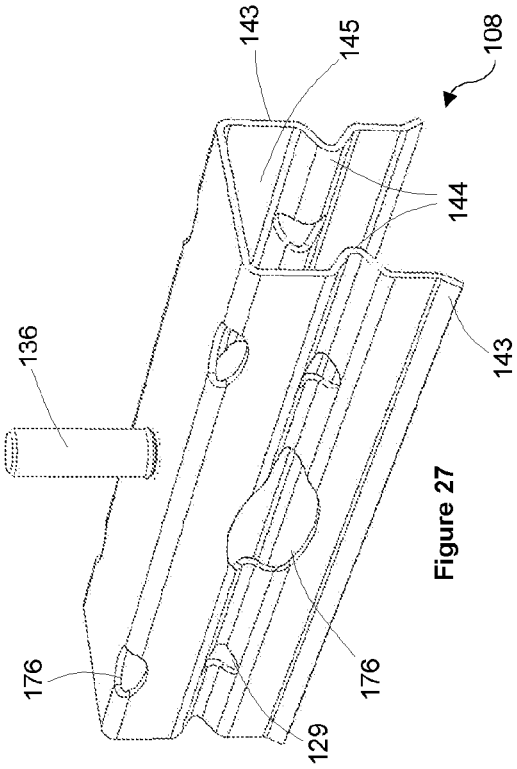

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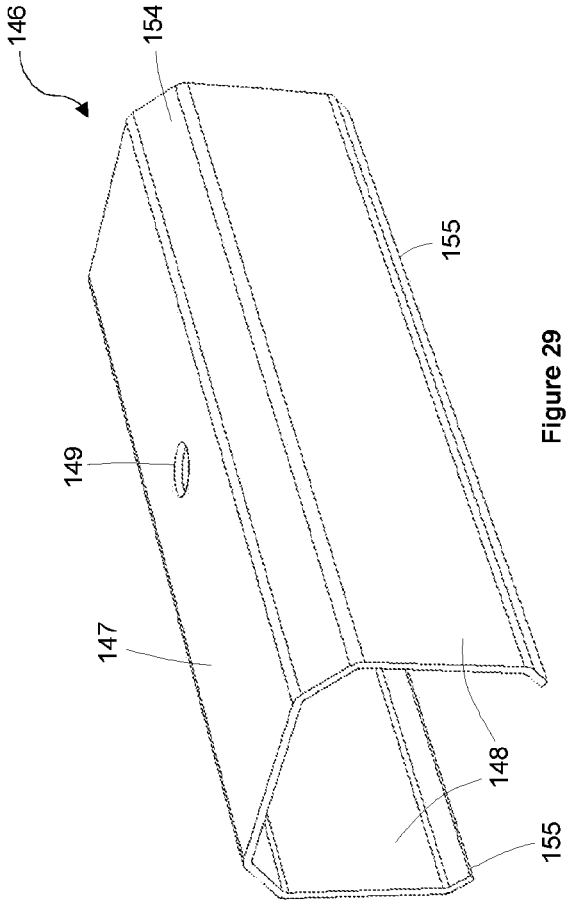

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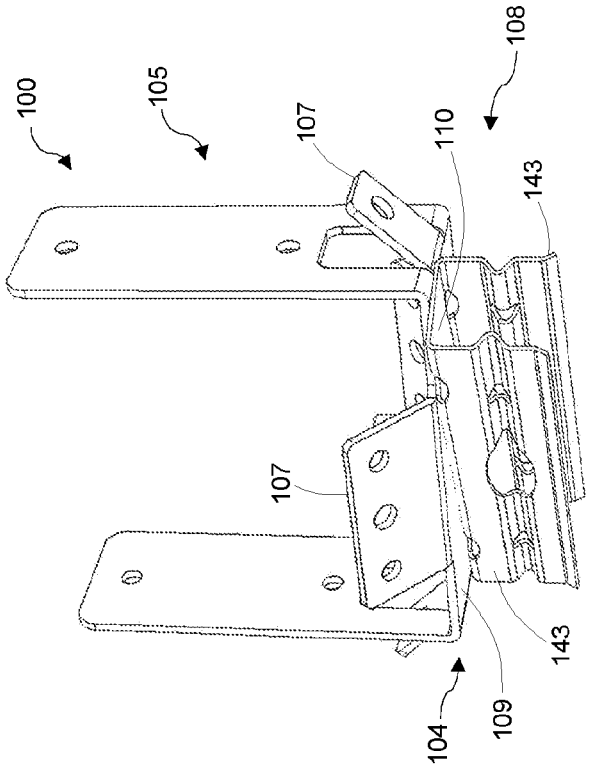

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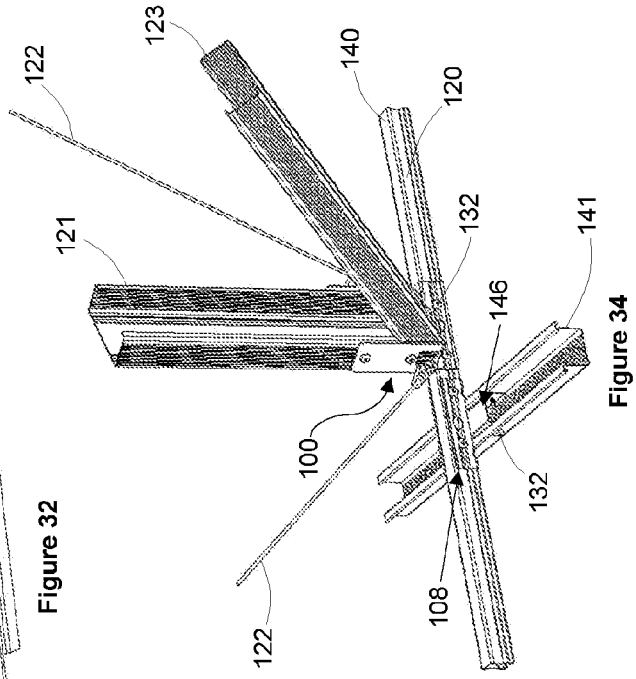

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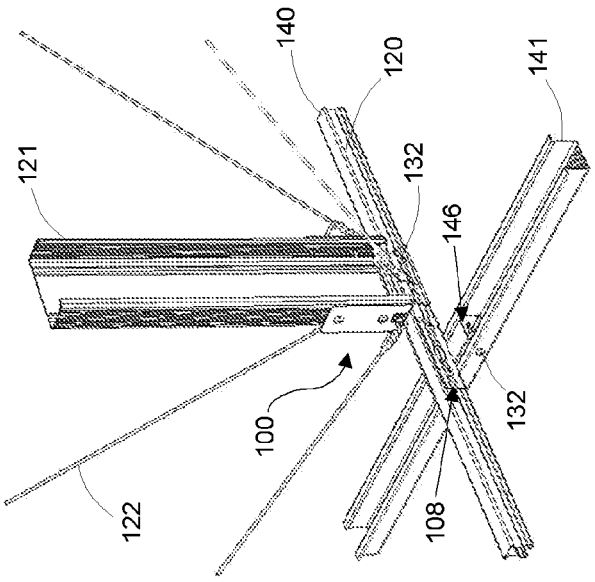

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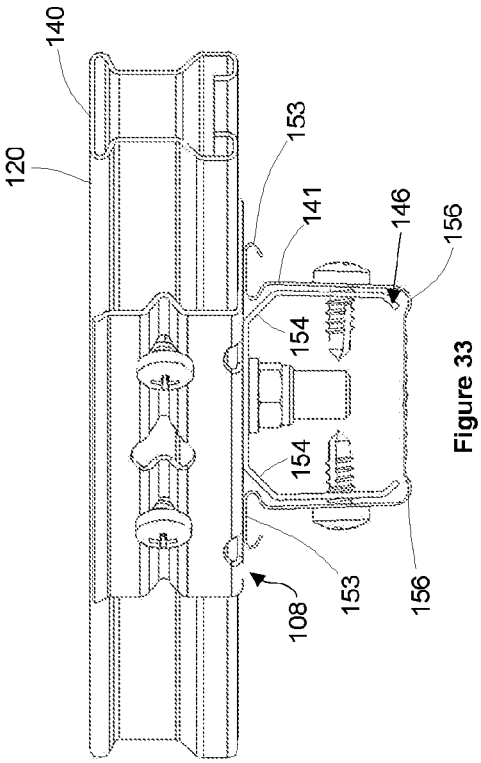

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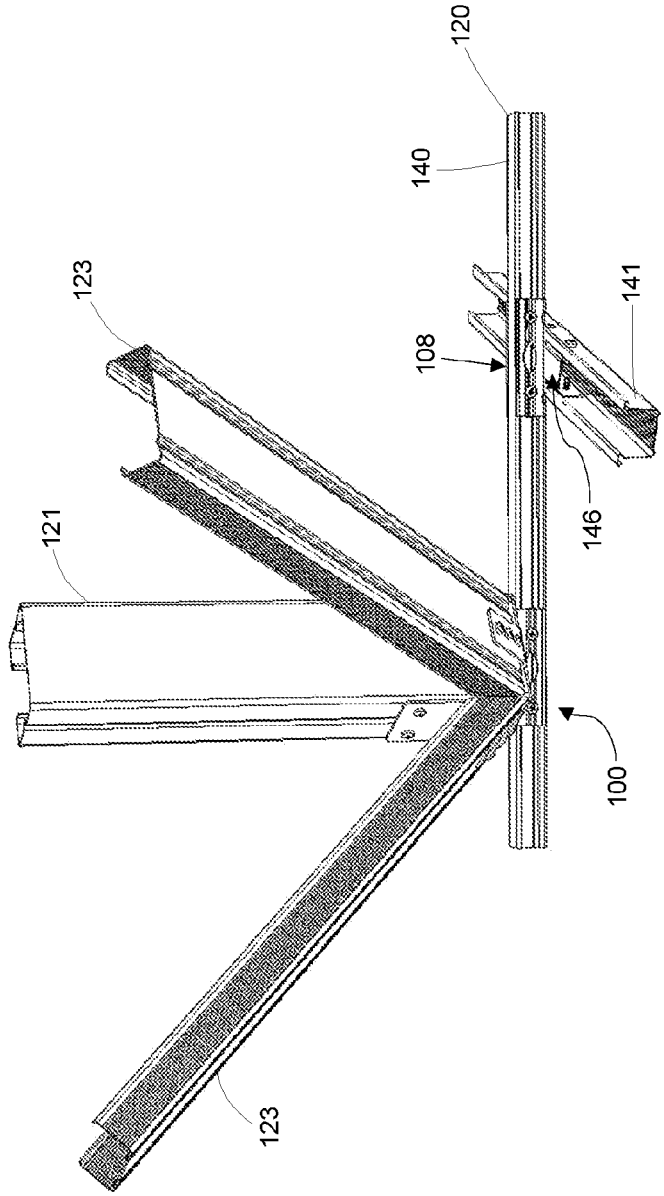

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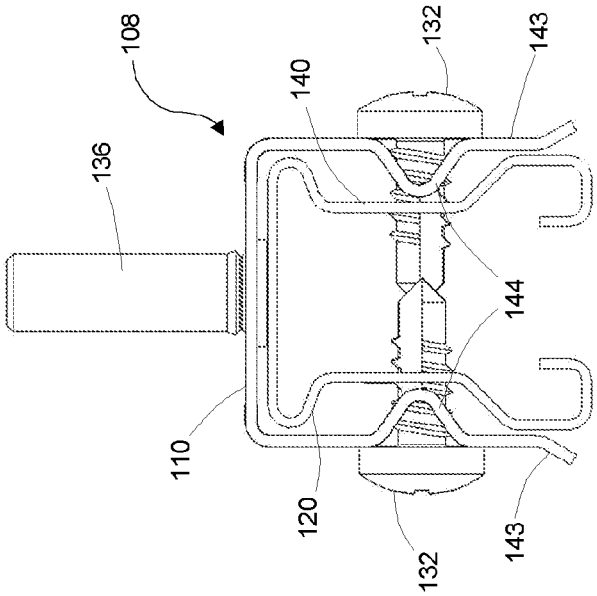

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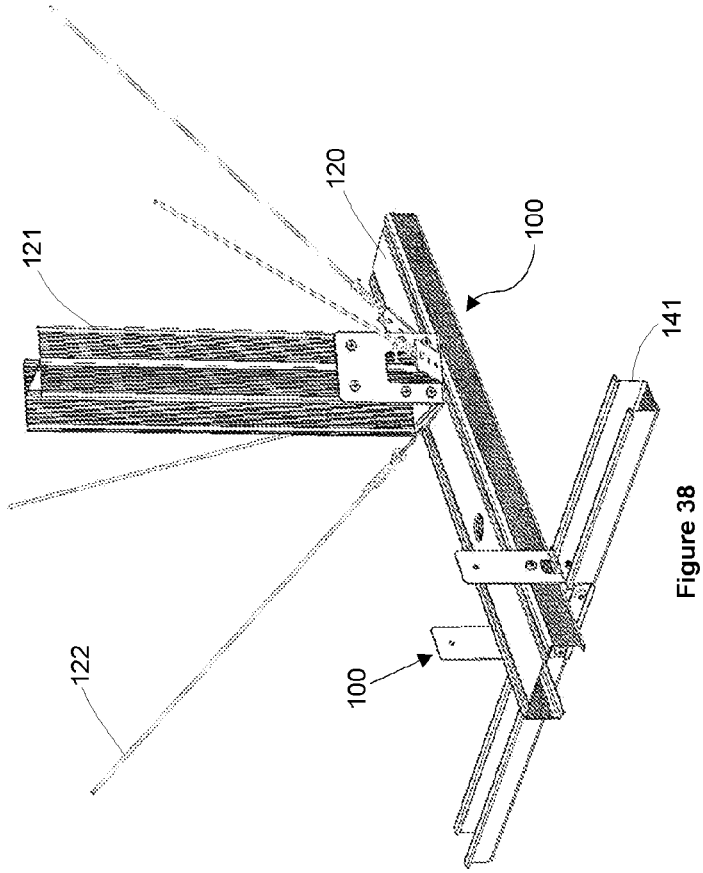

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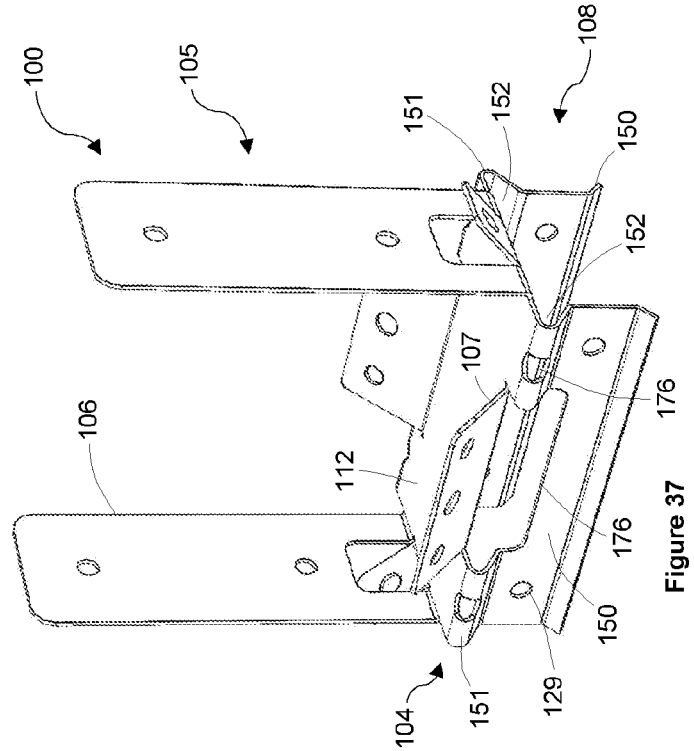

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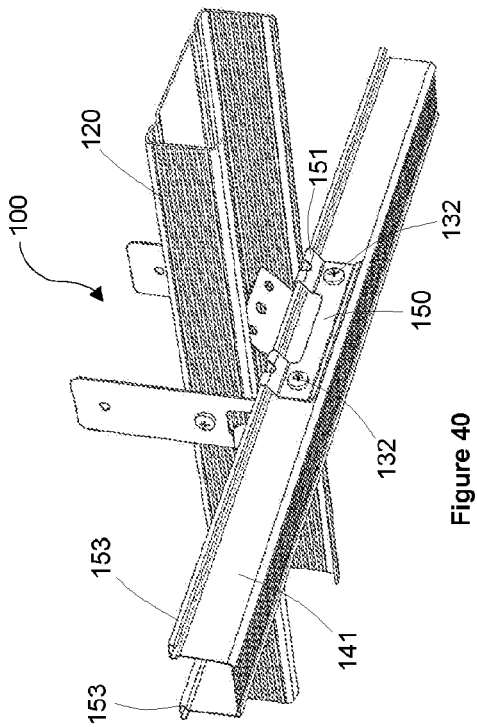

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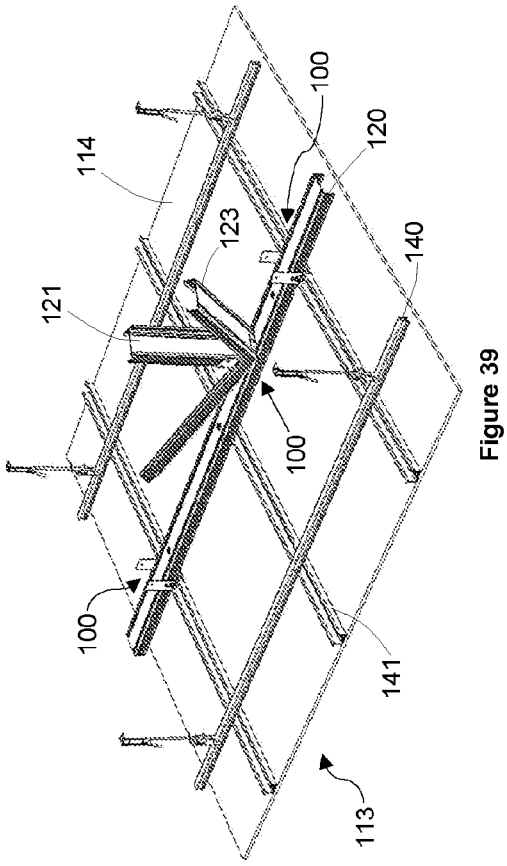

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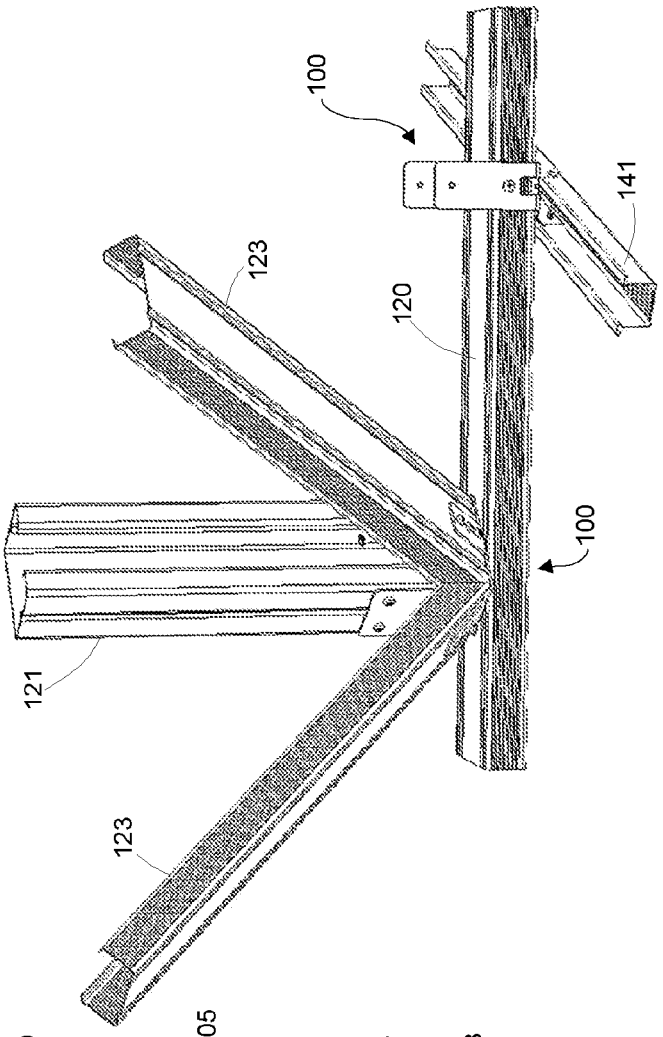

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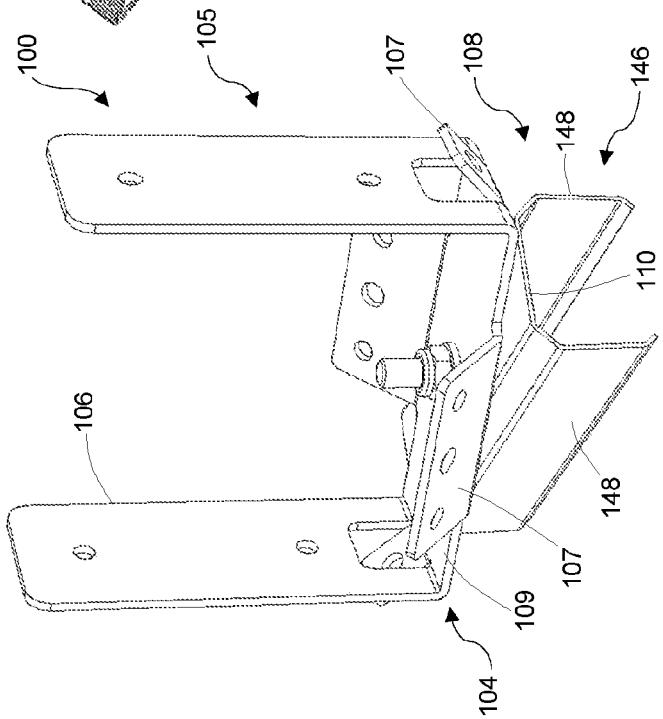

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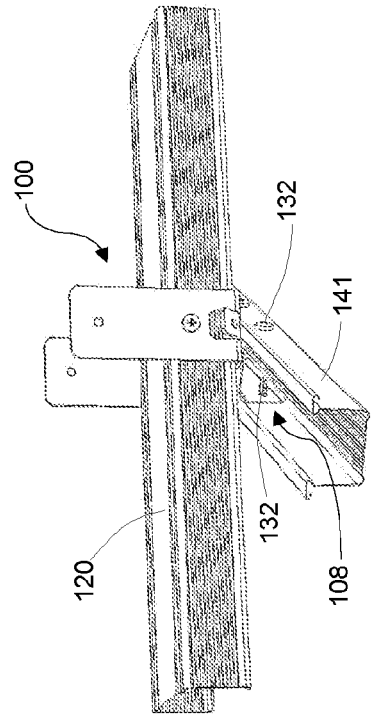

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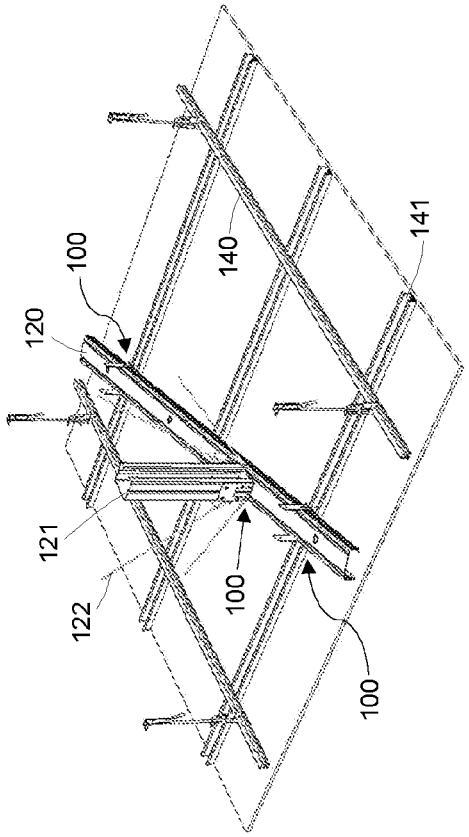

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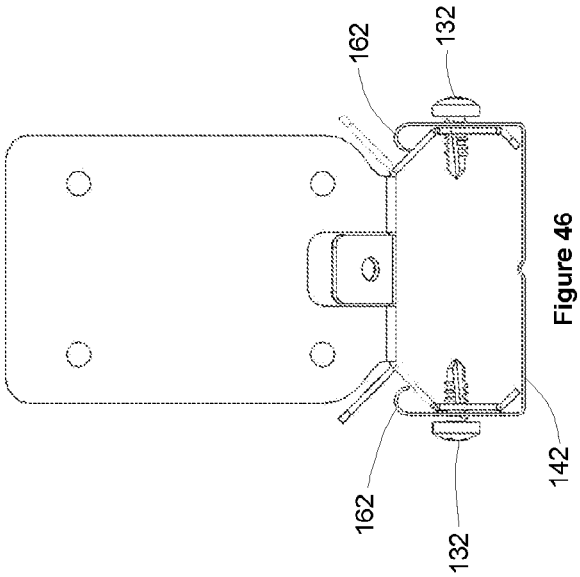

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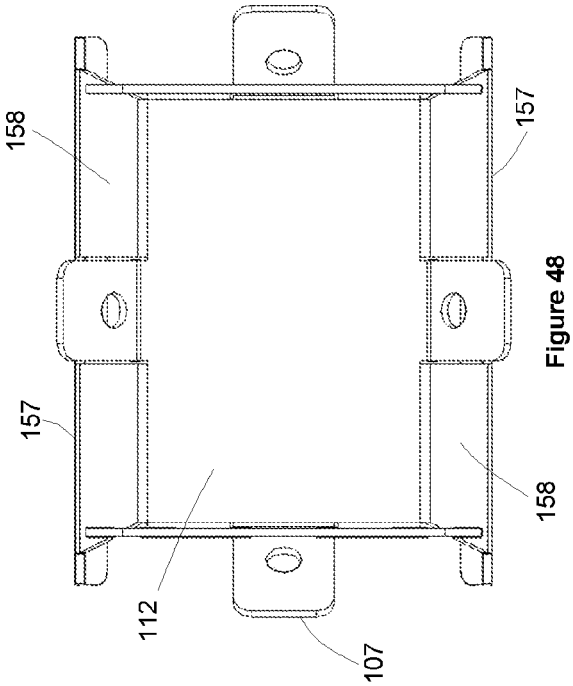

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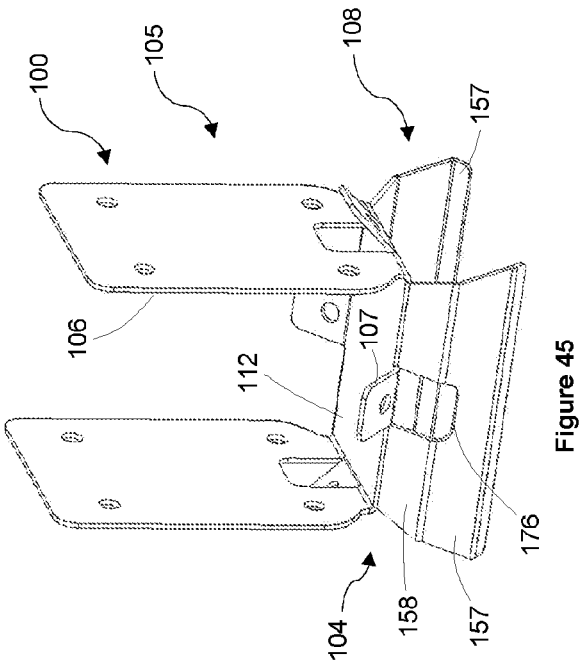

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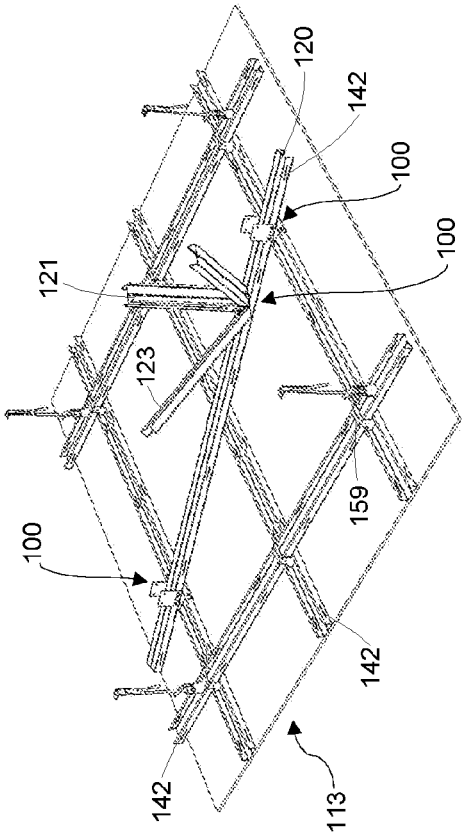

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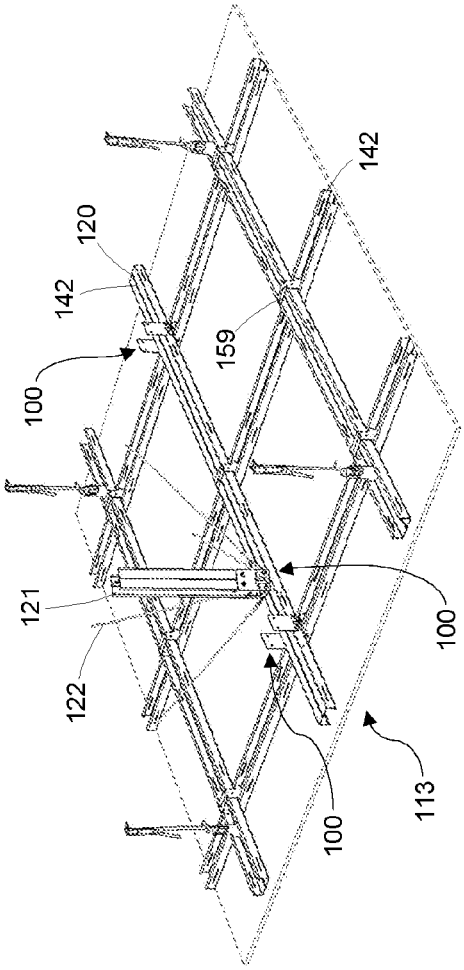

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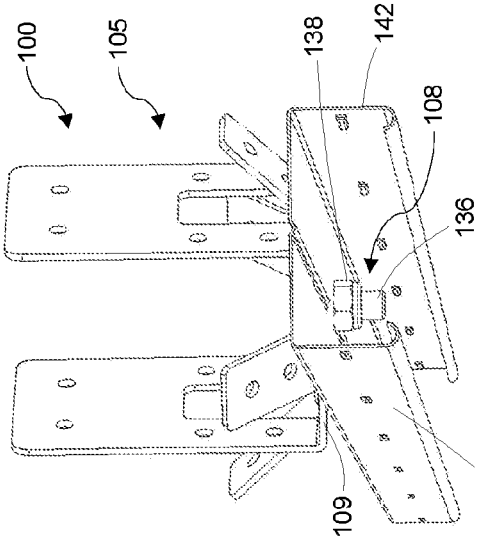

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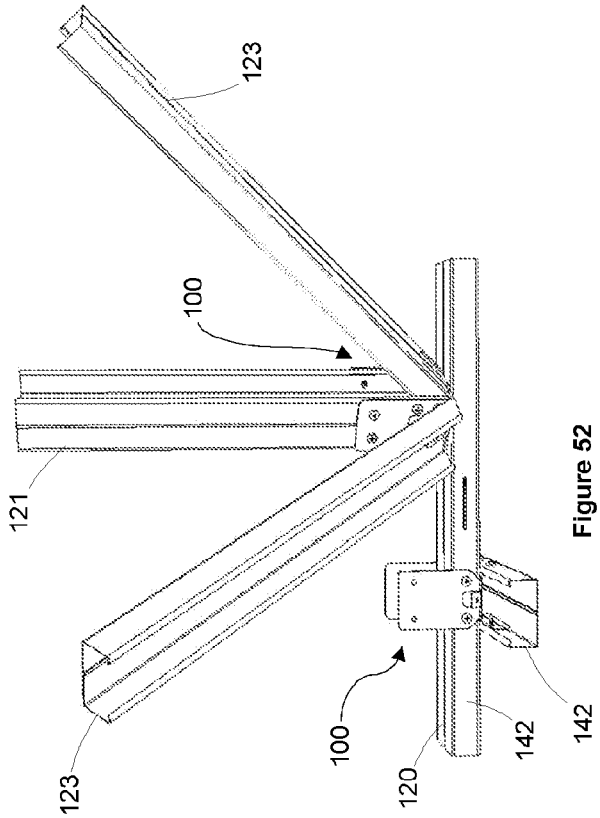

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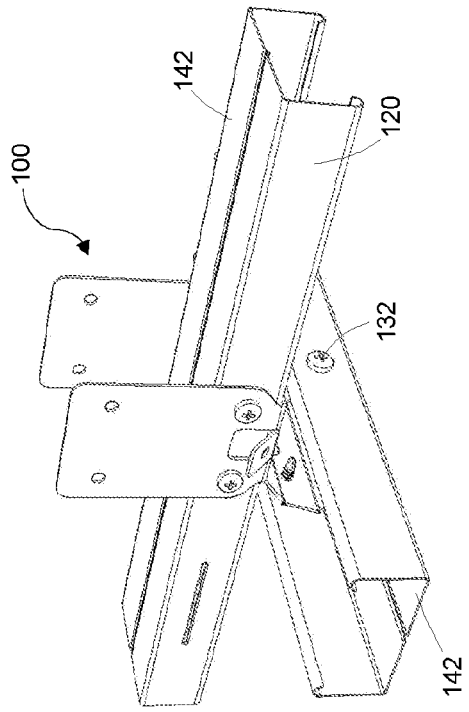

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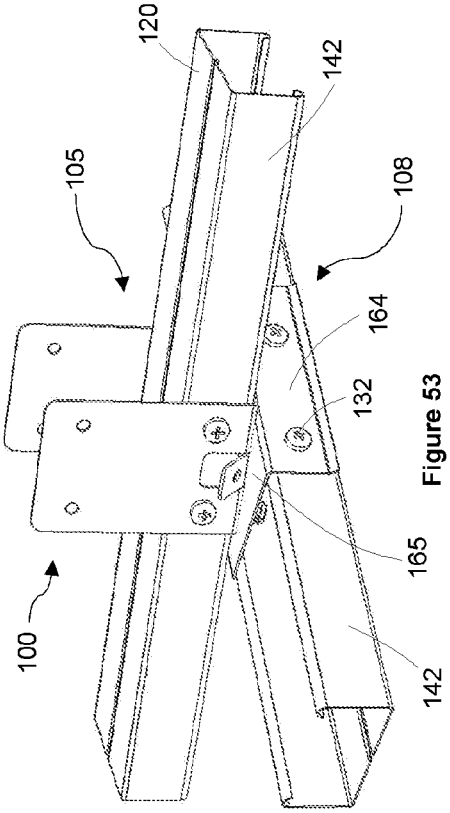

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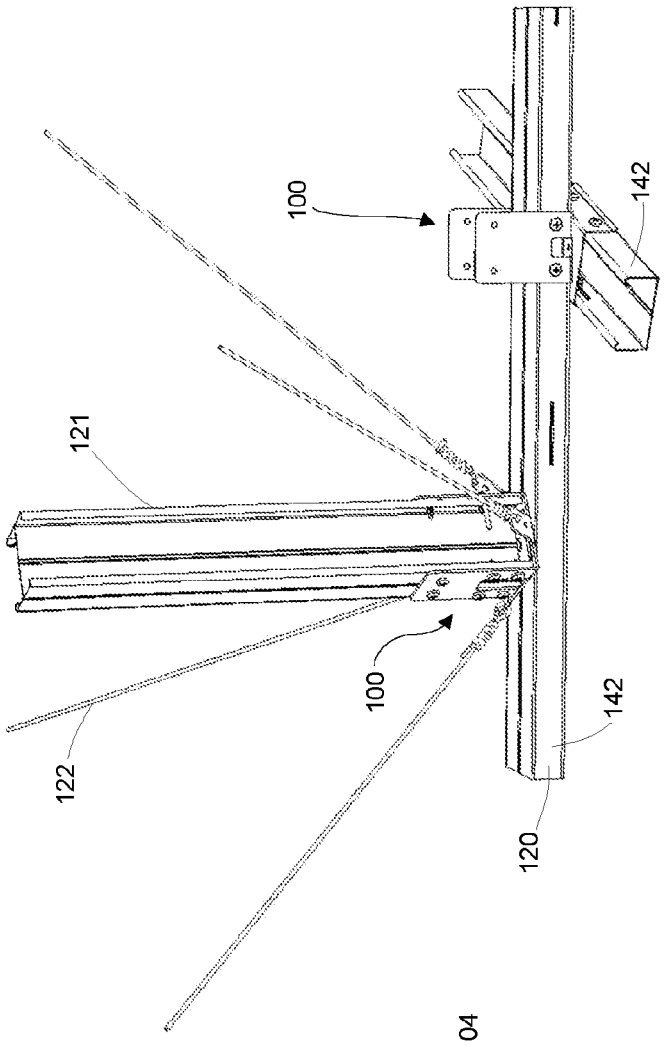

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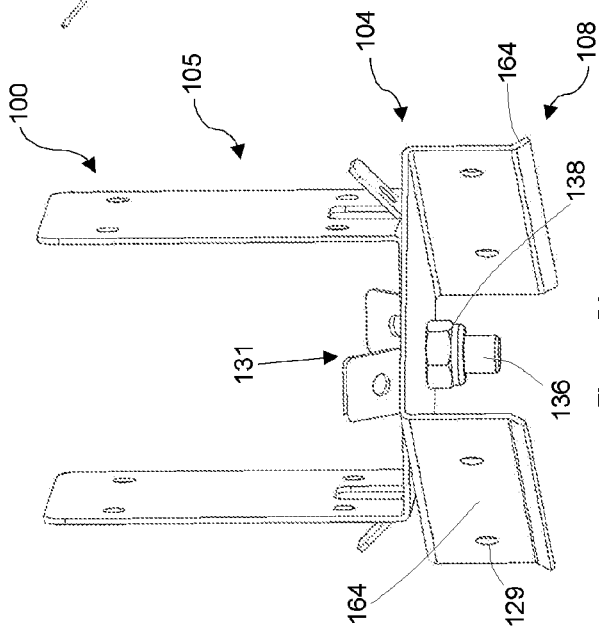

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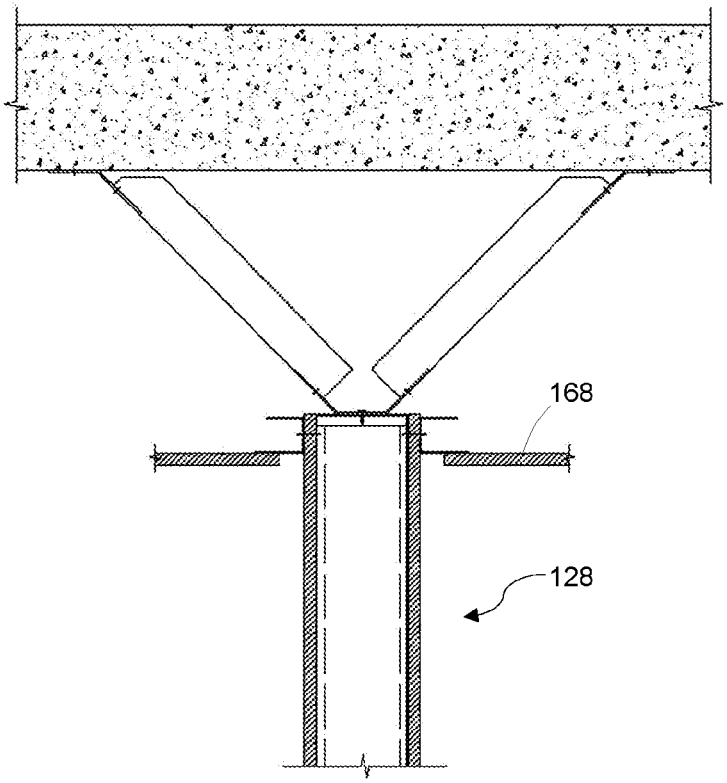

Figure 56 (Prior Art)

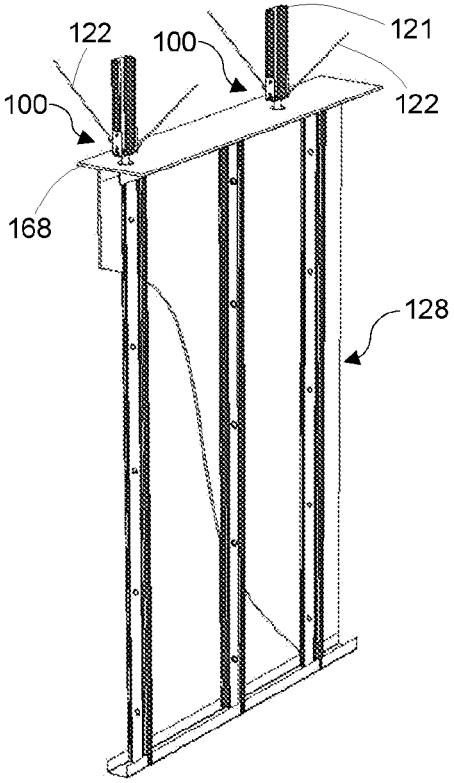

Figure 57

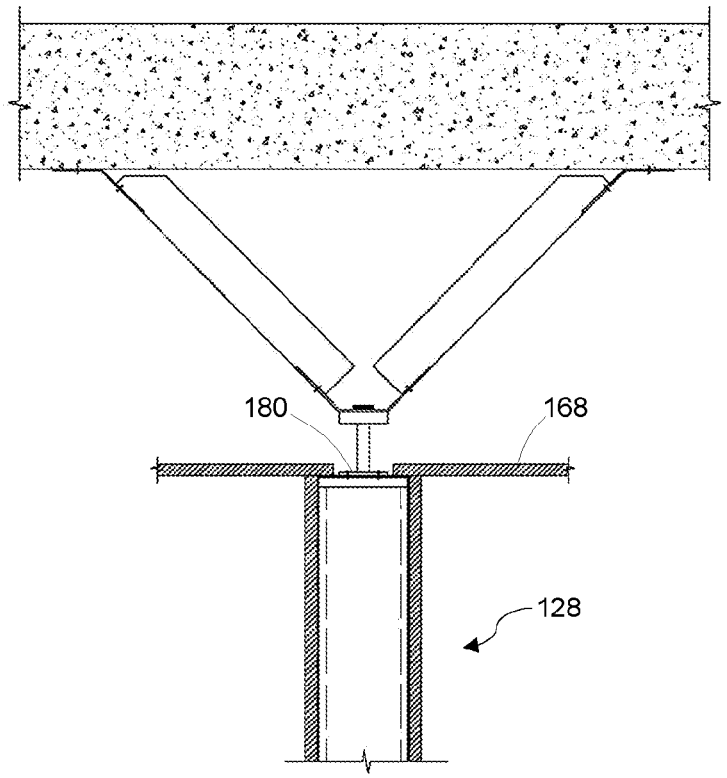

Figure 58 (Prior Art)

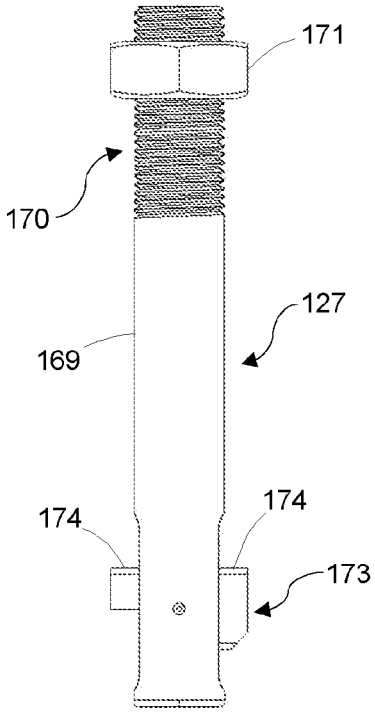

Figure 59

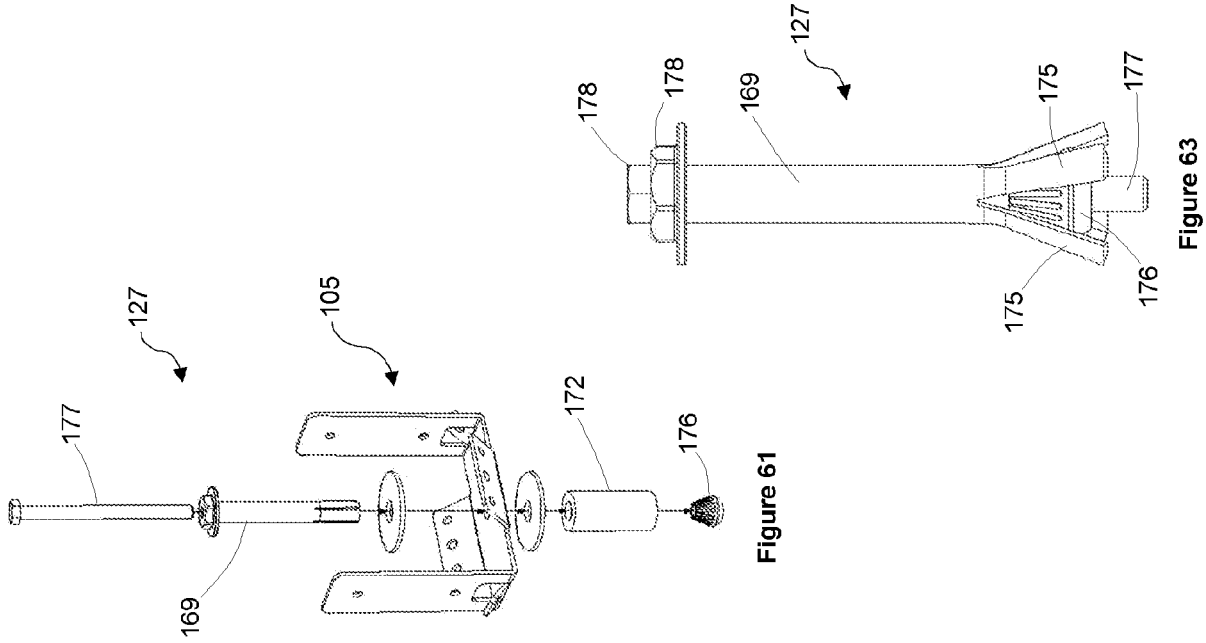

Figure 61

Figure 63

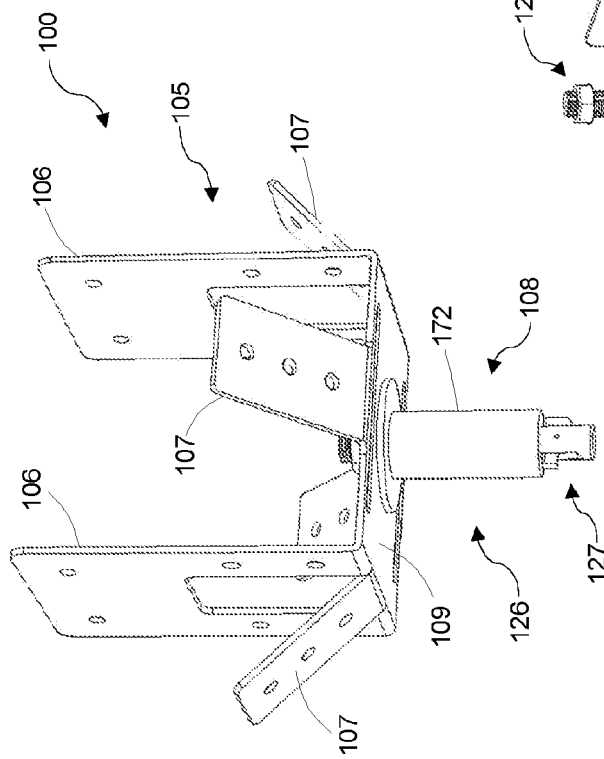

Figure 60

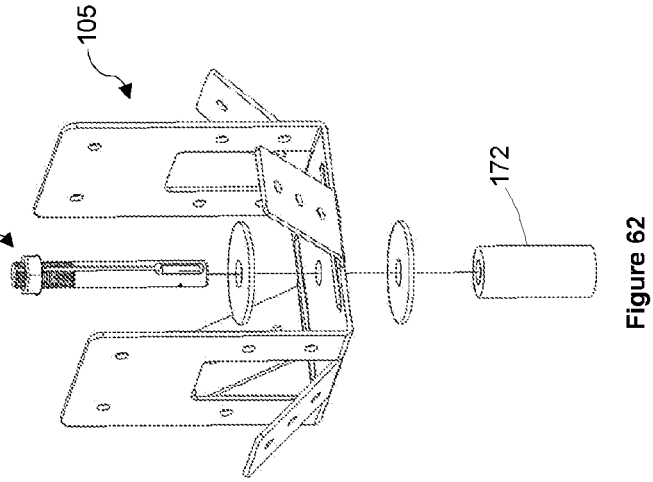

Figure 62

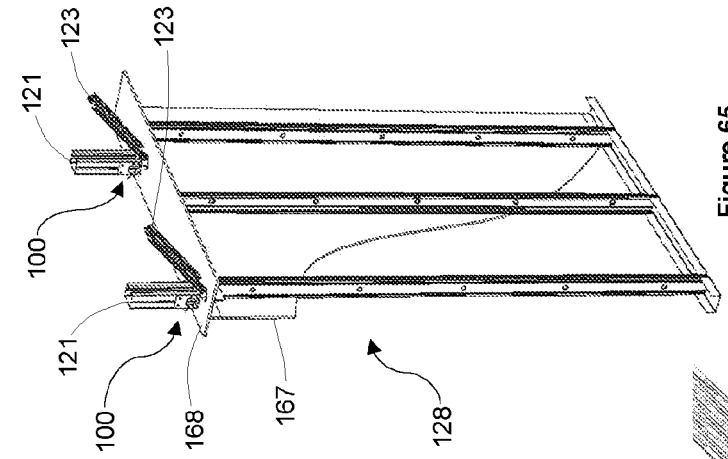

Figure 65

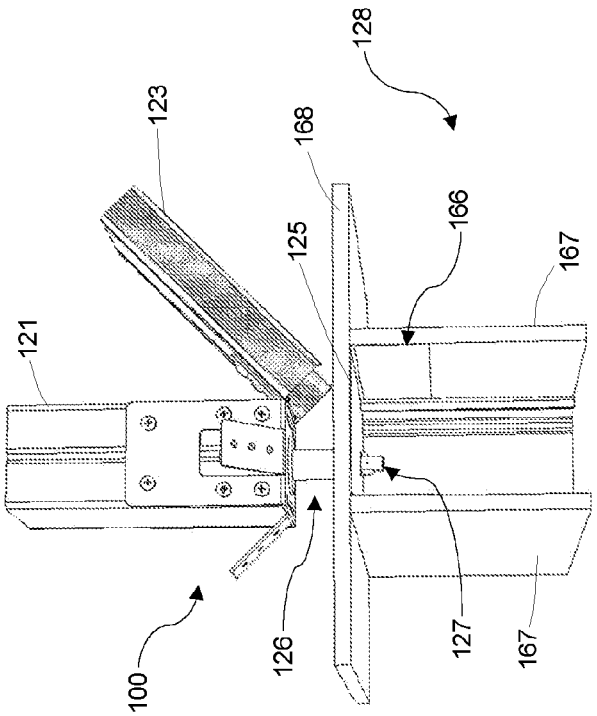

Figure 64

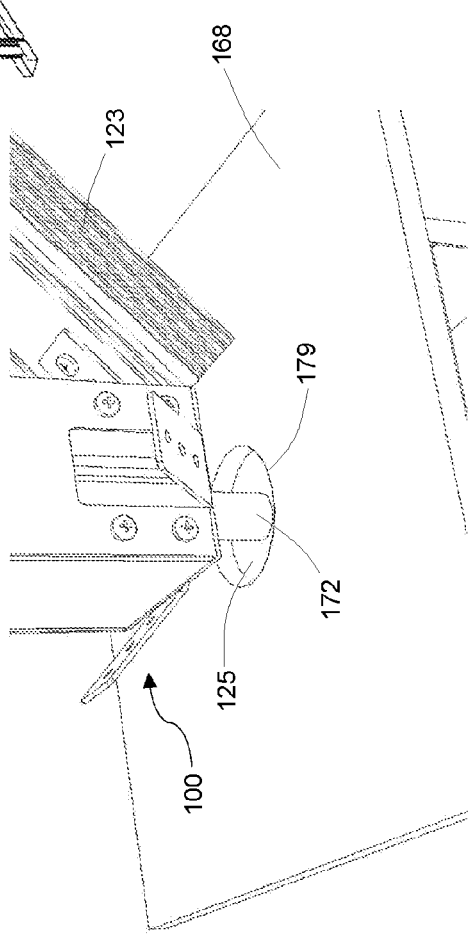

Figure 67

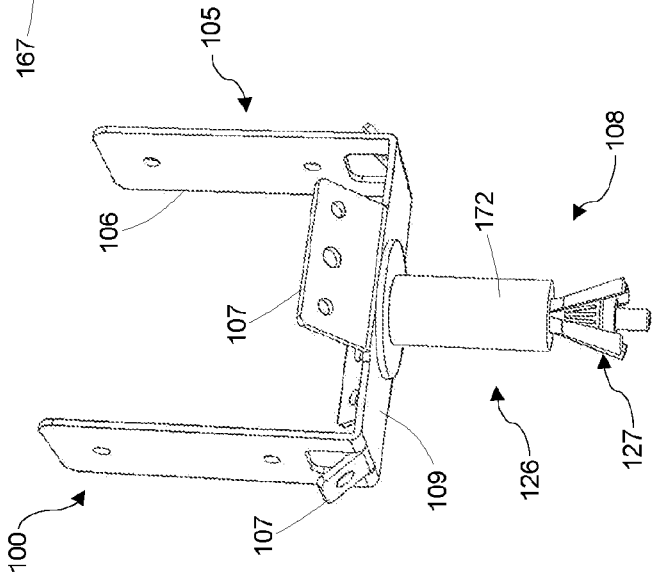

Figure 66

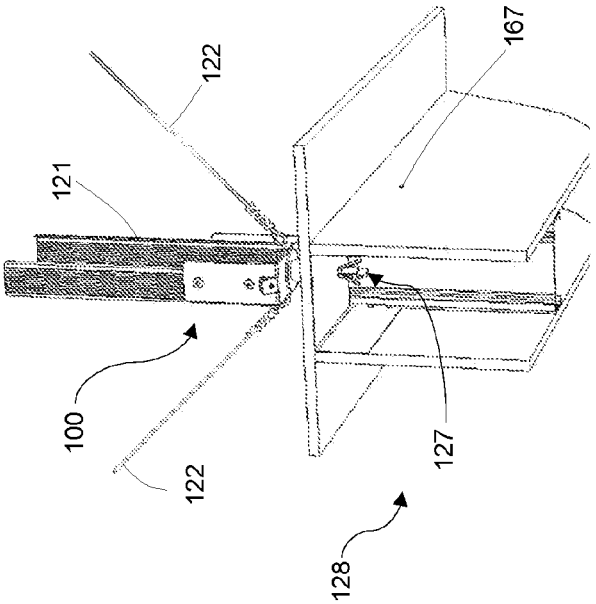

Figure 69

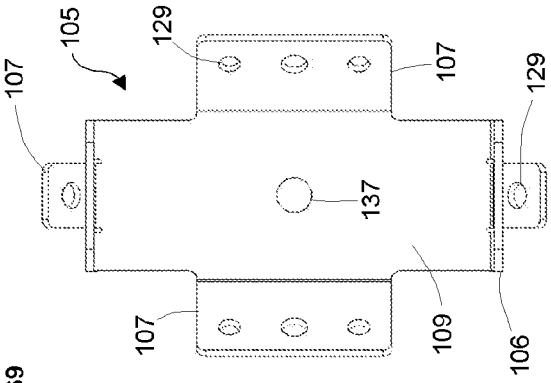

Figure 72

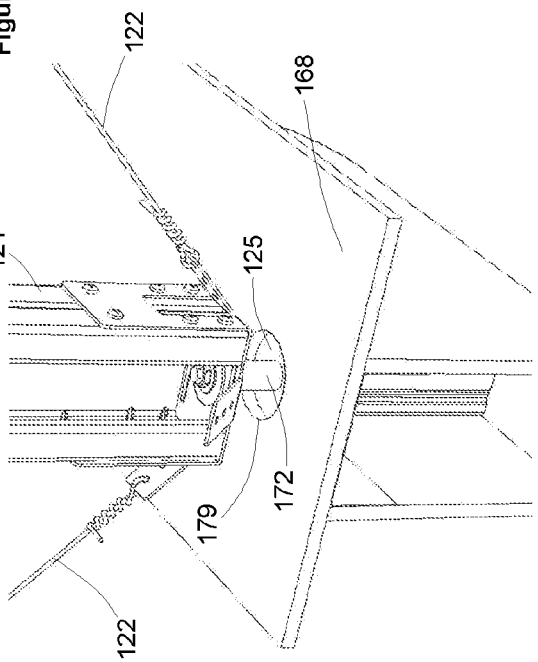

Figure 71

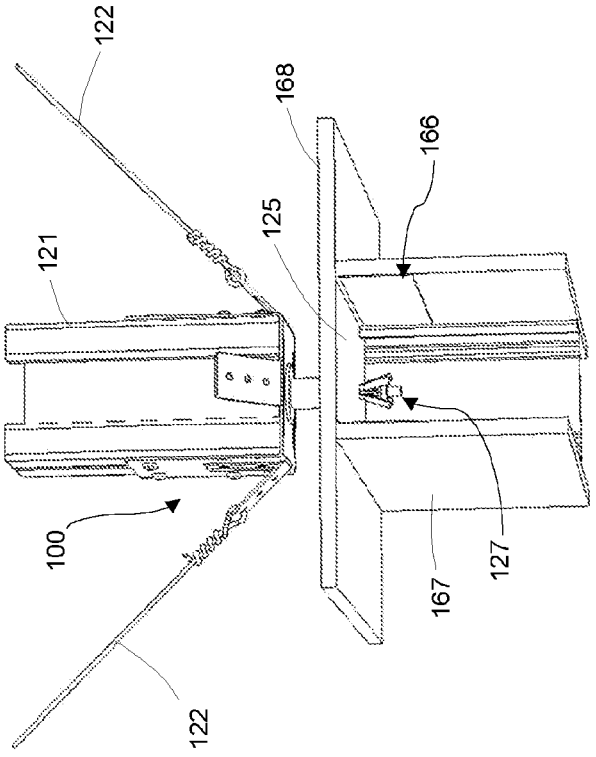

Figure 68

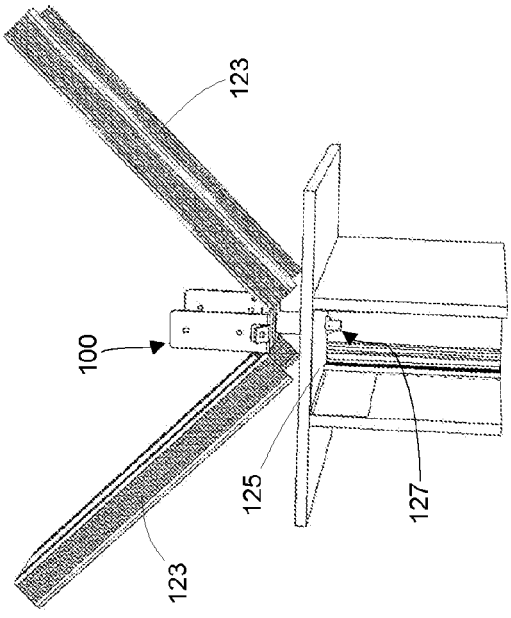

Figure 70

STRUCTURAL SOFFIT RESTRAINT ARRANGEMENTS

FIELD OF THE INVENTION

[0001] This invention relates generally to arrangements for restraining structures from overhead structural soffits. More particularly, this invention relates to connectors for restraining structures from overhead structural soffits and arrangements for restraining suspended ceilings and partition walls.

BACKGROUND OF THE INVENTION

[0002] Exposed-grid ceilings (Tee Ceilings) with lay-in panels are made from ceiling panels/tiles that rest in a square/rectangular grid made of interlocking inverted T-shaped profiles (runners). The ceiling grid is supported by the structural soffit with suspension hangers (typically metal rods). Such ceilings may be restrained by bracing in the plenum space, i.e. 'back-bracing'. Back-bracing is typically achieved by fixing the ceiling grid to an assembly of a vertical post and splayed ties or angled struts which are in turn fixed to an overhead structural soffit.

[0003] Furthermore, seismic restraint of a ceiling relies upon 'diaphragm action' to transfer earthquake actions to bracing elements. The spacing between braced member runs (brace lines) in a seismic-resilient suspended ceiling is often limited by the degree of diaphragm action that the ceiling can provide. This could, for instance, mean bracing every main runner in the case of exposed-grid ceilings. Such congested bracing, however, occupies the plenum space and may obstruct building service runs.

[0004] Further, partitions are typically built using metal studs with gypsum wallboard sheathing. Partitions are typically designed to withstand out-of-plane loads from wind, earthquake and/or body impact. Partitions may be constructed full-height (i.e. extending from floor-to-floor) or partial-height (i.e. extending to the ceiling but not to the structural soffit above). In the case of partial-height construction, the partition must be laterally supported independently from the ceiling by bracing to the structural soffit above, otherwise, the partition may damage the ceiling to which it is attached.

[0005] As such, an isolation/separation gap is required to avoid unwanted load swaps (structural interaction) between the ceiling and the partition. In cases where the finished height of the partition extends beyond the ceiling level, the isolation gap is typically provided by a floating/sliding connection at the ceiling perimeter trim/channel as shown herein in FIG. **56**. In cases where the ceiling runs over the partition, isolation/separation is typically provided by drilling a large hole through the ceiling lining and offsetting the bracing members from the ceiling using a 'mounting plinth' such as that which is disclosed in AU 2018204147 A1 (12 Jun. 2018) to Evans et al. and shown herein in FIG. **58**.

[0006] Such mounting plinths consist of a bearing member at the top, a mounting member at the base and a spacing member (sleeve) in between, that separates the bearing and mounting members from each other. The mounting member (typically a metal plate) is fixed to the top of the partition's top-plate (head track) typically by screw-fastening. This type of installation is generally used in retrofit scenarios, where there is no access to the partition cavity as the partition is enclosed by sheathing.

[0007] The present invention seeks to provide ways to overcome or substantially ameliorate at least some of the deficiencies of the prior art, or to at least provide an alternative.

[0008] It is to be understood that, if any prior art information is referred to herein, such reference does not constitute an admission that the information forms part of the common general knowledge in the art, in Australia or any other country.

SUMMARY OF THE DISCLOSURE

[0009] Current ceiling restraint arrangements can be improved by providing more flexibility in construction to avoid clashes with services in the plenum space by using flexible bracing ties such as metal wire that can be adjusted at various angles and utilizing swivelable bracing assemblies that can be oriented in various directions; greater ease of installation by having the option of using lightweight bracing ties such as metal wire, especially where there is a large ceiling suspension height, whilst maintaining the optionality of utilizing cantilevered restraining posts or rigid bracing struts such as metal studs which generally require a smaller bracing footprint and less occupy the plenum space in comparison to splayed ties; and more structural stability and strength by way of symmetry, concentric bracing and more robust connections.

[0010] Furthermore, a problem with mounting plinth arrangements for restraining partition walls is that the mounting baseplate obstructs the free deferential movements between the partition and ceiling, which is crucial especially in an earthquake or wind event, and as such, defeats the purpose of the isolation gap between the partition bracing and ceiling. Further, current practices cater for heavy rigid bracing members only (typically wall studs) to connect the partition to the structural soffit above. This can be problematic, especially when the ceiling drop is too high, as the installation of a long heavy member may prove challenging in practice. The solution provided addresses the above deficiencies.

[0011] There is provided herein arrangements and connectors for vertically and laterally restraining structures (such as a suspended ceiling or partition wall) from overhead structural soffits.

[0012] The connectors connect the structure to vertical restraining posts and/or angled bracing ties and/or angled bracing struts in a concentric and symmetrical manner.

[0013] The connector comprises a horizontal midsection between an upper bracing bracket and a lower structure joiner.

[0014] The upper bracing bracket extends up from the horizontal midsection and comprises a pair of upright parallel restraining post-engaging flanges extending from opposite sides of the horizontal midsection. The upper bracing bracket further comprises a quadrant of angled brace-engaging tabs extending upwardly and outwardly respectively from four sides of the horizontal midsection.

[0015] The upper bracing bracket may take the form of a standard upper bracing bracket such as given in FIGS. **16** and **21**, a semi-heavy-duty upper bracing bracket such as given in FIGS. **66** and **72**, or a heavy-duty upper bracing bracket such as given in FIGS. **9** and **11**, and wherein the standard upper bracing bracket can accommodate flexible bracing ties (e.g. metal wires) in either orthogonal direction

in transverse plane; the semi-heavy-duty upper bracing bracket can accommodate bracing ties in either orthogonal direction as well as rigid bracing struts (e.g. metal studs) on two sides; and, the heavy-duty upper bracing bracket can accommodate both bracing ties and/or bracing struts in either orthogonal direction.

[0016] Furthermore, the heavy-duty upper bracing bracket can accommodate stronger and stiffer post assemblies, for example, double C-shaped sections made from the same components used in a partition or ceiling, assembled in a web-to-web or lip-to-lip configuration (as shown in FIG. **55**). Alternatively, other heavy-duty profiles like jamb-studs (as shown in FIG. **64**) or square/rectangular hollow sections can be utilized as a vertical restraining post.

[0017] The lower structure joiner may be configured for engaging a variety of structure fixtures, including ceiling structural rails, including those of T-shaped sections, top cross rail, furring channel and C-shaped sections, and partition wall head tracks.

[0018] Specifically, the lower structure joiner may take the form of the Tee-type joiner given in FIG. **12**, the top cross rail-type joiner given in FIG. **27**, the furring channel-type joiner given in FIG. **29** and the Cee-type joiner given in FIG. **54**, all of which are preferably transversely biaxially symmetrical (i.e., symmetric with respect to both the X and Y axes of the transverse/horizontal plane) to avoid any undesirable actions such as torsion and bending that are caused by eccentricities.

[0019] The connectors are connectable directly to either flexible and/or rigid angled bracing members in either orthogonal direction as well as to a central vertical restraining post. Furthermore, the vertical restraining post can be removed when two counter-angled ('V' formation) bracing struts are used as shown in FIG. **70**, or the angled bracing members can be removed when the vertical restraining post is rigidly fixed to the overhead structural soffit (i.e. inverted cantilever).

[0020] The post-engaging flanges, brace-engaging tabs and the lower structure joiner are preferably transversely biaxially symmetric, such that, in use, lateral and vertical loads are transferred from the structure through a concentric focal point of the connector defined by the concentricity and symmetry of the post-engaging flanges, brace-engaging tabs and the lower structure joiner. This concentricity and symmetry avoids imbalanced load transfer between the structure and the vertical restraining post, angled bracing struts and/or angled bracing ties which could induce torsion, bending, warpage or other structural imbalances.

[0021] Further preferably, to avoid or reduce eccentricities, the angled brace-engaging tabs may locate inwards as far in as is practically possible toward the centroid of the connector whilst yet remaining just beyond edges of the vertical restraining post if installed. In other words, opposing brace-engaging tabs between the post-engaging flanges substantially commence from between adjacent side edges of the post-engaging flanges.

[0022] The upper bracing bracket and the lower structure joiner may be integrally formed from a single sheet of metal. This fixed-type connector may include the fixed T-shaped runner-type connector shown in FIG. **7**, the fixed top cross rail-type connector shown in FIG. **23**, the fixed furring channel-type connector shown in FIG. **37** and the fixed C-shaped channel-type connector shown in FIG. **45**, and wherein, in all of these, the lower structure joiner is transversely biaxially symmetric with respect to the upper bracing bracket to avoid any undesirable actions such as torsion and bending that are caused by eccentricities. The fixed-type connector provides an economic solution for applications where a cantilevered restraining post is in use without angled bracing members or where service clashes are not a major concern and bracing can be relatively easily connected transversely orthogonally (i.e. with respect to a transverse plane) with respect to ceiling structural rails.

[0023] The connector may be a swivel-type connector wherein the horizontal midsection is formed by the upper bracing bracket comprising an upper horizontal plate and the lower structure joiner comprising a lower horizontal plate and wherein the upper and lower horizontal plates are swivelably jointed at a central pivot point. For example, the connector may comprise the swivelable Tee-type connector shown in FIGS. **14** and **16**, the swivelable top cross rail-type connector shown in FIG. **32**, the swivelable furring channel-type connector shown in FIG. **41** and the swivelable Cee-type connector shown in FIG. **54**, all of which maintain structural symmetry even when the brace assembly is positioned in a transversely non-orthogonal orientation with respect to the ceiling structural rails. As such, using the swivel-type connector, bracing may be arranged to avoid service clashes in congested plenum spaces.

[0024] Preferably, the tabs extend from edges of the continuous horizontal midsection so as to not compromise the structural integrity thereof. Even for the swivel-type connector, the horizontal midsection comprises only a relatively small aperture not substantially compromising the structural integrity thereof.

[0025] As such, when compared to current market offerings, either flexible bracing ties and/or rigid bracing struts can be used in either orthogonal direction in a transverse plane, in a concentric arrangement by a connector being transversely biaxially symmetric in either a fixed or swivelable manner. The concentric and symmetrical bracing arrangement eliminates (or significantly reduces) detrimental effects due to eccentric loading such as torsion/bending of the structure. The central vertical post makes it possible to use flexible bracing ties as the post functions as a concentric compression strut. The brace-engaging tabs provide for a positive connection to angled flexible bracing ties as well as angled rigid bracing struts in either transverse orthogonal direction in a concentric manner.

[0026] The use of lightweight flexible bracing is particularly important where there are large suspension heights and handling and installing heavy rigid bracing can prove challenging. The use of angled bracing struts will generally reduce the bracing footprint and occupy less plenum space in comparison to splayed bracing ties, as only two angled struts will be required rather than four splayed ties. The use of angled bracing struts also makes it possible to remove the vertical post to avoid service clashes where required. Furthermore, the angled bracing members can be removed when the vertical restraining post is rigidly fixed to the overhead structural soffit, to further avoid service clashes where required.

[0027] The swivelability of the connector helps to avoid clashes between angled bracing members and building services in the plenum space, whilst the fixed-type connector option allows for a more economic design, for example, where service clashes are not a major concern or where a

cantilevered restraining post is in use without angled bracing members.

[0028] The connector may be used for vertically and laterally restraining Tee-grid ceilings concentrically and symmetrically in either direction of the ceiling with either flexible and/or rigid bracing members in either a fixed or swivelable manner, whilst having the optionality of removing either the vertical restraining post or angled bracing members.

[0029] In contrast to conventional bracing methods, where bracing members are offset from one another, in the present arrangement, bracing elements concentrically define a focal point so to eliminate (or significantly reduce) any eccentricity-induced stress resultants such as torsion and/or bending in the structure.

[0030] Furthermore, when compared to current market offerings, the present connector is structurally symmetrical, even when swivelled, and as such eliminate (or significantly reduce) undesirable torsional and/or flexural loads in the ceiling.

[0031] Furthermore, either lightweight flexible bracing ties can be used, which is particularly important where there are large suspension heights, or rigid bracing struts can be used where a smaller bracing footprint is required to avoid clashes with building services.

[0032] Further, the Tee-type joiner is coupled swivelably to the upper bracing bracket to avoid clashes with services in the plenum space. Also, the vertical restraining post can be removed when two counter-angled ('V' formation) bracing struts are used, or the angled bracing members can be removed when the vertical post is rigidly fixed to the overhead structural soffit, so to further avoid service clashes.

[0033] The fixed-type connector provides an economic solution, for example, where service clashes are not a major concern or where a cantilevered restraining post is in use without angled bracing members. The bracket is also directly connectable to other supporting members, such as strongback members disclosed herein.

[0034] Furthermore, when compared to current market offerings, the continuous longitudinal profile of the Tee-type joiner provides greater structural stiffness and strength. Also, the T-shaped ceiling runner is clamped between the joiner legs as well as being screw-fixed in a multiple-shear and multiple-pull-out configuration, giving a stronger connection. The joiner press-fits over the ceiling runner. The inclined lips and stress-relief perforations allow for easier press-fitting.

[0035] The connector may be used for extending the distance spacing between braced member runs (brace lines) in ceiling applications using elongate strongback members and wherein the connectors are connectable to ceiling structural rails in either a fixed or swivelable manner, and connectable directly to either flexible or rigid bracing members concentrically and symmetrically in either direction of the ceiling in either a fixed or swivelable manner, whilst having the optionality of removing either the vertical restraining post or angled bracing members, and wherein the connector is capable of concentrically transferring both lateral and vertical loads that are received through a focal point from adjoining members, i.e. the strongback and ceiling structural rails.

[0036] The strongback can be coupled swivelably to either the bracing assembly and/or ceiling grid to avoid clashes with services in the plenum space. Either lightweight flexible bracing ties can be used, which is especially beneficial where there are large ceiling drops, or rigid bracing struts can be used, where a reduced bracing footprint is required to free up the plenum space for building services. All components and sub-assemblies are symmetrical in either direction of the ceiling, and adjoining members concentrically transfer both lateral and vertical loads through a focal point, all of which in an effort to mitigate detrimental torsional and/or flexural stresses on the structure in an earthquake event or, for instance, under wind uplift.

[0037] The connector may also be used for bracing partial-height partition walls to a structure above via either flexible or rigid bracing members which allows for separation of the partition from an over-passing ceiling, without obstruction, including when the partition is fully lined/enclosed (i.e. the wall cavity is inaccessible).

[0038] This application resolves the mounting baseplate issue in that a flush connection is provided by using a cavity anchor rather than a screw-fixed mounting baseplate, thereby creating a clear isolation gap with no obstructions between the partition bracing and the ceiling. Further, the use of a cavity anchor provides a singular solution for both new constructions and retrofitting existing constructions where the partition wall is fully lined/enclosed.

[0039] The concentric vertical post makes it possible to use bracing ties (e.g. wire) as the post functions as a compression strut. The use of lightweight flexible bracing ties is particularly advantageous where there is a large distance between the partition top-plate and the structural soffit to which it is braced, as handling and installing heavy rigid bracing (e.g. metal studs) can prove challenging.

[0040] Furthermore, angled bracing members can be installed on either or only one side of the partition. The optionality of installing rigid bracing struts on only one side of the partition reduces the bracing footprint and chance of obstructing service runs in the plenum space, while a V-formation of the bracing struts (as shown in FIG. **70**) will allow for the removal of the vertical post and allow for services to run parallel and directly above the wall. Also, the angled bracing members can be removed when the vertical restraining post is rigidly fixed to the overhead structural soffit, to further avoid service clashes where required.

[0041] Furthermore, the present connector can accommodate either a single standard stud (as shown in FIG. **69**), a double stud (made from the same kind used in the partition), a heavy-duty jamb stud (as shown in FIG. **64**) or a square/rectangular hollow section to create a heavy-duty vertical restraining post.

[0042] The present connector allows for either in-plane and out-of-plane bracing of the wall.

[0043] As such, as can be appreciated from the above, the present arrangements may allow for a concentric and symmetrical bracing arrangement that can utilize either lightweight flexible tension-only bracing ties and/or rigid tension/compression bracing struts in either direction in either a fixed or swivelable manner, capable of concentrically transferring both lateral and vertical loads that are received through a focal point from adjoining members, up to the overhead structural soffit, whilst having the optionality of removing either the vertical restraining post or angled bracing members.

[0044] The present arrangements may allow for a concentric and symmetrical bracing arrangement for exposed-grid type ceilings that can utilize either lightweight flexible tension-only bracing ties and/or rigid tension/compression

bracing struts in either direction of the ceiling in either a fixed or swivelable manner, capable of concentrically transferring both lateral and vertical loads that are received through a focal point from the adjoining ceiling structural rail, up to the overhead structural soffit, whilst having the optionality of removing either the vertical restraining post or angled bracing members.

[0045] It will be apparent to one skilled in the art that other ceiling types may be braced in the similar manner by adopting the appropriate lower structure joiner of the connector.

[0046] The present arrangements may allow for a configurable bracing strongback to extend the distance spacing between brace lines in suspended ceilings; the distance between the brace lines typically being limited by the inadequacy of a ceiling diaphragm. The bracing strongback is configurable in the sense that it can be installed either orthogonally or non-orthogonally with respect to the ceiling structural rails in a transverse plane to avoid service clashes in the plenum space, as well as the bracing assembly itself, which is swivelably orientable. The bracing arrangement again is concentric and symmetrical and can utilize either lightweight flexible tension-only bracing ties and/or rigid tension/compression bracing struts in either direction of the ceiling in either a fixed or swivelable manner and capable of concentrically transferring both lateral and vertical loads that are received through a focal point from the adjoining strongback, up to the structural soffit, whilst having the optionality of removing either the vertical restraining post or angled bracing members.

[0047] . Alternatively, the strongback may be connected to and supported by other structures such as abutting walls (i.e. perimeter bracing), rather than being back-braced to the overhead structural soffit.

[0048] The present arrangements may allow for a concentric and symmetric bracing arrangement for partial-height partitions that can utilize either lightweight flexible tension-only bracing ties and/or rigid tension/compression bracing struts on either side of the wall in either out-of-plane and/or in-plane directions without obstructing the free lateral movement of the over-passing ceiling, for instance, in an earthquake or wind event. The method of connection, which utilizes a cavity anchor, provides a singular solution for both new constructions and retrofitting existing constructions where the partition wall is fully lined/enclosed.

[0049] As such, with the foregoing in mind, according to one aspect, there is provided an arrangement for restraining a structure from an overhead structural soffit, the arrangement comprising: a connector for connecting the structure to at least one of a vertical restraining post, angled bracing strut and angled bracing tie, the connector comprising: a horizontal midsection; an upper bracing bracket extending up from the horizontal midsection the upper bracing bracket comprising: a pair of upright parallel restraining post-engaging flanges extending from opposite sides of the horizontal midsection; a quadrant of angled brace-engaging tabs extending upwardly and outwardly respectively from four sides of the horizontal midsection, a lower structure joiner which engages the structure, wherein: the upper bracing bracket and the lower structure joiner substantially coincide at the horizontal midsection; and the post-engaging flanges, brace-engaging tabs and the lower structure joiner may be all transversely biaxially symmetric with respect to a concentric focal point.

[0050] The horizontal midsection may be formed by the upper bracing bracket comprising an upper horizontal plate and the lower structure joiner comprising a lower horizontal plate and wherein the upper and lower horizontal plates, may be swivelably joined at a central pivot point coincident with the focal point.

[0051] The central pivot point may be formed by at least one of the upper bracing bracket and the lower structure joiner comprising a stud which engages the horizontal plate of the upper bracing bracket or horizontal plate of the lower structure joiner and which extends through a corresponding central aperture of the other of the upper bracing bracket and the lower structure joiner.

[0052] The horizontal midsection may be formed by a horizontal plate and wherein the upper bracing bracket and the lower structure joiner may be integrally formed with the horizontal plate.

[0053] The lower structure joiner may comprise side plates extending from opposite sides of the horizontal plate between the post-engaging flanges.

[0054] The structure may comprise a suspended ceiling comprising a plurality of ceiling panels resting in a rectangular grid of interlocking inverted T-shaped ceiling runners, each runner comprising lateral feet, a neck and a widened head and wherein the structure joiner converges in from opposite edges of the horizontal midsection to parallel side plates which lie flat against either side of the neck.

[0055] The lower structure joiner may comprise an upper widened section formed by angled sides which angle in from the horizontal midsection to the parallel side plates and which defines a gap therein to accommodate the head of the runner therein.

[0056] Lower edges of the parallel side plates may flare outwardly.

[0057] The lower structure joiner may comprise stress relief perforations at least one of between the horizontal midsection and the angled sides and along the horizontal midsection.

[0058] The horizontal midsection may narrow in from the restraining post-engaging flanges to the opposite edges of the horizontal midsection.

[0059] The structure may comprise a suspended ceiling comprising a rectangular grid of structural ceiling rails and wherein the arrangement comprises: a pair of connectors connected to a respective pair of ceiling rails by lower structure joiners thereof; an elongate strongback member spanning between the pair of connectors; a further connector connecting the strongback member to a vertical ceiling post wherein the lower structure joiner of the further connector connects to the strongback member at a point between the pair of connectors and wherein the vertical restraining post may be connected between the post-engaging flanges of the further connector and wherein the further connector may be braced with at least one of the angled bracing ties and angled bracing struts connected to the angled brace-engaging tabs of the further connector.

[0060] The horizontal midsection of the pair of connectors may be formed by the upper bracing bracket of the pair of connectors comprising an upper horizontal plate and the lower structure joiner of the pair of connectors comprising a lower horizontal plate and wherein the upper and lower horizontal plates, may be swivelably joined at a central pivot point and wherein the elongate strongback member

extends non-orthogonally between the respective pair of ceiling rails in transverse plane.

[0061] The strongback member may be affixed between the respective post-engaging flanges of the pair of connectors.

[0062] The further connector may comprise at least one of a stud or bolt which inserts through an aperture of the strongback member.

[0063] The pair of ceiling rails may comprise inverted T-shaped ceiling runners, each runner comprising lateral feet, a neck and a widened head and wherein the lower structure joiner converges in from opposite sides of the horizontal midsection to parallel side plates which lie flat against either side of the neck.

[0064] The structure may comprise a partial-height partition wall comprising a partition wall top plate and wherein the lower structure joiner may comprise a fastening stem having a spacer sleeve and a cavity anchor inserted therethrough and wherein the lower distal end of the fastening stem extends through the top plate and wherein the cavity anchor thereof engages under the top plate.

[0065] The fastening stem may comprise a shaft and a spacer sleeve thereabout.

[0066] The shaft may comprise a threaded upper end comprising a nut that engages the upper bracing bracket and presses against the spacer sleeve to pull the cavity anchor in opposition and engage the lower distal end of the cavity anchor up against the underside of the partition wall top plate.

[0067] A wide aperture having a diameter substantially larger than that of the fastening stem may be formed within a ceiling board lying over the top plate and wherein the fastening stem extends through the wide hole and wherein the connector engages the top plate such that there may be no obstructions formed around the fastening stem on an upper surface of the top plate.

[0068] The cavity anchor may comprise a catch rotatably engaged through 90° to a distal end of the shaft wherein, when in rotational alignment with the shaft, allows the distal end of the shaft to be inserted through an aperture of the partition wall top plate and wherein when out of rotational alignment with the shaft defines adjacent upper bearing surfaces which engage under the partition wall top plate.

[0069] A pair of the brace-engaging tabs may be punched from the restraining post-engaging flanges.

[0070] The lower structure joiner may comprise side plates extending from opposite sides of the horizontal plate and wherein a pair of angled brace-engaging tabs may be punched from the lower structure joiner.

[0071] The arrangement may comprise a transversely orthogonal arrangement of angled bracing struts and may be without a vertical restraining post.

[0072] The arrangement may comprise a vertical restraining post which may be rigidly fixed to the overhead structural soffit and may be without angled bracing struts and angled bracing ties.

[0073] At least one of the vertical restraining post, angled bracing strut and angled bracing tie may not be orthogonal with respect to the lower structure joiner in transverse plane.

[0074] The brace-engaging tabs each may comprise a preformed aperture therein.

[0075] The brace-engaging tabs may be each longitudinal and each may comprise a series of preformed apertures in longitudinal alignment therewith.

[0076] A pair of the brace-engaging tabs may be punched from the restraining post-engaging flanges.

[0077] Opposing brace-engaging tabs between the post-engaging flanges may substantially commence from between adjacent side edges of the post-engaging flanges.

[0078] The brace-engaging tabs may extend from edges of the horizontal midsection and wherein the horizontal midsection may be substantially continuous therebetween.

[0079] The side plates may comprise preformed apertures therethrough for affixation of metal screws therethrough to engage the neck.

[0080] The at least one of the stud or bolt may be held with a nut.

[0081] The ceiling may comprise top cross rails and lower furring channels and the strongback member may be a top cross rail and the lower structure joiner may comprise side plates defining a gap therebetween to accommodate a top cross rail therein.

[0082] The side plates may comprise inwardly projecting V-shaped rails which engage within indentations formed within the sides of the top cross rail.

[0083] Lower edges of the side plates may flare outwardly.

[0084] The ceiling may comprise top cross rails and lower furring channels and wherein the lower structure joiner may comprise side plates which engage within a furring channel.

[0085] The top plate may transition to each side plate to form a chamfer that engages under inner sides of top rails of the furring channel.

[0086] Lower edges of the side plates may transition inwardly.

[0087] The ceiling may comprise top cross rails and lower furring channels and wherein the strongback member may be C-shaped in cross section and wherein the lower structure joiner may comprise parallel side plates that engage around a lower furring channel.

[0088] The parallel side plates may deviate inwardly at bends to define upper inner channels which accommodate outer edges of the top rails of the furring channel.

[0089] Each parallel side plate may flare outwardly at a lower edge thereof.

[0090] The side plates may comprise preformed apertures therein through which metal screws engage sides of the furring channel.

[0091] The ceiling structural rails may comprise C-shaped channels and wherein the strongback member may be C-shaped in cross section and wherein the lower structure joiner engages a C-shaped channel.

[0092] The lower structure joiner may comprise side plates that extend outwardly to engage against inner sides of the C-shaped channel.

[0093] Each side plate may flare inwardly at a lower edge thereof.

[0094] The horizontal midsection may transition to the side plates by shoulders forming an outer chamfer which engages under the inner sides of top rails of the C-shaped channel.

[0095] The lower structure joiner may comprise side plates that extend downwardly and orthogonally from the horizontal top plate to engage against outer sides of the C-shaped channel.

[0096] Each side plate may flare outwardly at a lower edge thereof.

[0097] The cavity anchor may comprise a distal end of the shaft being split into splices and wherein a tapered toggle

forces the splices apart to engage under the partition wall top plate.

[0098] The tapered toggle may be engaged to an inner shaft having upper tightening nuts, which, when turned, splits the splices.

[0099] Other aspects of the invention are also disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0100] Notwithstanding any other forms which may fall within the scope of the present invention, preferred embodiments of the disclosure will now be described, by way of example only, with reference to the accompanying drawings in which:

[0101] FIG. **1** shows a suspended ceiling arrangement in accordance with the prior art;

[0102] FIG. **2** shows a conventional ceiling back-bracing using angled bracing struts in accordance with the prior art;

[0103] FIG. **3** shows an arrangement for ceiling back-bracing comprising a vertical restraining post and angled bracing struts using a swivel-type connector in accordance with an embodiment;

[0104] FIG. **4** shows a conventional ceiling back-bracing using angled bracing ties in accordance with the prior art;

[0105] FIG. **5** shows a top plan view of a fixed Tee runner-type connector in accordance with an embodiment;

[0106] FIG. **6** shows an arrangement for ceiling back-bracing using the fixed Tee-type connector of FIG. **5** and angled bracing ties in accordance with an embodiment;

[0107] FIG. **7** shows an isometric view of the fixed Tee-type connector of FIG. **5** in accordance with an embodiment;

[0108] FIG. **8** shows a side view of the fixed Tee-type connector of FIG. **5** with a Tee ceiling runner fixed therein in accordance with an embodiment;

[0109] FIG. **9** shows a top plan view of a heavy-duty-type upper bracing bracket of a swivel-type connector in accordance with an embodiment;

[0110] FIG. **10** shows a side view of a swivelable Tee-type lower structure joiner with a Tee ceiling runner fixed therein in accordance with an embodiment;

[0111] FIG. **11** shows an isometric view of the swivelable heavy-duty-type upper bracing bracket of FIG. **9** in accordance with an embodiment;

[0112] FIG. **12** shows an isometric view of the swivelable Tee-type lower structure joiner of FIG. **10** in accordance with an embodiment;

[0113] FIG. **13** shows an arrangement for ceiling back-bracing using a swivelable Tee-type connector and angled bracing ties in accordance with an embodiment;

[0114] FIG. **14** shows an isometric view of the swivelable Tee-type connector used in FIG. **13**, having the heavy-duty-type upper bracing bracket of FIG. **11** in accordance with an embodiment;

[0115] FIG. **15** shows an arrangement for ceiling back-bracing using a Cee channel-type strongback in an orthogonal configuration relative to a Tee-grid type ceiling grid in accordance with an embodiment;

[0116] FIG. **16** shows an isometric view of a swivelable Tee-type connector, having a standard-type upper bracing bracket in accordance with an embodiment;

[0117] FIG. **17** shows a detailed view of the orthogonal intersection between the strongback and Tee ceiling runner of FIG. **15** using the fixed Tee-type connector of FIG. **7** in accordance with an embodiment;

[0118] FIG. **18** shows an overview of an orthogonal strongback bracing arrangement for a Tee-grid type ceiling with a swivelable restraining post and angled bracing ties in accordance with an embodiment;

[0119] FIG. **19** shows an arrangement for ceiling back-bracing using a Cee-type strongback in a non-orthogonal configuration relative to a Tee-type ceiling grid using the swivelable Tee-type connector of FIG. **16** in accordance with an embodiment;

[0120] FIG. **20** shows an overview of a non-orthogonal strongback bracing arrangement for a Tee-grid type ceiling with a swivelable vertical restraining post and angled bracing struts in accordance with an embodiment;

[0121] FIG. **21** shows a top plan view of the swivelable standard-type upper bracing bracket of FIG. **16** in accordance with an embodiment;

[0122] FIG. **22** shows a non-orthogonal strongback bracing arrangement for a Tee-grid type ceiling with a swivelable vertical restraining post and angled bracing ties in accordance with an embodiment;

[0123] FIG. **23** shows an isometric view of a fixed top cross rail-type connector in accordance with an embodiment;

[0124] FIG. **24** shows a side view of the fixed top cross rail-type connector of FIG. **23** with a ceiling top cross rail fixed therein in accordance with an embodiment;

[0125] FIG. **25** shows an arrangement for ceiling back-bracing using a top cross rail-type strongback in a non-orthogonal configuration relative to the ceiling grid, which is made of top cross rails and lower furring channels in accordance with an embodiment;

[0126] FIG. **26** shows a top plan view of the fixed top cross rail-type connector of FIG. **23** in accordance with an embodiment;

[0127] FIG. **27** shows an isometric view of a swivelable top cross rail-type structure joiner in accordance with an embodiment;

[0128] FIG. **28** shows a side view of the swivelable top cross rail-type structure joiner of FIG. **27** press-fit from under a ceiling top cross rail fixed therein in accordance with an embodiment;

[0129] FIG. **29** shows an isometric view of a swivelable furring channel-type structure joiner in accordance with an embodiment;

[0130] FIG. **30** shows the top cross rail-type structure joiner of FIG. **27** and the furring channel-type structure joiner of FIG. **29** swivelably joined to each other in accordance with an embodiment;

[0131] FIG. **31** shows an orthogonal top cross rail-type strongback bracing arrangement with a vertical restraining post and angled bracing ties connected to the fixed top cross rail-type connector of FIG. **23** in accordance with an embodiment;

[0132] FIG. **32** shows an isometric view of a swivelable top cross rail-type connector, having a semi-heavy-duty-type upper bracing bracket in accordance with an embodiment;

[0133] FIG. **33** shows a ceiling top cross rail and lower furring channel connected to their respective structure joiners in accordance with an embodiment;

[0134] FIG. **34** shows an orthogonal top cross rail-type strongback bracing arrangement with a vertical restraining post, and an angled bracing strut, and angled bracing ties

connected to the swivelable top cross rail-type connector of FIG. **32** in accordance with an embodiment;

[0135] FIG. **35** shows a non-orthogonal top cross rail-type strongback bracing arrangement with a swivelable vertical restraining post and angled bracing struts in accordance with an embodiment;

[0136] FIG. **36** shows a side view of the swivelable top cross rail-type structure joiner of FIG. **27** press-fit over a ceiling top cross rail fixed therein in accordance with an embodiment;

[0137] FIG. **37** shows an isometric view of a fixed furring channel-type connector in accordance with an embodiment;

[0138] FIGS. **38** and **39** show an arrangement for ceiling back-bracing using a Cee channel-type strongback in an orthogonal configuration relative to the ceiling grid, which is made of top cross rails and lower furring channels in accordance with an embodiment;

[0139] FIG. **40** shows a detailed view of the orthogonal intersection between the Cee channel-type strongback and ceiling furring channel of FIG. **39** using the fixed furring channel-type connector of FIG. **37** in accordance with an embodiment;

[0140] FIG. **41** shows an isometric view of a swivelable furring channel-type connector in accordance with an embodiment;

[0141] FIGS. **42** and **43** show a non-orthogonal Cee channel-type strongback arrangement for a ceiling made of top cross rails and lower furring channels in accordance with an embodiment;

[0142] FIG. **44** shows a detailed view of the non-orthogonal intersection between the Cee channel-type strongback and ceiling furring channel of FIG. **43** using the swivelable furring channel-type connector of FIG. **41** in accordance with an embodiment;

[0143] FIG. **45** shows an isometric view of a fixed Cee channel-type connector in accordance with an embodiment;

[0144] FIG. **46** shows a side view of the fixed Cee-type connector of FIG. **45** connected to a Cee channel-type ceiling rail in accordance with an embodiment;

[0145] FIGS. **47** and **55** show an arrangement for ceiling back-bracing using a Cee channel-type strongback in a non-orthogonal configuration relative to the ceiling grid, which is also made of the same type of Cee channel as the strongback in accordance with an embodiment;

[0146] FIG. **48** shows a top plan view of the fixed Cee-type connector of FIG. **45** in accordance with an embodiment;

[0147] FIG. **49** shows a detailed view of a swivelable connection between an upper bracing bracket and a Cee-type strongback in accordance with an embodiment;

[0148] FIGS. **50** and **52** show an orthogonal Cee-type strongback arrangement for a ceiling made of the same type of Cee channel as the strongback in accordance with an embodiment;

[0149] FIG. **51** shows a detailed view of the orthogonal intersection between the Cee-type strongback and Cee-type ceiling rail of FIGS. **50** and **52** using the fixed Cee-type connector of FIG. **45** in accordance with an embodiment;

[0150] FIG. **53** shows a detailed view of the non-orthogonal intersection between the Cee-type strongback and Cee-type ceiling rail of FIGS. **47** and **55** using the swivelable Cee-type connector of FIG. **54** in accordance with an embodiment;

[0151] FIG. **54** shows an isometric view of a swivelable Cee-type connector in accordance with an embodiment;

[0152] FIG. **56** shows a conventional partial-height partition wall back-bracing using angled bracing struts in accordance with the prior art, wherein the partition height exceeds the ceiling level;

[0153] FIG. **57** shows an arrangement for partial-height partition wall back-bracing comprising a vertical restraining post and angled bracing ties using a connector in accordance with an embodiment;

[0154] FIG. **58** shows a conventional partial-height partition back-bracing using angled bracing struts in accordance with the prior art, where a ceiling runs over the top of the partition and a mounting plinth is used for separating the partition bracing from the ceiling;

[0155] FIG. **59** shows a side view of a toggle-type cavity anchor in accordance with an embodiment;

[0156] FIG. **60** shows an isometric view of a partition-type connector, having a heavy-duty-type upper bracing bracket and a lower fastening stem comprising a spacer sleeve and a toggle-type cavity anchor in accordance with an embodiment;

[0157] FIG. **61** shows an exploded view of the partition-type connector of FIG. **66** in accordance with an embodiment;

[0158] FIG. **62** shows an exploded view of the partition-type connector of FIG. **60** in accordance with an embodiment;

[0159] FIG. **63** shows a side view of an expansion-type cavity anchor in accordance with an embodiment;

[0160] FIGS. **64** and **65** show a back-bracing arrangement for a partial-height partition wall comprising a vertical restraining post and an angled bracing strut on one side of the partition in accordance with an embodiment;

[0161] FIG. **66** shows an isometric view of a partition-type connector, having a semi-heavy-duty-type upper bracing bracket and a lower fastening stem comprising a spacer sleeve and the expansion-type cavity anchor of FIG. **63** in accordance with an embodiment;

[0162] FIG. **67** shows an isolation gap between a partition-type connector and a suspended ceiling in accordance with an embodiment;

[0163] FIGS. **68**, **69** and **71** show back-bracing arrangements for a partial-height partition comprising a vertical restraining post and angled bracing ties on either side of the partition wall in accordance with an embodiment;

[0164] FIG. **70** shows a back-bracing arrangement for a partial-height partition wall without a vertical restraining post and counter-angled bracing struts on either side of the partition in accordance with an embodiment;

[0165] FIG. **72** shows a top plan view of a semi-heavy-duty-type upper bracing bracket of a swivel-type connector in accordance with an embodiment.

DESCRIPTION OF EMBODIMENTS

[0166] Arrangements for restraining a structure (such as a suspended ceiling **113** or partition wall **128**) from a structural soffit comprises a connector **100** for connecting the structure to at least one of vertical restraining posts **121**, angled bracing struts **123** and angled bracing ties **122** from the structural soffit.

[0167] With reference to FIG. **7**, the connector **100** comprises a horizontal midsection **104** and an upper bracing

bracket **105** extending up from the horizontal midsection **104**.

[0168] The upper bracing bracket **105** comprises a pair of upright parallel restraining post-engaging flanges **106** extending from opposite sides of the horizontal midsection **104**. The post-engaging flanges **106** may comprise screw fix apertures **129** preformed therethrough.

[0169] The upper bracing bracket **105** further comprises a quadrant of angled brace-engaging tabs **107** extending upwardly and outwardly respectively from four sides of the horizontal midsection **104**.

[0170] The brace-engaging tabs **107** may be smaller than the post-engaging flanges **106** and may comprise preformed apertures **129** therethrough through which metal screws may be inserted to engage angled bracing struts **123** or through which angled bracing ties **122** may be tied off.

[0171] The upper bracing bracket **105** may take the standard form as shown in FIGS. **7** and **21** wherein each tab **107** comprises a single preformed aperture **129** and are much smaller as compared to the adjacent post-engaging flanges **106**, or the semi-heavy-duty form as shown in FIGS. **66** and **72** or the heavy-duty embodiment given in FIGS. **9** and **11** wherein one or more of the angled brace-engaging tabs **107** of the semi-heavy-duty or heavy-duty embodiments may be wider and/or longer than those shown in FIG. **7** and may have more than one preformed aperture **129**, and wherein the post-engaging flanges **106** may also be wider than those given in FIG. **7**. For the semi-heavy duty and heavy-duty upper bracing brackets **105**, the brace-engaging tabs **107** may be designed to attach to angled bracing struts **123** as well as angled bracing ties **122**. Further, in the case of the heavy-duty upper bracing bracket **105**, the post-engaging flanges **106** may be designed to accommodate a double stud, jamb stud or square/rectangular hollow section as a vertical restraining post **121**.

[0172] In accordance with the semi-heavy-duty embodiment as best shown in FIGS. **66** and **72**, the post-engaging flanges **106** and corresponding angled brace-engaging tabs **107** may be similar to that of the standard upper bracing bracket **105**, however, the opposing angled brace-engaging tabs **107** on either non-post-engaging edge of the horizontal midsection **104** may have a width being more than a quarter or approximately half the width of the horizontal midsection **104**. Furthermore, in accordance with this embodiment, the more robust angled brace-engaging tabs **107** may comprise a plurality of preformed apertures **129** preferably arranged transversely across the width of the tab **107**, especially useful for inserting a plurality of metal screws into angled bracing struts **123**.

[0173] In accordance with the heavy-duty embodiment as best shown in FIGS. **9** and **11**, the post-engaging flanges **106** may be approximately twice the width of the flange of a standard C-shaped profile used in the ceiling or partition structural frame and the angled brace-engaging tabs **107** may be approximately half the length of the post-engaging flanges **106** and may furthermore have a width being more than a quarter or approximately half the width of the post-engaging flanges **106**. Furthermore, in accordance with this embodiment, the more robust angled brace-engaging tabs **107** may comprise a plurality of preformed apertures **129** preferably arranged longitudinally there along, especially useful for inserting a plurality of metal screws into angled bracing struts **123**.

[0174] The connector **100** further comprises a lower structure joiner **108** for engaging the structure. The lower structure joiner **108** may take a variety of configurations as will be described in further detail hereunder, including the Tee-type joiner given in FIG. **12**, the top cross rail-type joiner given in FIG. **27**, the furring channel-type joiner given in FIG. **29** and the Cee-type joiner given in FIG. **54**.

[0175] In a preferred embodiment, the upper bracing bracket **105** is transversely biaxially symmetric with the lower structure joiner **108** wherein the upper bracing bracket **105** and the lower structure joiner **108** are biaxially symmetric in both the X and Y axes (defining a transverse plane) such that, in use, lateral and vertical loads are transferred from the structure through a concentric focal point of the connector defined by the concentricity and symmetry of the post-engaging flanges **106**, brace-engaging tabs **107** and the lower structure joiner **108**.

[0176] Where the connector **100** is the fixed-type connector comprising the horizontal plate **112**, the horizontal plate **112** itself may be biaxially symmetric with the post-engaging flanges **106** and the brace-engaging tabs **107** such that load is concentrically transferred therethrough from the lower structure joiner to the upper bracing bracket. Where the connector **100** is the swivel-type connector, the upper bracing bracket **105** and lower structure joiner **108** may be biaxially symmetric with respect to the central pivot point **131** such that load is concentrically transferred therethrough.

[0177] Furthermore, lower ends of the upper bracing bracket **105** and the lower structure joiner **108** substantially coincide at the horizontal midsection so that the upper bracing can be closely connected to the structure, thereby reducing or avoiding bending force which may be experienced by an otherwise more vertically elongate connection.

[0178] With reference to FIG. **9**, the post-engaging flanges **106** may be symmetric about a midline or midpoint **130** of the horizontal midsection **104** therebetween. Furthermore, each opposing pair of brace-engaging tabs **107** may also be symmetric about the midline or midpoint **130**. With reference to the embodiment of FIG. **5** wherein the horizontal midsection **104** is not square, opposing pairs of brace-engaging tabs **107** may similarly be symmetric about the midline or midpoint **130** therebetween.

[0179] The embodiment of FIG. **7** shows wherein the connector **100** is a fixed-type connector **100**. In accordance with this embodiment, the horizontal midsection **104** is formed by a horizontal plate **112** and wherein the upper bracing bracket **105** and the lower structure joiner **108** are integrally formed with the horizontal plate **112** and wherein the lower structure joiner **108** is transversely biaxially symmetric with the upper bracing bracket **105**. In accordance with this embodiment, the connector **100** may be press formed from a continuous sheet of metal.

[0180] Furthermore, a first pair of angled brace-engaging tabs **107** may be punched from the post-engaging flanges **106** and a second pair of angled brace-engaging tabs **107** may be punched from side plates of the lower structure joiner **108**.

[0181] FIG. **16** shows an embodiment wherein the connector **100** is a swivel-type connector **100** wherein the horizontal midsection **104** is formed by the upper bracing bracket **105** comprising an upper horizontal plate **109** and the lower structure joiner **108** comprising a lower horizontal plate **110** and wherein the upper and lower horizontal plates

109, **110** are swivelably coupled at a central pivot point **131**. With reference to FIG. **12**, the central pivot point **131** may be formed by the lower structure joiner **108** comprising a self-clinching threaded stud **136** which engages the horizontal plate **110** of the lower bracing bracket **108** and extends up through a central aperture **137** of the horizontal plate **109** of the upper bracing bracket **105** and which is secured with a nut **138** in the manner shown in FIG. **16**.

[0182] FIG. **1** shows a first arrangement wherein the structure comprises a suspended ceiling **113** and, more particularly, to an exposed-grid ceiling comprising a plurality of ceiling panels **114** resting on a rectangular grid of interlocking inverted T-shaped ceiling runners **115**. With reference to FIG. **10**, each runner **115** comprises lateral feet **116**, a vertical neck **117** and a widened head **118**. The ceiling runner **115** is typically made from roll formed steel or extruded aluminium.

[0183] FIGS. **2** and **4** show prior art arrangements of restraining the runners **115** when a vertical restraining post **121** is screw-fixed with metal screws **132** through distal end thereof to a neck **117** of a runner **115**. FIG. **2** shows an embodiment wherein the vertical restraining post **121** is restrained with angled bracing struts **123** connected directly thereto and FIG. **4** shows wherein the runners **115** are braced using angled bracing ties **122** connected around the head **118** through the neck **117** of the runner **115**.

[0184] FIG. **7** illustrates a Tee-type joiner wherein the lower structure joiner **108** thereof is suited for connecting to inverted T-shaped ceiling runners **115**.

[0185] Specifically, with reference to FIG. **10**, the lower structure joiner **108** converges in from opposite edges of the horizontal midsection **104** to parallel side plates **119** which lie flat against either side of the neck **117**. The parallel side plates **119** may comprise preformed apertures **129** therethrough through which metal screws **132** may be engaged to perform in a multiple-shear and multiple-pull-out manner.

[0186] The lower structure joiner **108** may comprise an upper widened section **133** formed by angled sides **134** which angle in from the horizontal midsection **104** to the parallel plates **119** and which defines a gap **135** therein to accommodate the head **118** of the runner **115** therein.

[0187] The horizontal midsection **104** may narrow in from the restraining post-engaging flanges **106** to the opposite edges of the horizontal midsection **104** to form a narrow joiner **108** suited for the T-shaped ceiling runners **115**.

[0188] As further shown in FIG. **10**, lower edges of the parallel side plates **119** may flare outwardly such that the lower structure joiner **108** may be press-fit over the head **118** of the runner **115** to engage the runner **115**.

[0189] As shown in FIG. **12**, the lower structure joiner **108** may comprise stress relief perforations **176** between the horizontal midsection **104** and the angled sides **134** to assist with this press-fit engagement. The angled sides **134** and/or parallel side plates **119** may further comprise a longitudinal stress relief perforation **176** therealong. As shown in FIG. **7**, the cut-outs formed by punching out the brace-engaging tabs **107** from the side plates of the lower structure joiner **108** may also serve as stress relief perforations **176**.

[0190] FIG. **6** shows the first arrangement wherein the lower structure joiner **108** of the connector **100** of FIG. **7** engages either side of a runner **115** and which is attached thereto by metal screws **132**. Furthermore, the upright parallel restraining post-engaging flanges **106** of the upper bracing bracket **105** of the connector **100** are screw-fixed engaged to either side of a vertical restraining post **121** similarly using metal screws **132**.

[0191] The vertical restraining post **121** may be braced by bracing ties **122** tied to respective angled brace-engaging tabs **107** as shown in FIG. **6**. Alternatively, as shown in FIG. **3**, the vertical restraining post **121** may be braced by angled bracing struts **123** screw-fixed engaged to the angled brace-engaging tabs **107**. The embodiment of FIG. **3** shows wherein the connector **100** comprises the heavy-duty brace-engaging tabs **107** as described above with reference to FIGS. **9** and **11** and wherein a plurality of metal screws **132** are engaged through the preformed apertures **129** thereof to more securely engage the angled bracing struts **123**.

[0192] Furthermore, the embodiment of FIG. **3** shows wherein the connector **100** is a swivel-type connector **100** wherein the upper bracing bracket **105** is rotated with respect to the lower structure joiner **108** such that the angled bracing struts **123** extend non-orthogonally with respect to the runners **115** in a transverse plane.

[0193] FIG. **13** shows an embodiment wherein the connector **100** is similarly a swivel-type connector **100** but wherein bracing ties **122** are connected to one of the preformed apertures **129** of the angled brace-engaging tabs **107** such that the angled bracing ties **122** can similarly extend non-orthogonally with respect to the runners **115** in a transverse plane.

[0194] FIGS. **15 - 55** shows a second arrangement wherein the structure comprises a suspended ceiling **113** comprising a rectangular grid of ceiling structural rails **139**.

[0195] The ceiling structural rails **139** may include the aforedescribed inverted T-shaped runners **115**, top cross rails **140** as shown in FIG. **25**, lower furring channels **141** as also shown in FIG. **25** and/or C-shaped channels **142** as shown in FIG. **47**.

[0196] With reference to FIG. **18**, this second arrangement comprises at least one pair of connectors **100**A connected to respective ceiling rails **139** by the lower structure joiners **108** thereof.

[0197] An elongate strongback member **120** spans between the connectors **100**. In the embodiment shown in FIG. **18**, the strongback member **120** is affixed between respective post-engaging flanges **106** of the pair of connectors **100**A in the manner shown in more detail in FIGS. **15** and **17**.

[0198] With reference to FIG. **18**, this second arrangement may further comprise one or more further connectors **100**B connecting the strongback member **120** to vertical restraining posts **121** wherein the further connector **100**B may be swivelably connected directly to the strongback **120** wherein the lower structure joiner **108** takes the form of a self-clinching threaded stud **136** (as best shown in FIG. **49**) which engages the horizontal plate **109** of the upper bracing bracket **105** and which inserts through an aperture of the strongback **120** and which is held with a nut **138**. Alternatively, the lower structure joiner **108** may take the form of a standard bolted connection used to swivelably connect the further connector **100**B to the strongback **120**.

[0199] The vertical restraining post **121** may be connected between the post-engaging flanges **106** of the further connector **100**B in the manner shown in more detail in FIG. **22**. Preferably, at least two further connectors **100**B are employed to enhance stability.

[0200] In the manner shown in FIG. **15**, the angled bracing struts **123** may be connected to the brace-engaging tabs **107** of the further connector **100**B. In the manner shown in FIG. **22**, angled bracing ties **122** may be connected to the brace-engaging tabs **107** of the further connector **100**B.

[0201] Alternatively, the strongback member **120** may be connected to and supported by other structures such as abutting walls (i.e. perimeter bracing), rather than being back braced to the overhead structural soffit.

[0202] In the embodiment shown in FIG. **18**, the connectors **100** may be fixed-type connectors **100** such that the strongback member **120** extends orthogonally with respect to the ceiling rails **139** in transverse plane.

[0203] However, in the embodiment shown in FIG. **20**, the connectors **100** may be swivel-type connectors **100** such that the strongback member **120** extends non-orthogonally with respect to the ceiling rails **139** in transverse plane.

[0204] The embodiments given in FIGS. **15** - **22** show wherein the lower structure joiner **108** is the Tee-type joiner shown in FIG. **7** which is configured for engaging inverted T-shaped runners **115**.

[0205] FIGS. **23** - **36** show embodiments for suspended ceilings **113** comprising top cross rails **140** and lower furring channels **141** and wherein the strongback member **120** is a top cross rail **140**.

[0206] It should be noted that the top cross rail-type strongback arrangement as shown in FIG. **25** can be distinguished from the Cee channel-type strongback arrangement as shown in FIGS. **18** and **47** wherein the further connector **100**B connects directly to the Cee channel-type strongback **120** via a bolted connection as shown in FIG. **49**, whereas in the case of a top cross rail-type strongback **120**, the further connector **100**B is connected to the top cross rail-type strongback **120** via a top cross rail-type lower structure joiner **108**. Also, the top cross rail-type strongback **120** is connected differently to the lower furring channel **141**, as the typical connector **100** is not used. Instead, a top cross rail-to-furring channel connector as shown in FIG. **30** may be used that is made from a top cross rail-type joiner **108** and a furring channel-type joiner **146**. This contrasts to a Cee channel-type strongback **120**, as a Cee channel-type strongback **120** connects to a lower ceiling structural rail **139** via a connector **100**.

[0207] FIG. **23** shows an embodiment of the fixed type connector **100** wherein the lower structure joiner **108** of the connector **100** is a top cross rail-type joiner comprises side plates **143** defining a gap **145** therebetween to accommodate a top cross rail **140** therebetween in the manner shown in FIG. **24** and which comprise inwardly projecting V-shaped rails **144** which engage within indentations formed within the sides of the top cross rail **140** and provide a positive connection between the side plates **143** and the top cross rail **140**.

[0208] The V-shaped rails **144** of the top cross rail-type joiner **108** may be designed to press-fit from either the top or bottom of the top cross rail **140** as best shown in FIGS. **36** and **28**, respectively.

[0209] The V-shaped rails **144** may comprise preformed apertures **129** therein through which metal screws **132** may be used to engage sides of the top cross rail **140**.

[0210] Lower edges of the side plates **143** may flare outwardly to allow the structure joiner **108** to be press-fit over the top cross rail **140**.

[0211] As further shown in FIG. **23**, the lower structure joiner **108** may comprise stress relief perforations **176** between the horizontal midsection **104** and the side plates **143** to assist with this press-fit engagement. The cut-outs formed by punching out the brace-engaging tabs **107** from the side plates **143** may also serve as stress relief perforations **176**.

[0212] As such, the connector **100** may be used to connect a vertical restraining post **121** to a top cross rail-type strongback **120** with metal screws **132** in the manner shown in FIG. **31**.

[0213] FIGS. **27** and **36** show the top cross rail-type structure joiner **108** of the swivel type connector **100** shown in FIGS. **32** and **34** similarly comprising the side plates **143** defining a gap **145** therebetween and the inwardly projecting V-shaped rails **144** for positively engaging a top cross rail **140** therein, and outwardly flared lower edges and stress relief perforations **176** to assist with press-fitting the structure joiner **108** over the top cross rail **140**.

[0214] FIG. **29** illustrates an inner furring channel-type joiner **146** comprising a top plate **147** and side plates **148** which can be used to engage within a furring channel in the manner shown in FIG. **33**. The top plate **147** may comprise an aperture **149** therein. The top plate **147** may transition to each side plate **148** to form a chamfer **154** that engages under the inner sides of top rails **153** of a furring channel **140** in the manner shown in FIG. **33**. Furthermore, lower edges **155** of the side plates **148** may transition inwardly to navigate the bottom corners **156** of the furring channel **141** also in the manner shown in FIG. **33** and to allow press-fit engagement into the furring channel **141**.

[0215] FIG. **30** shows wherein the top cross rail-type joiner **108** of the swivel type connector **100** is connected to the inner furring channel-type joiner **146** in a swivelable manner wherein the self-clinching threaded stud **136** of the top cross rail-type joiner **108** is inserted through the aperture **149** of the furring channel-type joiner **146** and secured with a nut **138**.

[0216] As such, in the manner shown in FIG. **33**, the interconnected furring channel-type joiner **146** and top cross rail-type structure joiner **108** may be used to connect a top cross rail-type strongback **120** and lower furring channel **141** together, including wherein the swivelability thereof allow the top cross rail-type strongback **120** and the lower furring channel **141** to be connected orthogonally in transverse plane in the manner shown in FIG. **34** or non-orthogonally in transverse plane in the manner shown in FIG. **35**.

[0217] FIGS. **37** - **44** show embodiments for suspended ceilings **113** comprising a grid of top cross rails **140** and lower furring channels **141** and wherein the strongback member **120** is a C-shaped channel.

[0218] FIG. **37** shows a fixed-type connector **100** wherein the lower structure joiner **108** is a furring channel-type joiner **108** suited to engage around a furring channel **141** in the manner shown in FIG. **40**. In this embodiment, the lower structure joiner **108** comprises parallel side plates **150** that deviate inwardly from the horizontal plate **112** at bends **151** that define upper inner channels **152** therein that accommodate outer edges of the top rails **153** of the furring channel **141** in the manner shown in FIG. **40**.

[0219] The side plates **150** may comprise preformed apertures **129** therein through which metal screws **132** may be used to engage sides of the furring channel **141**.

[0220] Lower edges of the side plates **150** may flare outwardly to allow the structure joiner **108** to be press-fit over the furring channel **141**.

[0221] As further shown in FIG. **37**, the lower structure joiner **108** may comprise stress relief perforations **176** between the horizontal plate **112** and the side plates **150** to assist with this press-fit engagement. The cut-outs formed by punching out the brace-engaging tabs **107** from the side plates **150** may also serve as stress relief perforations **176**.

[0222] As such, using the fixed-type connector **100** of FIG. **37**, a C-shaped strongback member **120** may be used to engage a furring channel **141** orthogonally in transverse plane in the manner shown in FIGS. **38** - **40**. Alternatively, the connector **100** of FIG. **37** could be a swivel-type connector **100** as shown in FIG. **41**, allowing a C-shaped strongback **120** engage a furring channel **141** non-orthogonally in transverse plane, as shown in FIGS. **42** - **44**.

[0223] FIG. **41** shows a swivel-type connector **100** wherein the lower structure joiner **108** comprises the inner furring channel-type joiner **146** described previously with reference to FIG. **29**.

[0224] As such, in the manner shown in FIG. **44**, the connector **100** may be used to connect a C-shaped strongback member **120** and a furring channel **141** wherein the lower structure joiner **108** engages within the furring channel **141** in the aforedescribed manner. Metal screws **132** may pierce the sides of the furring channel **141** to engage the lower structure joiner **108** within the furring channel **141**.

[0225] As shown in FIG. **42**, the connector **100** of FIG. **41** may be used to non-orthogonally connect a C-shaped strongback member **120** and a furring channel **141** in transverse plane.

[0226] FIGS. **45** - **55** show in embodiments for a ceiling **113** wherein the ceiling structural rails **139** comprise upper and lower C-shaped channels **142** and wherein the strongback member **120** is also a C-shaped channel **142**. The C-shaped channels **142** may be connected together in an orthogonal grid using interchange clips **159**.

[0227] FIG. **45** shows a connector **100** suited for this arrangement wherein the lower structure joiner **108** is an inner C-shaped channel-type joiner **108** configured for engaging within a C-shaped channel **142** and which comprises side plates **157** that extend outwardly from the horizontal plate **112** by shoulders **158** to reach and engage against inner sides of the C-shaped channel **142** in the manner shown in FIGS. **46** and **51**.

[0228] The shoulders **158** may form outer chamfers which engages under the inner sides of top rails **162** of the C-shaped channel **142** in the manner shown in FIG. **46**. The lower edges of the side plates **157** may transition inwardly in the manner shown in FIG. **46** to allow press-fit engagement into the C-shaped channel **142**.

[0229] The cut-outs formed by punching out the brace-engaging tabs **107** from the side plates **157** may serve as stress relief perforations **176** to assist with this press-fit engagement.

[0230] Metal screws **132** may be used to engage the side plates **157** to the sides of the C-shaped channel **142** in the manner shown in FIG. **46**.

[0231] Whereas FIG. **45** shows a fixed type connector **100** used for connecting C-shaped strongback members **120** orthogonally to lower C-shaped channels **142** in the manner shown in FIGS. **50** - **52**, in the embodiment shown in FIG. **47**, swivel type connectors **100** are used to engage a C-shaped strongback member **120** non-orthogonally to lower C-shaped channels **142**.

[0232] FIGS. **53** and **54** show an embodiment wherein the connector **100** is a swivel type connector **100** and wherein the connector **100** comprises an outer C-shaped channel-type joiner **108** configured for engaging outside a C-shaped channel **142**. In accordance with this embodiment, the lower structure joiner **108** comprises a top plate **165** which transitions downwardly and orthogonally to parallel side plates **164** and wherein the side plates **164** are spaced wide enough to engage outside sides of the C-shaped channel **142**. The lower edges of the side plates **164** may flare outwardly to allow the lower structure joiner **108** to be press-fit over the C-shaped channel **142**. The side plates **164** may comprise preformed apertures **129** therein for insertion of metal screws **132** therethrough to engage the sides of the C-shaped channels **142**. In the manner shown in FIG. **55**, the connector **100** may be used to engage a C-shaped strongback **120** non-orthogonally with a lower C-shaped channel **142**.

[0233] FIG. **49** illustrates the connection between a connector **100** used for connecting a vertical restraining post **121** to a C-shaped strongback member **120**. In accordance with this embodiment, the lower structure joiner **108** takes the form of a self-clinching threaded stud **136** which engages the horizontal plate **109** of the upper bracing bracket **105** and which inserts through an aperture of the strongback **120** and which is held with a nut **138**. This manner of connection allows the connector **100** to swivel with respect to the strongback **120** in the manner shown in FIG. **50**. Alternatively, the lower structure joiner **108** may take the form of a standard bolted connection used to swivelably connect the connector **100** to the strongback **120**.

[0234] FIGS. **56** - **72** show an embodiment wherein the connector **100** is suited for restraining a partial-height partition wall **128** in the manner shown in FIGS. **57** and **65**.

[0235] In accordance with this embodiment, the connector **100** comprises the upper bracing bracket **105** comprising the pair of upright restraining post-engaging flanges **106** and the quadrant of angled brace-engaging tabs **107**. The lower structure joiner **108** comprises a fastening stem **126** which defines a spacer sleeve **172** and a cavity anchor **127** inserted therethrough which engages through a top plate **125** of the partition wall **128**. The top plate **125** usually forms part of the head track **166** of the partition wall **128** which holds wallboard sheathing **167** adjacently, and over which a ceiling **168** lies. Neither the ceiling **168** nor the wallboard sheathing **167** are fixed to the head track.

[0236] With reference to FIG. **59**, the cavity anchor **127** may comprise a shaft **169** which may comprise a threaded upper end **170** comprising a nut **171** that engages the upper bracing bracket **105** and presses against the spacer sleeve **172** (as best shown in FIGS. **60** and **62**) to pull the cavity anchor **127** in opposition and engage the lower distal end of the cavity anchor **127** up against the underside of the partition wall top plate **125** in the manner shown in FIGS. **64** and **70**.

[0237] With reference to FIG. **59**, the cavity anchor **127** may comprise a catch **173** rotatably engaged through 90° to a distal end of the shaft **169** wherein, when in rotational alignment with the shaft **169** as shown in FIG. **62**, allows the lower distal end of the cavity anchor **127** to be inserted through an aperture of the partition wall top plate **125** and wherein when out of rotational alignment with the shaft **169**

as shown in FIG. **59**, defines adjacent upper bearing surfaces **174** which engage under the partition wall top plate **125**.

[0238] FIG. **63** shows an alternative embodiment of the cavity anchor **127** wherein a distal end of the shaft **169** is split into splices **175** and wherein a tapered toggle **176** engages to an inner shaft **177** and travels in between the splices **175** when turning tightening nut **178** to split the splices **175** apart to engage under the partition wall top plate **125** in the manner shown in FIGS. **68** and **69**.

[0239] As such, the connector **100** of FIGS. **60** and **66** may be used to restrain a partial-height partition wall **128** to a vertical restraining post **121** with lightweight flexible bracing ties **122** applied on either side of the wall **128** as shown in FIGS. **57** and **69**, or a vertical restraining post **121** with a rigid bracing strut **123** applied only on one side of the wall **128** as shown in FIGS. **64** and **65**, or without a vertical restraining post **121** when two counter-angled ('V' formation) bracing struts **123** are applied on either side of the wall **128** in the manner shown in FIG. **70**. Also, the angled bracing members can be removed when the vertical restraining post is rigidly fixed to the overhead structural soffit. The embodiment of FIG. **70** shows wherein the connector **100** comprises the aforedescribed semi-heavy-duty form with reference to FIGS. **66** and **72** and wherein a plurality of metal screws are engaged through the preformed apertures **129** thereof to more securely engage the angled bracing struts **123**.

[0240] A plurality of connectors **100** may be arranged along a partial-height partition wall **128** in the manner shown in FIGS. **57** and **65**.

[0241] FIG. **67** illustrates a wide aperture **179** formed in the ceiling **168** lying over the top plate **125**, the wide aperture **179** comprising a diameter substantially larger than that of the sleeve **172** to allow a sufficient gap for differential movement between the ceiling and partition bracing. FIG. **67** further illustrates the sleeve **172** interfaces the partition wall top plate **125** without creating peripheral obstruction thereabout (such as would be the case using a mounting plate **180** as shown in FIG. **58**) on an upper surface of the top plate **125** which could impede differential motion of the ceiling **168**.

[0242] The foregoing description, for purposes of explanation, used specific nomenclature to provide a thorough understanding of the invention. However, it will be apparent to one skilled in the art that specific details are not required in order to practise the invention. Thus, the foregoing descriptions of specific embodiments of the invention are presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed as obviously many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the following claims and their equivalents define the scope of the invention.

[0243] The term "approximately" or similar as used herein should be construed as being within 10% of the value stated unless otherwise indicated.

1. An arrangement for restraining a structure from an overhead structural soffit, the arrangement comprising:

a connector (**100**) for connecting the structure to at least one of a vertical restraining post (**121**), angled bracing strut (**123**) and angled bracing tie (**122**), the connector (**100**) comprising:

a horizontal midsection (**104**);

an upper bracing bracket (**105**) extending up from the horizontal midsection (**104**) the upper bracing bracket (**105**) comprising:

a pair of upright parallel restraining post-engaging flanges (**106**) extending from opposite sides of the horizontal midsection (**104**);

a quadrant of angled brace-engaging tabs (**107**) extending upwardly and outwardly respectively from four sides of the horizontal midsection (**104**),

a lower structure joiner (**108**) which engages the structure, wherein: the upper bracing bracket and the lower structure joiner substantially coincide at the horizontal midsection (**104**); and

the post-engaging flanges (**106**), brace-engaging tabs (**107**) and the lower structure joiner (**108**) are all transversely biaxially symmetric with respect to a concentric focal point (**130**).

2. The arrangement as claimed in claim **1**, wherein the horizontal midsection (**104**) is formed by the upper bracing bracket (**105**) comprising an upper horizontal plate (**109**) and the lower structure joiner (**108**) comprising a lower horizontal plate (**110**) and wherein the upper and lower horizontal plates (**109**), (**110**) are swivelably joined at a central pivot point coincident with the focal point.

3. The arrangement as claimed in claim **2**, wherein the central pivot point is formed by at least one of the upper bracing bracket (**105**) and the lower structure joiner (**108**) comprising a stud (**136**) which engages the horizontal plate (**109**) of the upper bracing bracket (**105**) or horizontal plate (**110**) of the lower structure joiner (**108**) and which extends through a corresponding central aperture (**137**) of the other of the upper bracing bracket (**105**) and the lower structure joiner (**108**).

4. The arrangement as claimed in claim **1**, wherein the horizontal midsection is formed by a horizontal plate (**112**) and wherein the upper bracing bracket (**105**) and the lower structure joiner (**108**) are integrally formed with the horizontal plate (**112**).

5. The arrangement as claimed in claim **1**, wherein the lower structure joiner (**108**) comprises side plates (**119**) extending from opposite sides of the horizontal plate (**112**) between the post-engaging flanges (**106**).

6. The arrangement as claimed in claim **1**, wherein the structure comprises a suspended ceiling (**113**) comprising a plurality of ceiling panels (**114**) resting in a rectangular grid of interlocking inverted T-shaped ceiling runners (**115**), each runner (**115**) comprising lateral feet (**116**), a neck (**117**) and a widened head (118) and wherein the structure joiner (**108**) converges in from opposite edges of the horizontal midsection (**104**) to parallel side plates (**119**) which lie flat against either side of the neck (**117**).

7. The arrangement as claimed in claim **6**, wherein the lower structure joiner (**108**) comprises an upper widened section (**133**) formed by angled sides (**134**) which angle in from the horizontal midsection (**104**) to the parallel side plates (**119**) and which defines a gap (**135**) therein to accommodate the head (**118**) of the runner (**115**) therein.

8. (canceled)

9. The arrangement as claimed in claim **7**, wherein the lower structure joiner comprises stress relief perforations

(176) at least one of between the horizontal midsection (104) and the angled sides (134) and along the horizontal midsection (104).

10. (canceled)

11. The arrangement as claimed in claim 1, wherein the structure comprises a suspended ceiling (113) comprising a rectangular grid of structural ceiling rails (139) and wherein the arrangement comprises:

a pair of connectors (100A) connected to a respective pair of ceiling rails (139) by lower structure joiners (108) thereof;

an elongate strongback member (120) spanning between the pair of connectors (100A);

a further connector (100B) connecting the strongback member (120) to a vertical ceiling post (121) wherein a lower structure joiner (108) of the further connector (100B) connects to the strongback member (120) at a point between the pair of connectors (100A) and wherein the vertical restraining post (121) is connected between the-post-engaging flanges (106) of the further connector (100B) and wherein the further connector (100B) is braced with at least one angled bracing tie (122) and angled bracing strut (123) connected to angled brace-engaging tabs (107) of the further connector (100B).

12. The arrangement as claimed in claim 11, wherein the horizontal midsection (104) of the pair of connectors (100A) is formed by the upper bracing bracket (105) of the pair of connectors (100A) comprising an upper horizontal plate (109) and the lower structure joiner (108) of the pair of connectors (100A) comprising a lower horizontal plate (110) and wherein the upper and lower horizontal plates (109), (110) are swivelably joined at a central pivot point and wherein the elongate strongback member (120) extends non-orthogonally between the respective pair of ceiling rails in transverse plane.

13. The arrangement as claimed in claim 11, wherein the strongback member (120) is affixed between the respective post-engaging flanges (106) of the pair of connectors (100A).

14. (canceled)

15. (canceled)

16. The arrangement as claimed in claim 1, wherein the structure comprises a partial-height partition wall comprising a partition wall top plate (125) and wherein the lower structure joiner (108) comprises a fastening stem (126) having a spacer sleeve (172) and a cavity anchor (127) inserted therethrough and wherein a lower distal end of the fastening stem (126) extends through the top plate (125) and wherein the cavity anchor (127) thereof engages under the top plate (125).

17. (canceled)

18. (canceled)

19. The arrangement as claimed in claim 16, wherein a wide aperture (179) having a diameter substantially larger than that of the fastening stem (126) is formed within a ceiling board lying over the top plate and wherein the fastening stem (126) extends through the wide hole (179) and wherein the connector engages the top plate (125) such that there are no obstructions formed around the fastening stem (126) on an upper surface of the top plate (125).

20. (canceled)

21. The arrangement as claimed in claim 1, wherein a pair of the brace-engaging tabs (107) are punched from the restraining post-engaging flanges (106).

22. The arrangement as claimed in claim 1, wherein the lower structure joiner (108) comprises side plates (119) extending from opposite sides of the horizontal plate (112) and wherein a pair of angled brace-engaging tabs (107) are punched from the lower structure joiner (108).

23-32. (canceled)

33. The arrangement as claimed in claim 11, wherein the ceiling (113) comprises top cross rails (140) and lower furring channels (141) and wherein the lower structure joiner (108) comprises side plates (143) defining a gap (145) therebetween to accommodate a top cross rail (140) of the top cross rails (140) therein.

34. The arrangement as claimed in claim 33, wherein the side plates (143) comprise inwardly projecting V-shaped rails (144) which engage within indentations formed within sides of the top cross rail (140).

35. (canceled)

36. The arrangement as claimed in claim 11, wherein the ceiling (113) comprises top cross rails (140) and lower furring channels (141) and wherein the lower structure joiner (108) comprises side plates (148) which engage within a furring channel (141).

37. The arrangement as claimed in claim 36, wherein the top plate (147) transitions to each side plate (148) to form a chamfer (154) that engages under inner sides of top rails (153) of the furring channel (141).

38. The arrangement as claimed in claim 36, wherein lower edges (155) of the side plates (148) transition inwardly.

39. The arrangement as claimed in claim 11, wherein the ceiling (113) comprises top cross rails (140) and lower furring channels (141) and wherein the lower structure joiner (108) comprises parallel side plates (150) that engage around a lower furring channel (141).

40. The arrangement as claimed in claim 39, wherein the parallel side plates (150) deviate inwardly at bends (151) to define upper inner channels (152) which accommodate outer edges of the top rails (153) of the furring channel (141).

41. The arrangement as claimed in claim 39, wherein each parallel side plate (150) flares outwardly at a lower edge thereof.

42. (canceled)

43. The arrangement as claimed in claim 11, wherein the ceiling structural rails (139) comprise C-shaped channels (142) and wherein the strongback member (120) is C-shaped in cross section and wherein the-lower structure joiners (108) of the pair of connectors (100A) engages a C-shaped channel (142).

44-50. (canceled)

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