(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 308 111 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.05.2003 Bulletin 2003/19

(51) Int Cl.[7]: **A47B 57/42**

(21) Application number: **02257498.2**

(22) Date of filing: **29.10.2002**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LU MC NL PT SE SK TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **31.10.2001 IL 14625301**

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(54) Upright and modular support assembly using same

(57) Upright (100) for a modular support assembly where the upright is a linear member having a polygonal cross-section defining a plurality of mutually adjacent faces. Each face resides in a plane so as to define elongate corner portions, each portion having one or more indentations formed along the length of the member. The upright also includes retaining structures (110) formed around the one or more indentations, the structures positioned generally transverse to the long axis of the upright, and defining recesses in the one or more indentations. The recesses thus formed receive and retain insertable engagement means (330) extending from the rear surface (350) of horizontal support members. The faces of the upright form a quasi-corrugated perimeter which more easily support compressional forces. The faces also form a backing for the recesses resisting torques generated by loads on the horizontal support members. A modular support assembly using these uprights is also discussed.

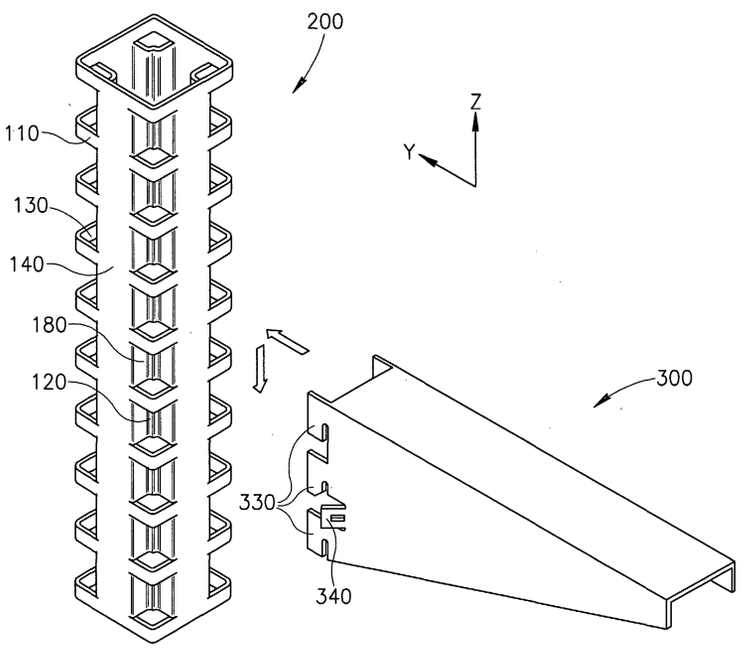

FIG.6A

EP 1 308 111 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to an upright and a modular support assembly which employs the upright described herein. The upright and the assembly using the upright can support loads greater than those carried by currently available uprights and modular assemblies.

BACKGROUND OF THE INVENTION

[0002] A variety of modular support assemblies for storing or exhibiting articles are known. Such support assemblies usually include metal vertical beam-like members, also known as uprights, and horizontal support members, called brackets. Screws can be used to attach the brackets to the uprights. Alternatively, the uprights can be provided with holes, slots or apertures adapted to receive engagement means, usually hook-like extensions, extending from the rear surface of the brackets. Shelves, on which a load can be positioned, are supported by the brackets.

[0003] Israel Patent IL 112,757, entitled "Security Means for Shelves", describes brackets which are attached to uprights in a modular support assembly by hook-like members and tongue-like cutouts located at the rear of the brackets. These hook-like members are moved into holes in the upright while the tongue-like cutouts secure their position, preventing the brackets from accidentally moving and being released from the upright.

[0004] In prior art modular support assemblies, vertical uprights are typically constructed as shown in Figs. 1A-1I, to which reference is now made. Fig. 1A shows a prior art upright 10 before being subjected to a load. The beam-like upright 10 is generally a hollow piece of metal. The holes 60 for receiving support brackets are placed in the corners of the beam, or, alternatively, positioned in the faces of the beam. Usually, holes 60 are punched out when upright 10 is fabricated. Engagement means extend from the bracket and are constructed so as to fit into the holes 60 of upright 10.

[0005] Figs. 1B-1I show the result of torques and compressional forces produced by loads on upright 10 of Fig. 1A. The brackets positioned on upright 10 and the loads positioned thereon are not shown. However, it should be evident to one skilled in the art that too large a load placed on a bracket appended to upright 10 via the holes 60 shown generates a compressional force on upright 10 which leads to bending, and possibly even collapse, of the upright 10. It is also obvious to one skilled in the art that any hook-like member inserted into the holes 60 exerts a torque on that part of the upright 10 proximate to, and immediately above, the hook-like member, resulting in an outward and upward force which can lead to bracket disengagement and bending of the upright 10.

SUMMARY OF THE PRESENT INVENTION

[0006] Currently available modular support assemblies using horizontal support members, herein also referred to as brackets, which employ snap-in engagement with the assembly's vertical members, herein also referred to as uprights, often cause the uprights to bend and/or buckle under compressional forces and torques transmitted by the assembly's horizontal support members.

[0007] It is therefore an object of the present invention to provide an upright that can withstand greater compressional forces and torques produced by loaded snap-in generally horizontal support members than currently available uprights.

[0008] It is yet another object of the present invention to provide a modular support assembly employing uprights and /or horizontal members constructed and operative as described herein which can be used to support greater loads and torques.

[0009] It is a further object of the present invention to provide a horizontal support member for modular support assemblies which are easily engaged with the uprights described herein, and which prevent movement in at least one direction of the horizontal member with respect to the upright.

[0010] It is another object of the present invention to provide a modular support assembly and upright which are simple to construct and assemble.

[0011] Further objects of the invention will become apparent from the discussion herein below.

[0012] There is thus provided in accordance with the present invention an upright for use as a vertical support member in modular support assemblies. The upright includes a generally linear member having a polygonal cross-section defining a plurality of mutually adjacent faces. Each face resides in a generally flat plane, adjacent faces defining between them elongated corner portions. Each corner portion has one or more indentations formed along the length of the generally linear member. The upright also includes retaining structures formed around the one or more indentations, and the structures are positioned generally transverse to the long axis of the upright. The retaining structures are configured to define recesses in the one or more indentations, so that the recesses thus formed and configured can receive and retain insertable and interlockable engagement means extending from the rear surface of generally horizontal support members. The faces of the linear member form and are operative as a quasi-corrugated perimeter of the linear member, thereby more easily supporting compressional forces acting on the upright produced by loads resting on horizontal support members. The faces also form a backing for the recesses resisting torques generated by loads on the horizontal support members. The torques act through the engagement means of the support structure when the engagement means are inserted into, and retained in, the recesses.

[0013] Further, in accordance with another embodiment of the present invention, an upright as described above further includes one or more ribs formed in the one or more indentations. The one or more ribs positioned substantially opposite to a corner portion of the upright.

[0014] Additionally, in accordance with a preferred embodiment of the present invention, the retaining structures are equally spaced in the direction of the long axis of the upright. In other embodiments, the retaining structures are unequally spaced in the direction of the long axis of the upright.

[0015] Further in yet another embodiment of the present invention, the retaining structures are unequally spaced in the direction of the long axis of the upright and the structures are positioned in groups, each group including a number of retaining structures, at least equal to the number of engagement means of a single horizontal support member.

[0016] Additionally, there is provided in accordance with the present invention, a modular support assembly which includes two or more uprights constructed according to any one of the above embodiments and two or more horizontal support members positioned generally transverse to the uprights. The support members have engagement means extending from the member. The uprights receive and retain the engagement means, the means being insertable into and interlockable with recesses of the upright. The retention in the recesses is effected by the retaining structures and the quasi-corrugated perimeter of the uprights.

[0017] In an alternative embodiment of a modular support assembly, the two or more support members further include flexible locking means for preventing translation of the support members within the recesses in the direction parallel to the long axis of the upright. The locking means are insertable within the recesses and extend rearwardly from the support members. In a further embodiment of the invention, the flexible locking means also prevents translation of the support members within the recesses in one or more directions generally perpendicular to the long axis of the upright.

[0018] Further, in a preferred embodiment of the of the modular support assembly, when not flexed, the flexible locking means lies in a plane of a lateral surface of the support member and when flexed, the locking means lies out of the plane of the surface.

[0019] Additionally, in a preferred embodiment of the modular support assembly constructed according to the present invention, each of the two or more uprights has at least one horizontal support member engaged thereto.

[0020] Additionally, there is provided in accordance with an embodiment of the present invention, a horizontal support member for use with a modular support assembly, the member including one or more engagement means for snap-in insertion into recesses positioned in an upright of the assembly. The one or more engagement means extends towards the upright from the surface of the support member proximate to the upright. The one or more locking means is insertable into a recess in the upright, the locking means preventing motion of the support member within the recess of the upright.

[0021] Additionally, in a preferred embodiment of the invention, the one or more locking means of the support member is flexible and kept flexed when the engagement means are inserted into and engaged with the recesses. The one or more locking means is returned to its unflexed position after insertion into the recess in the upright.

[0022] Further, in yet another embodiment of the invention, when not flexed, the flexible locking means of the support member lies in the plane of a lateral surface of the support member and when flexed, the locking means lies out of the plane of the surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

Figs. 1A-1I show lengthwise side views of an upright constructed in accordance with the prior art before and after bending or buckling;

Figs. 2A-2C are respective top-side, side and top views illustrating an upright constructed according to a preferred embodiment of the present invention;

Figs. 3A-3C are respective top-side, side and top views illustrating an upright constructed according to a second preferred embodiment of the present invention;

Figs. 4A-4D are side, top-side and top views illustrating a bracket for use with uprights constructed according to the present invention;

Figs. 5A-5D are side, top-side and top views illustrating another bracket for use with uprights constructed according to the present invention;

Figs. 6A-6C illustrate the method of engagement of brackets with uprights constructed according to the present invention;

Figs. 7A-7D and 8A-8D are respective side, enlarged side and top views of the brackets of Figs. 4A-4D and Figs. 5A-5D, respectively, engaged with uprights constructed according to the embodiment shown in Figs. 2A-2C; and

Figs. 9A-9D are respective side, enlarged side and top views of a bracket engaged with uprights constructed according to the embodiment shown in Figs. 3A-3C.

[0024] Similar elements in the Figures are numbered with similar reference numerals.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0025] Modular support assemblies are widely employed, often as shelving units. These modular assemblies are comprised of generally horizontal support members, herein called brackets, which are attached to vertical support members, herein called uprights, the latter typically hollow metal polygonal structures. The brackets can be bolted directly to the upright or attached by "snap-in" insertion. Snap-in brackets are generally appended to the uprights by inserting hooks, which extend from the bracket's rear surface, into holes drilled in the corners or surfaces of the uprights. Shelves are placed on the inserted brackets for supporting loads. Torques and compressional forces generated by these loads act on the uprights, often causing them to bend and even buckle completely.

[0026] Applicant has realized that uprights having holes with a backing resist the torques and compressional forces produced by loads on appended brackets, better than currently existing hollow uprights. The backing can be viewed as a "quasi-corrugated" wall formed from the surfaces of the original polygonal structure. The "quasi-corrugated" perimeter of the upright resists the torque produced by the upper part of the engagement means when a load is placed on a shelf positioned on a horizontal support member. Additionally, using uprights having holes or recesses which can accommodate a locking means positioned on the rear surface of brackets prevents movement of the brackets, forestalling their unintentional disengagement. Using uprights constructed as described herein changes the forces on the engagement means of the brackets from bending to shear forces. In some embodiments the upright has an additional rib or ribs within the accepting recesses; this additional rib or ribs provides additional structural strength to the upright and prevents the formation of cracks during manufacture of the upright.

[0027] Reference is now made to Figs. 2A, 2B and 2C, in which top-side, side and top views, respectively, of an upright constructed according to a preferred embodiment of the present invention are illustrated. The upright, referenced generally 100, is typically fabricated from a hollow square- shaped metal beam-like member and possesses a plurality of recesses referenced 130 positioned at the corners of the member. Retaining structures referenced 110 are located at the top and bottom of each open face of every recess 130.

[0028] To better understand the structure and function of an upright fashioned according to the present invention, it is instructive to consider a method which can be used to construct the upright. To form the upright, a series of cuts are made in the beam-like member at an angle of 45 degrees with respect to each corner. The cuts are spaced so that they form relatively closely spaced pairs, with each pair separated from its adjacent pairs by much larger spacings. The metal between adjacent pairs is then pushed inwards, thereby forming recesses 130. Each recess is defined by two retaining structures 110 which are formed from that portion of the metal beam-like member that is not pushed inwards. Recesses 130 and retaining structures 110 are configured and dimensioned to receive engagement means, and possibly one or more locking means, formed on the rear surface of brackets, described more fully below.

[0029] It is readily apparent to one skilled in the art that uprights constructed according to the present invention and similar to the one shown in Figs. 2A-2C, also may be formed by molding the upright as an integral structure directly. Furthermore, while the upright described above has been described as being formed of metal, any rigid material of sufficient mechanical strength can be used.

[0030] Unlike prior art vertical support members, uprights constructed according to the present invention have a cross-shaped core referenced 140, best seen in Fig. 2C. The arms of the cross separate adjacent corner recesses 130 and are formed when the metal between the larger spacings described above is pushed inward. The purpose of the cross-shaped core 140 is best seen in Figs. 7B-7C and Figs. 8B-8C below, where the arms of cross-shaped core 140 provide a support backing for the engagement means protruding from the rear of the bracket. Cross-shaped core 140 can be viewed as the upright's "quasi-corrugated" perimeter. It is readily apparent that such a structure is better able to withstand compressional stresses than prior art uprights having quadrilateral-shaped perimeters. A further discussion of the increased structural support provided by uprights constructed according to the present invention is described in connection with Figs. 7A-9D below.

[0031] Figs. 2A-2C show uprights that include retaining structures 110 positioned equidistantly from each other along the vertical axis of the upright. However, in other embodiments, structures 110 may be grouped into subunits of two or more, each grouping suitable for engaging a single bracket.

[0032] In some embodiments, the upright is an integral unit, while in others, the upright is formed by joining together sections constructed as described above, typically by welding.This can be effected by joining the sections in a direction perpendicular to the long axis of the upright. In yet other embodiments, instead of using a hollow square beam-like member, the upright can be constructed by joining two U-shaped rails along their long axes, either before, but generally after, the formation of recesses 130 and retaining structures 110, constructed as described above. Finally, in still other embodiments, the upright may be formed from rectangular beam-like members.

[0033] In general, cross-shaped core 140 is formed from a hollow metal beam, but in some embodiments it can be formed from a solid metal beam. In such cases, recesses 130 and retaining structures 110 can be made by cutting or punching out suitably shaped blocks of

metal from the corners so that a structure similar to that shown in Figs. 2A-2C is formed.

[0034] While we have herein above described recesses 130 as possessing no bottom, as best seen in Figs. 7A-9D discussed herein below, other embodiments contemplate uprights having recesses 130 which can have bottoms.

[0035] Reference is now made to Figs. 3A-3C, which illustrate respective top-side, side and top views of an upright constructed according to a second preferred embodiment of the present invention. While Fig. 2A shows an upright 100 whose central structure or core has a cross-like shape 140, Figs. 3A-3C show an embodiment where the cross-like core 140 of an upright, referenced generally 200, has a ridge referenced 120 positioned substantially opposite each of the corners of upright 200. Ridge 120 provides additional support to the bracket's engagement means; this support is best seen in, and will be discussed below in conjunction with, Fig. 9D.

[0036] Referring now to Figs. 4A-4D which illustrate respective side, top-side and top views of a bracket suitable for use with uprights constructed according to the present invention, a bracket, referenced generally 300, which has a truncated generally triangular shape with a plurality of engagement means referenced 330 projecting rearwardly from the edges of the bracket's, generally vertical, rear surface referenced 350 is shown. Engagement means 330 are configured and dimensioned to be received within recesses 130 and retained by retaining structures 110 of uprights 100 and 200 of Figs. 2A-3C. When engaged in the upright, bracket 300 is positioned in a plane substantially transverse to the plane of the upright. Engagement means 330 can be formed as hook-shaped elements or L-shaped lugs, but clearly a variety of other suitable engagement means capable of releasably interlocking or interconnecting with the uprights of the present invention may also be used.

[0037] On the edge of back surface 350 of bracket 300, at least one locking means referenced 340, here, a restraining stop, extends rearwardly. Locking means 340, typically positioned co-linear with a lateral surface referenced 360 of bracket 300, is flexible and can be bent out of the plane of lateral surface 360. Figs. 4B and 4D show this flexibility which facilitates the insertion of engagement means 330 into recesses 130 in uprights 100 and 200 described in Figs. 2A-3C.

[0038] Figs. 4A-4C show a bracket having three engagement means 330, however, it is readily apparent to one skilled in the art that more or less than three engagement means may be used. Similarly, more than a single locking means 340 can be provided. Bracket 300 is preferably formed of metal but it can be formed of any strong, rigid material capable of supporting a shelf and a load placed thereon.

[0039] Figs. 5A-5D, to which reference is now made, illustrate side, top-side and top views of another type of bracket for use with uprights constructed according to the present invention. The bracket, generally referenced 400, illustrated in Figs. 5A-5D represents a bracket described in Israel Patent IL 112,757, which is hereby incorporated by reference. Fig. 5C shows the displacement of locking means referenced 440, here a tongue-like cut-out, after the bracket is inserted into recesses 130 and retaining structures 110 of upright 100 or 200 of Figs. 2A-2C and Figs. 3A-3C respectively. In the position shown in Fig. 5C, locking means 440 prevents movement of the inserted bracket within recesses 130.

[0040] Reference is now made to Figs. 6A-6C which illustrate the method of insertion of brackets into uprights constructed according to the present invention. Fig. 6A shows bracket 300 first being translated in the Y direction and being brought near to upright 200. Bracket 300 is then translated in the negative Z direction inserting engagement means 330 over retaining structures 110 and into recesses 130. While engagement means 330 is inserted over retaining structures 110 and into recesses 130, locking means 340 remains flexed as shown in Fig. 6B so as not to interfere with the insertion. Once engagement means 330 have been successfully inserted into recesses 130 as shown in Fig. 6B, locking means 340 is released and positioned in recess 130, as seen in Fig. 6C. Locking means 340 and retaining structures 110 prevent movement of bracket 300 parallel to the long axis of upright 200. Fig. 6C illustrates bracket 300 fully engaged in upright 200.

[0041] Figs. 7A-7D and 8A-8D, to which reference is now made, show side and top views of brackets engaged in upright 100, the latter constructed according to the preferred embodiment of the present invention shown in Figs. 2A-2C. The brackets are under a load exerting a force P in the direction shown. Figs. 7A-8D, especially the enlarged views of Figs. 7C and 8C, illustrate the locked position produced by locking means 340 and 440 which prevents translational motion in the direction parallel to the long axis of the upright. The enlarged views of Figs. 7B and 8B illustrate that a torque resulting from a load positioned on a shelf resting on brackets 300 and 400 rotating around engagement means 330 and 430 respectively, is resisted by walls referenced 180 of the upright's cross-shaped core 140.

[0042] Walls 180 are absent in prior art uprights, which, therefore, provide little or no resistance to torques produced by loads rotating around engagement means 330. Moreover, walls 180 can be viewed as the "quasi-corrugated" perimeter of the upright which can withstand compressional forces acting on the upright better than a quadrilateral shaped perimeter. As a result, structural failure of uprights constructed according to the present invention occurs at higher loads than with uprights constructed according to prior art. It should be noted that the construction of the upright according to the present invention effectively transforms the forces acting on engagement means 330 from bending to shear forces.

[0043] It is also readily apparent from Figs. 7A and 8A that the use of locking means 340 and 440 prevents un-

premeditated release of engagement means 330 and 430, which could result in complete disengagement of brackets 300 and 400.

[0044] Reference is now made to Figs. 9A -9D, which illustrate the advantage of adding ribs 120 to walls 180 of cross-shaped core 140 of an upright constructed according to a preferred embodiment of the present invention. The ribs are positioned substantially opposite the corners of the upright, as mentioned above in reference to Figs. 3A-3C. As can be seen when comparing Fig. 9D with Figs. 7D and 8D, the addition of ribs 120 as shown in Figs. 9A-9D restricts movement of bracket 300 in the direction shown by the arrow in Fig. 9D. This additional restricted movement further reduces the possibility of unintended release of engagement means 330, which could result in the complete disengagement of bracket 300 from the upright. An additional advantage of the rib is that it prevents cracking of the upright during manufacture.

[0045] It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described herein above. Rather the scope of the invention is defined solely by the claims that follow:

Claims

1. An upright for use as a vertical support member in modular support assemblies, said upright including:

   a generally linear member having a polygonal cross-section so as to define a plurality of mutually adjacent faces, each face residing in a generally flat plane so as to define therebetween elongate corner portions, each portion having at least one indentation formed therealong, along the length of said generally linear member; and

   retaining structures formed around said at least one indentation, said structures positioned generally transverse to the long axis of said upright, and configured to define recesses in said at least one indentation,

   whereby said recesses thus formed and configured can receive and retain insertable and interlockable engagement means extending from the rear surface of generally horizontal support members, and where said faces of said linear member form, and are operative as, a quasi-corrugated perimeter of said linear member, thereby more easily supporting compressional forces acting on said upright produced by loads resting on the horizontal support members, and where said faces form a backing for said recesses resisting torques generated by loads on the horizontal support members acting through their engagement means when the engagement means are inserted into, and retained in, said recesses.

2. An upright according to claim 1, further including at least one rib formed in said at least one indentation, said at least one rib positioned substantially opposite to a corner portion of the upright.

3. An upright according to claim 1, wherein said retaining structures are equally spaced in the direction of the long axis of said upright.

4. An upright according to claim 1, wherein said retaining structures are unequally spaced in the direction of the long axis of said upright.

5. An upright according to claim 1, wherein said retaining structures are unequally spaced in the direction of the long axis of said upright and where said structures are positioned in groups, each group including a number of retaining structures at least equal to the number of engagement means of a single horizontal support member.

6. A modular support assembly including:

   at least two uprights, each upright including;

   a generally linear member having a polygonal cross-section so as to define a plurality of mutually adjacent faces, each face residing in a generally flat plane so as to define therebetween elongate corner portions, each portion having at least one indentation formed therealong, along the length of said generally linear member; and retaining structures formed around said at least one indentation, said structures positioned generally transverse to the long axis of said upright, and configured to define recesses in said at least one indentation,

   whereby said recesses thus formed and configured can receive and retain insertable and interlockable engagement means extending from the rear surface of generally horizontal support members, and where said faces of said linear member form, and are operative as, a quasi-corrugated perimeter of said linear member, thereby more easily supporting compressional forces acting on said upright produced by loads resting on the horizontal support members, and where said faces form a backing for said recesses resisting torques generated by loads on the horizontal support members acting through their engagement means when the engagement means are inserted into, and retained in,

said recesses; and

at least two horizontal support members positioned generally transverse to said uprights, said support members having engagement means extending from said member,
said uprights receiving and retaining said engagement means, said means being insertable into and interlockable with recesses of said upright, the retention in said recesses effected by said retaining structures and said quasi-corrugated perimeter of said uprights.

7. A modular support assembly according to claim 6, further including at least one rib formed in said at least one indentation, said at least one rib positioned substantially opposite to a corner portion of the upright.

8. A modular support assembly according to claim 6, wherein said retaining structures are equally spaced in the direction of the long axis of said upright.

9. A modular support assembly according to claim 6, wherein said retaining structures are unequally spaced in the direction of the long axis of said upright.

10. A modular support assembly according to claim 6, wherein said retaining structures are unequally spaced in the direction of the long axis of said upright and where said structures are positioned in groups, each group including a number of retaining structures at least equal to the number of engagement means of a single horizontal support member.

11. A modular support assembly according to claim 6, wherein said at least two support members further include flexible locking means for preventing translations of said support members within said recesses in the direction parallel to the long axis of said upright, said locking means insertable within said recesses and extending rearwardly from said support members.

12. A modular support assembly according to claim 11, wherein said flexible locking means also prevents translation of said support members within said recesses in at least one direction generally perpendicular to the long axis of said upright.

13. A modular support assembly according to claim 11, wherein said flexible locking means when not flexed lies in a plane of a lateral surface of said support member and when flexed lies out of the plane of said surface.

14. A modular support assembly according to claim 6, wherein each of said at least two uprights has at least one horizontal support member engaged thereto.

15. A modular support assembly according to claim 6, wherein said horizontal support members include:

at least one engagement means for snap-in insertion into recesses positioned in an upright off the assembly, said at least one engagement means extending towards the upright from the surface of said support member proximate to the upright; and
at least one locking means insertable into a recess in the upright; said locking means preventing motion of said support member within the recess of the upright.

16. A modular support assembly according to claim 11, wherein said flexible locking means is kept flexed when said engagement means are inserted into and engaged with said recesses and said locking means is returned to its unflexed position after insertion into said recess in said upright.

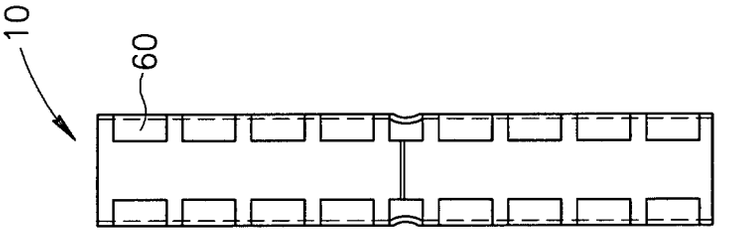

FIG.1E
PRIOR ART

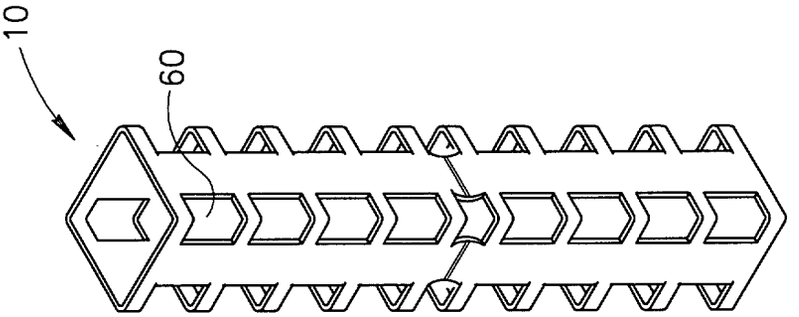

FIG.1D
PRIOR ART

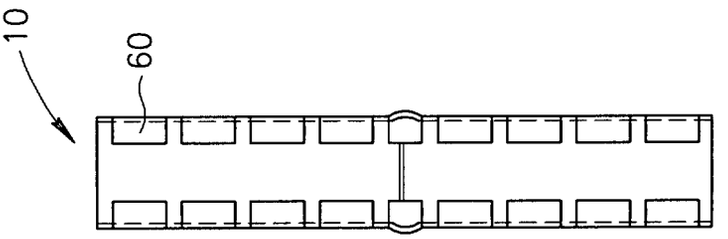

FIG.1C
PRIOR ART

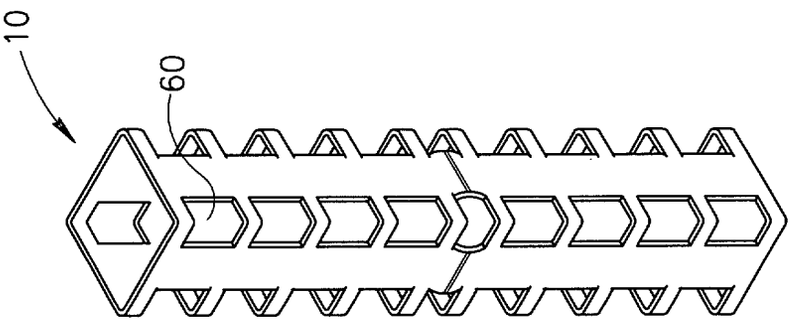

FIG.1B
PRIOR ART

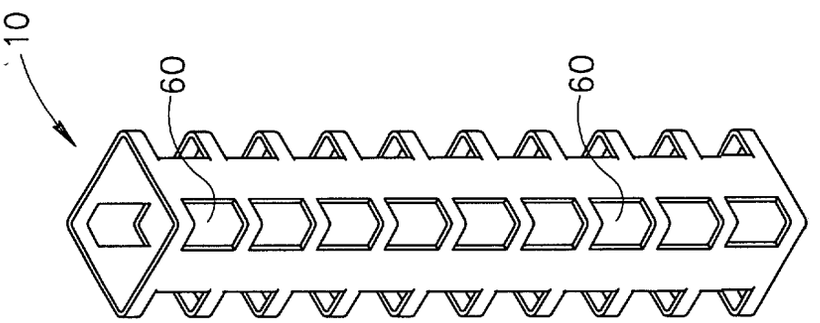

FIG.1A
PRIOR ART

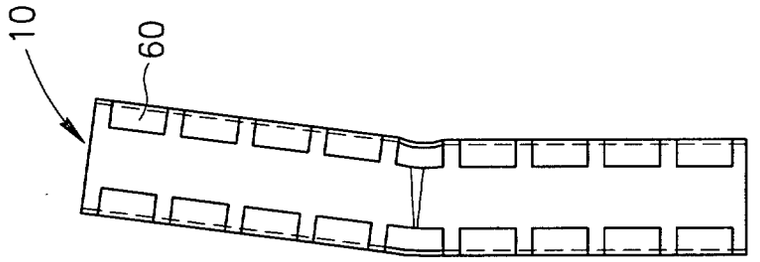

FIG.1I
PRIOR ART

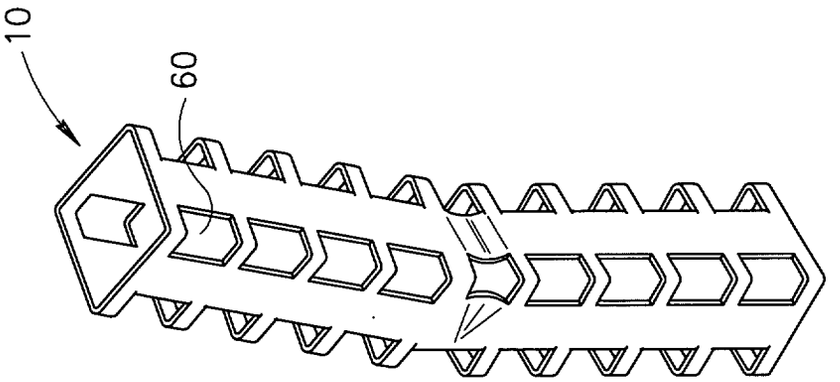

FIG.1H
PRIOR ART

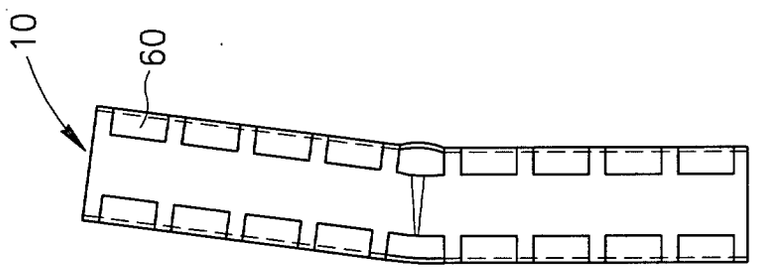

FIG.1G
PRIOR ART

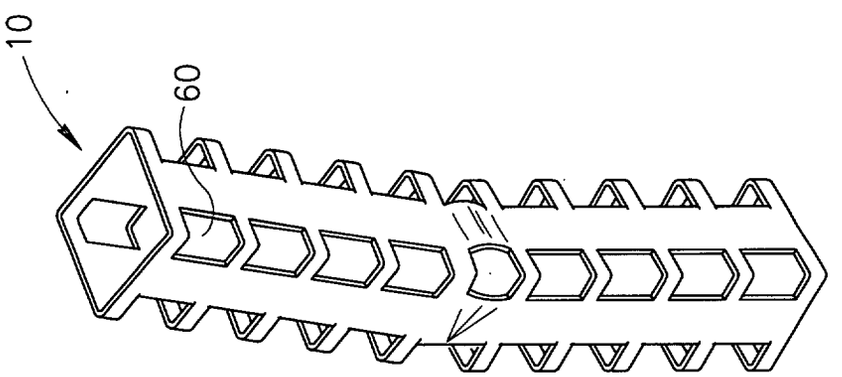

FIG.1F
PRIOR ART

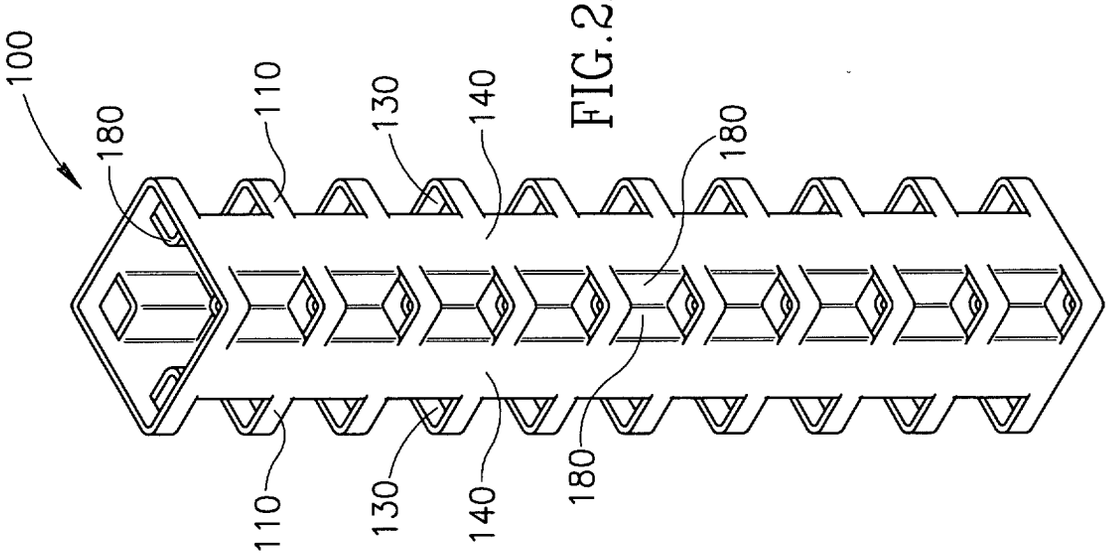

FIG.2A

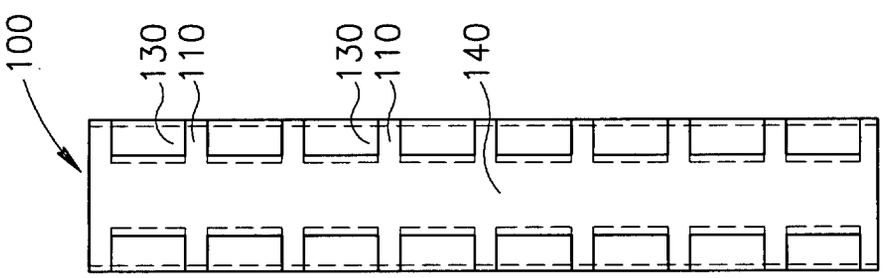

FIG.2B

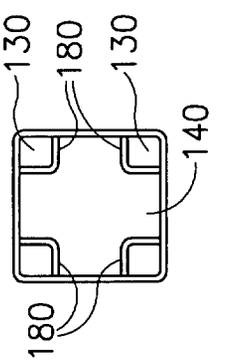

FIG.2C

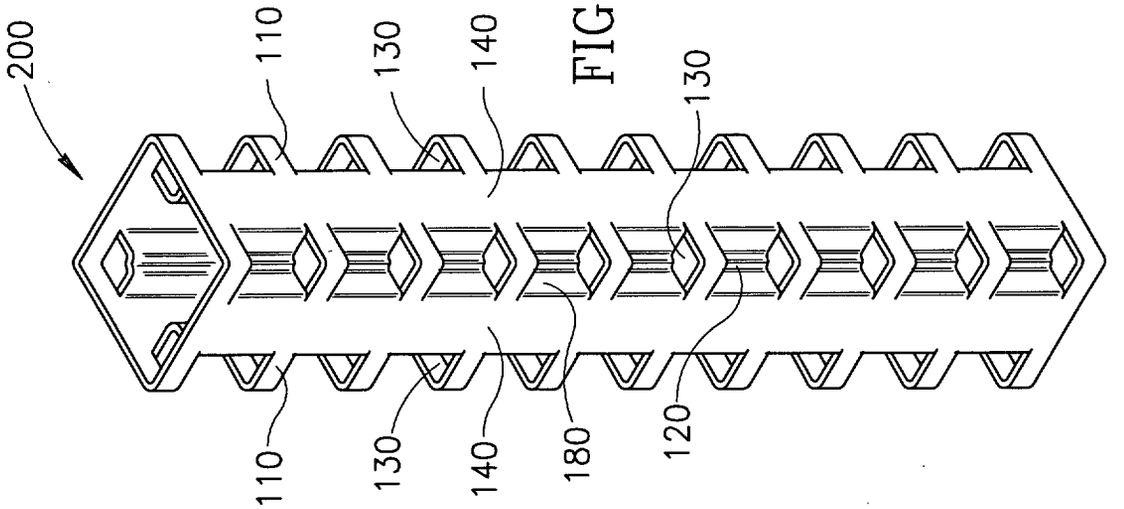

FIG.3A

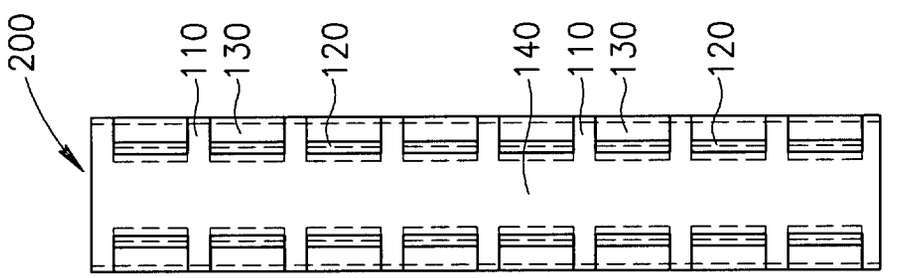

FIG.3B

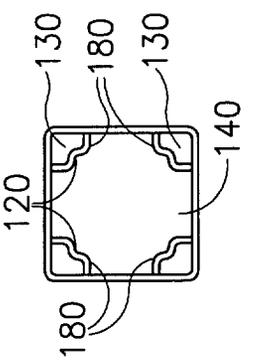

FIG.3C

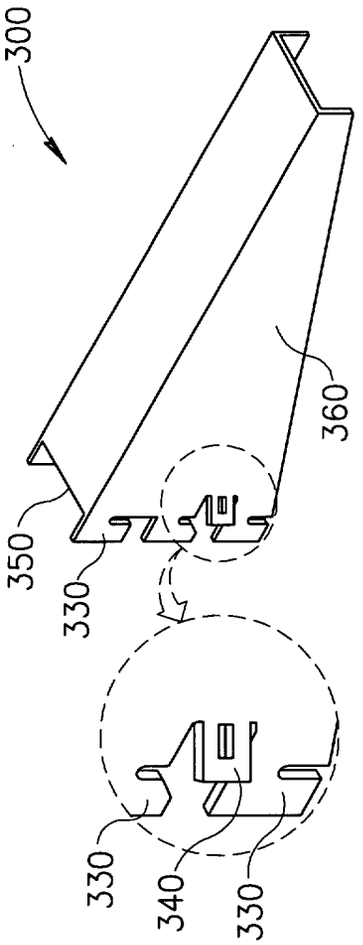

FIG.4B

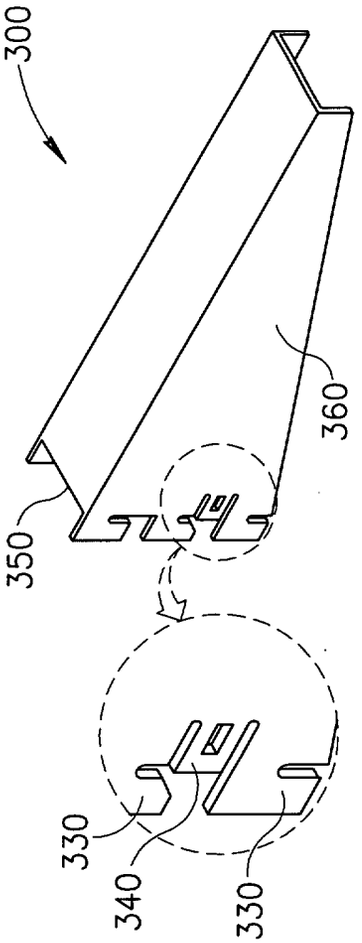

FIG.4C

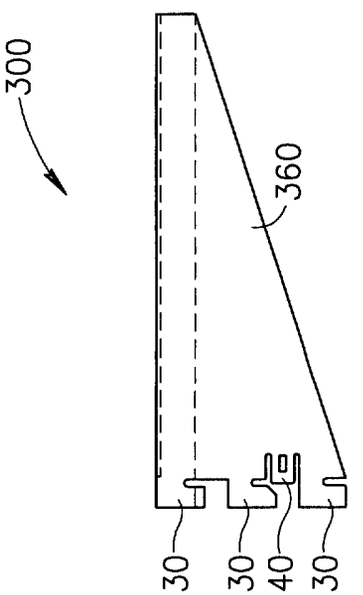

FIG.4A

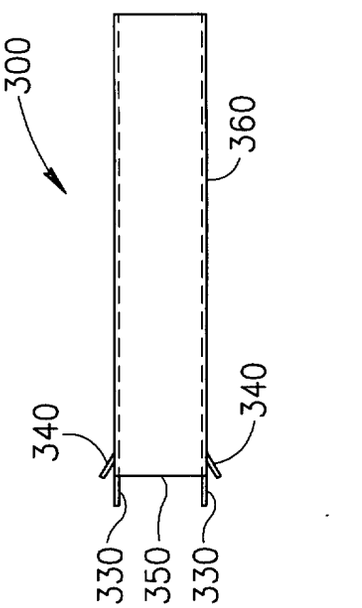

FIG.4D

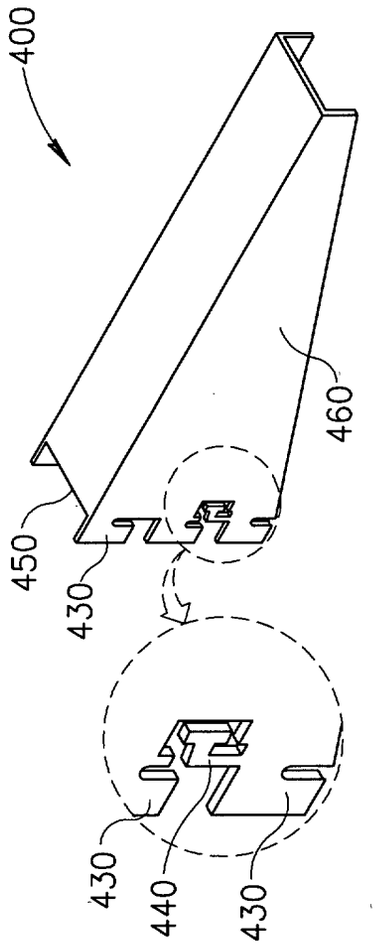

FIG.5B

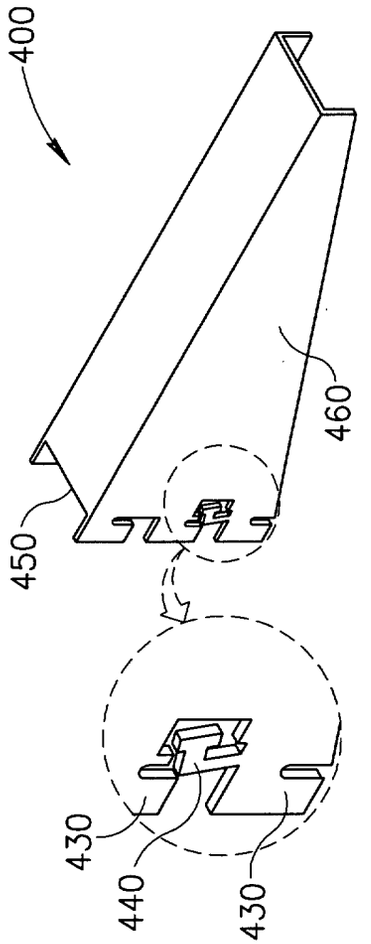

FIG.5C

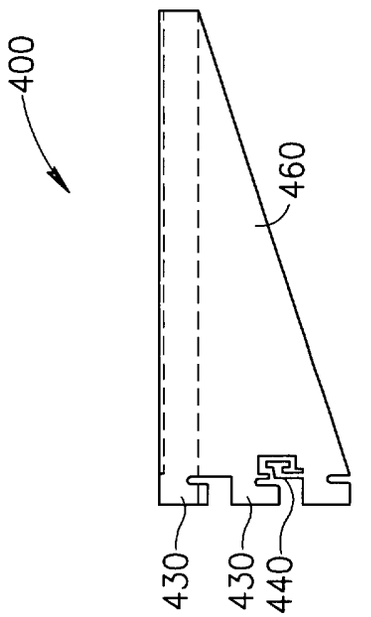

FIG.5A

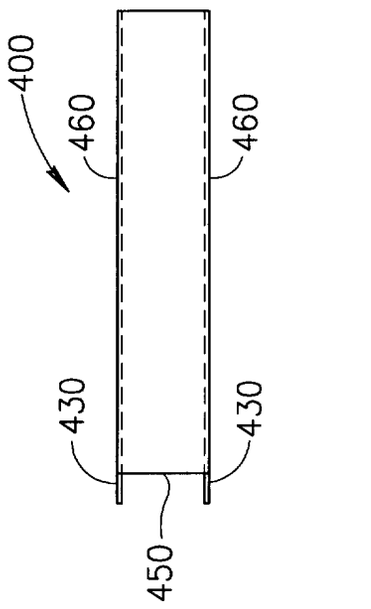

FIG.5D

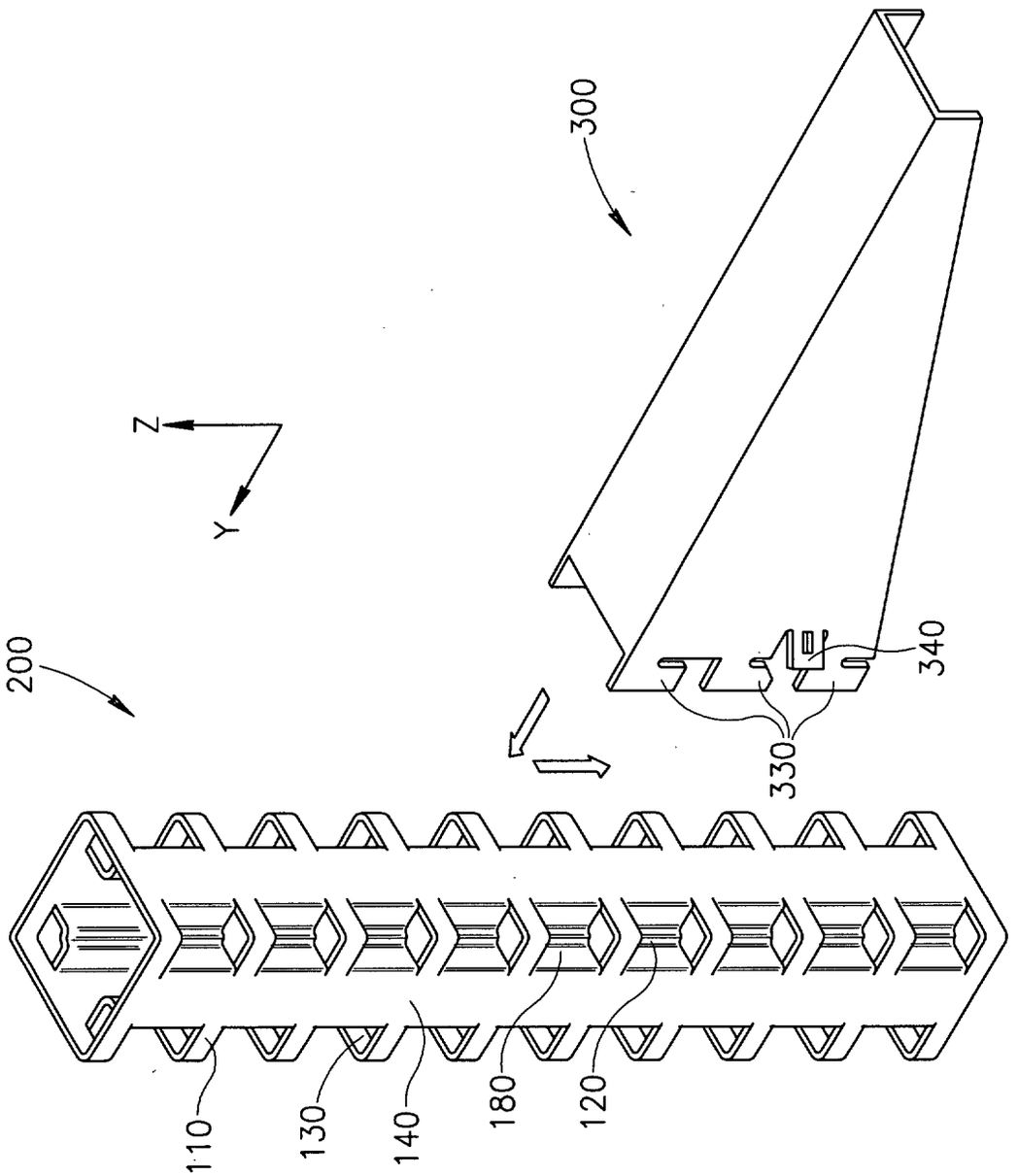

FIG.6A

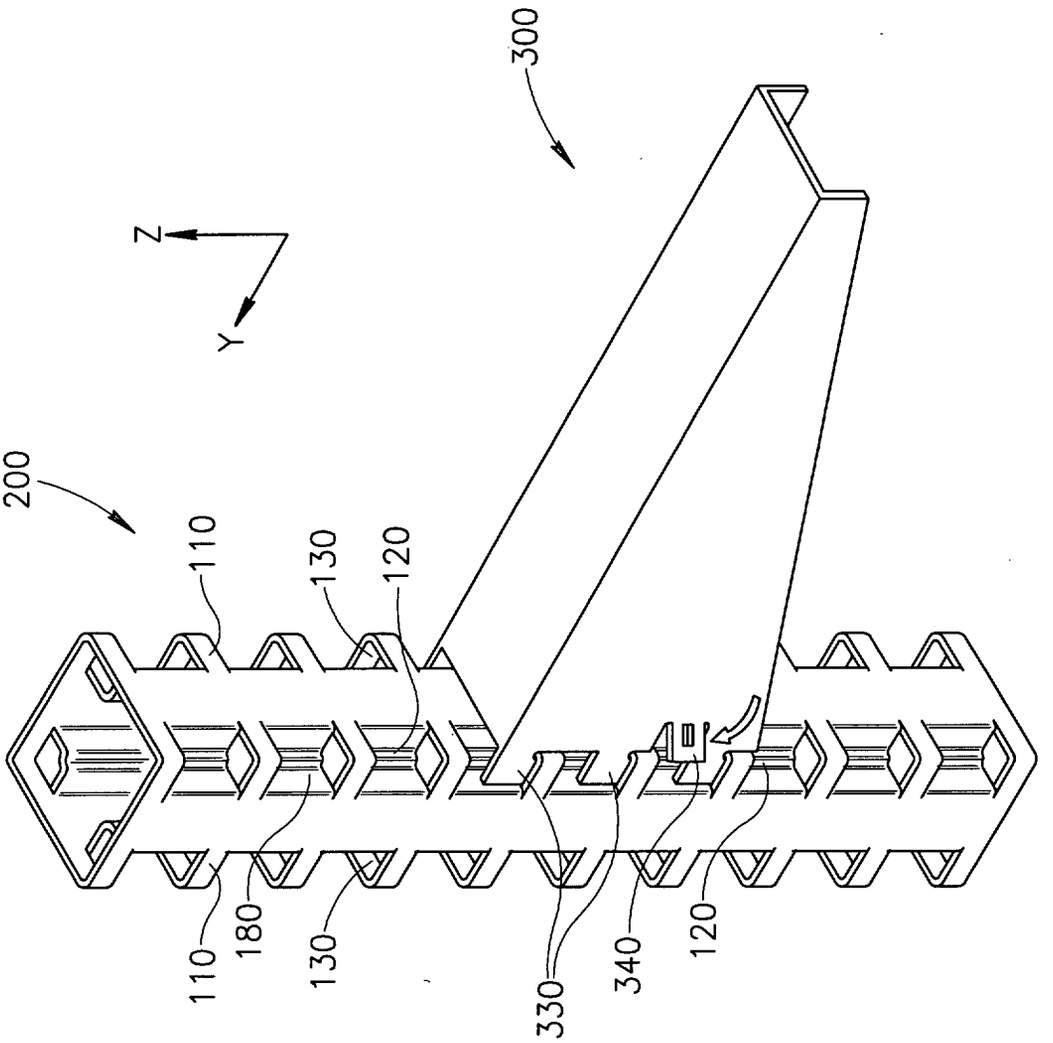

FIG.6B

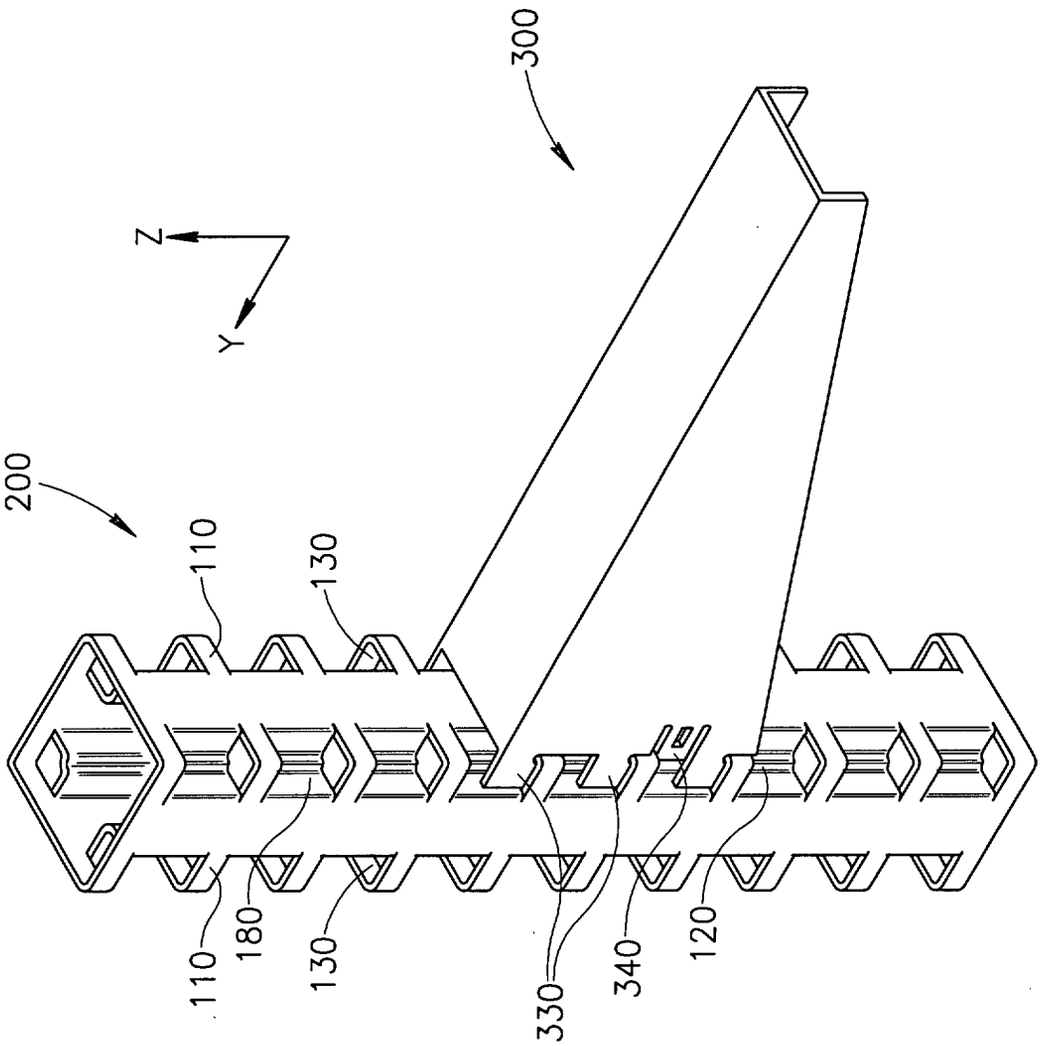

FIG.6C

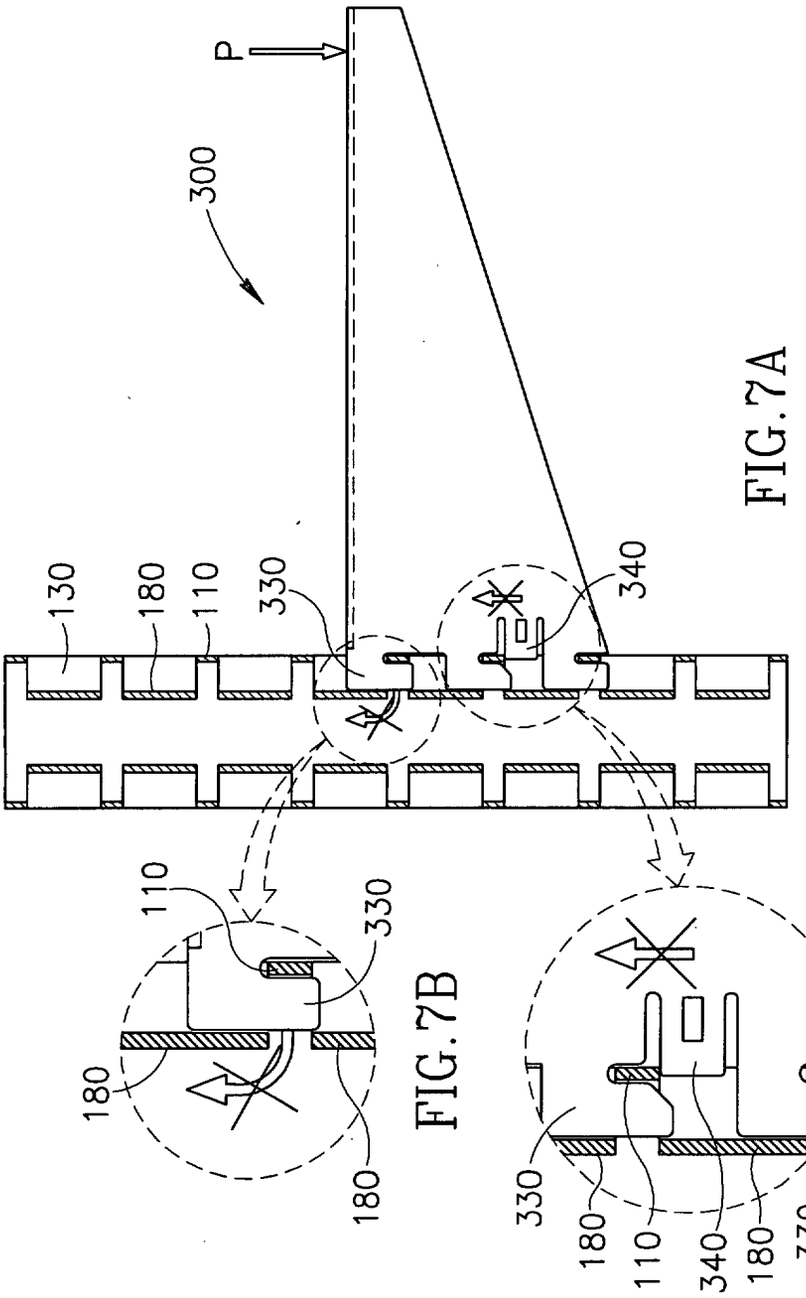

FIG. 7A

FIG. 7B

FIG. 7C

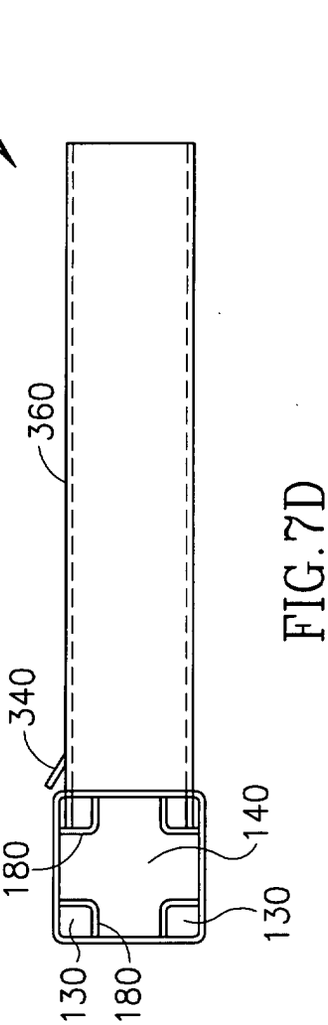

FIG. 7D

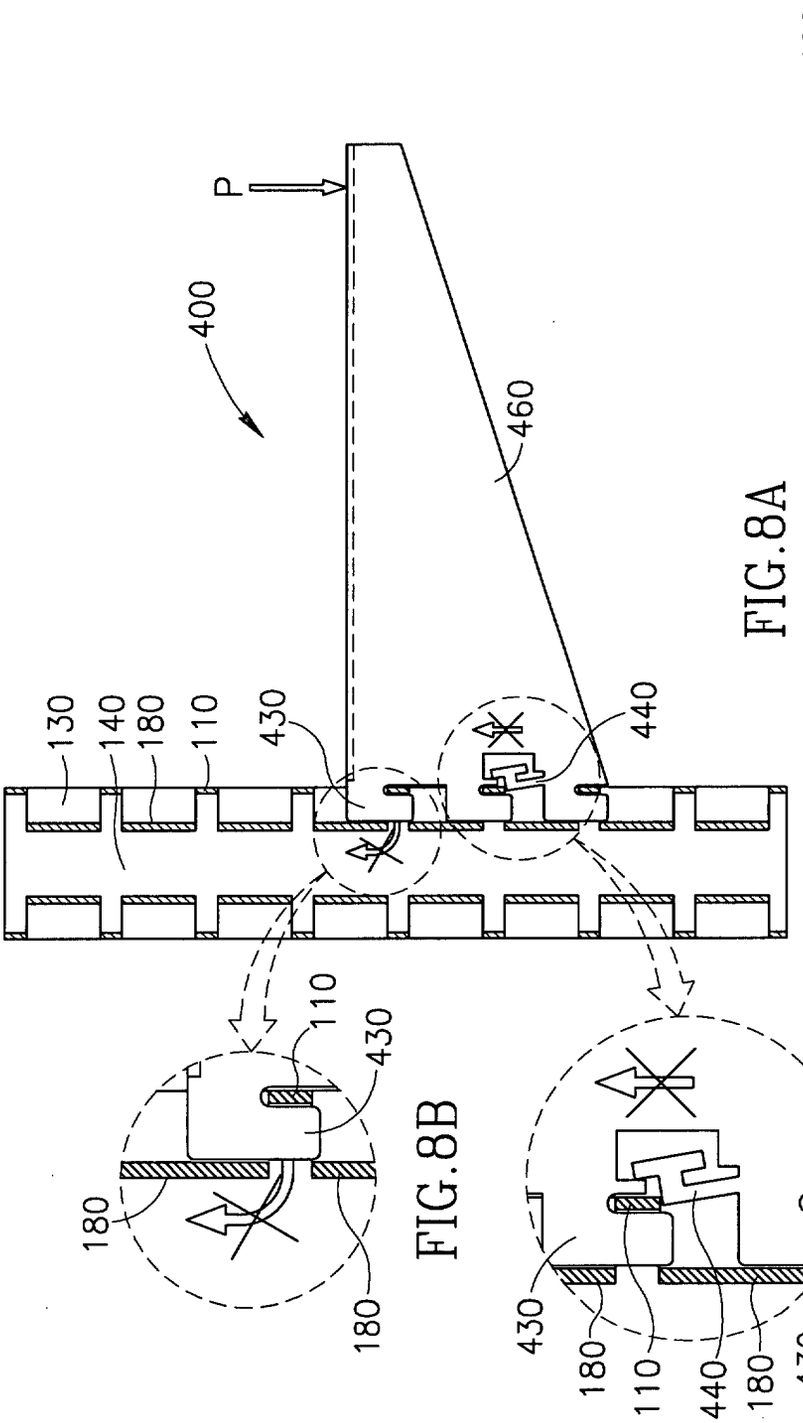

FIG.8A

FIG.8B

FIG.8C

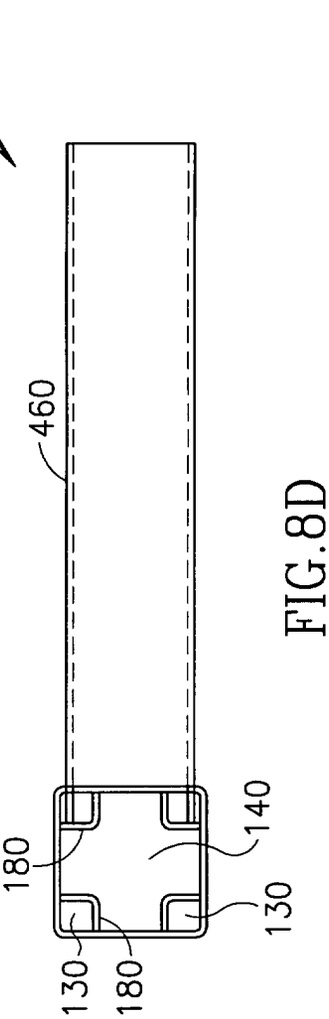

FIG.8D

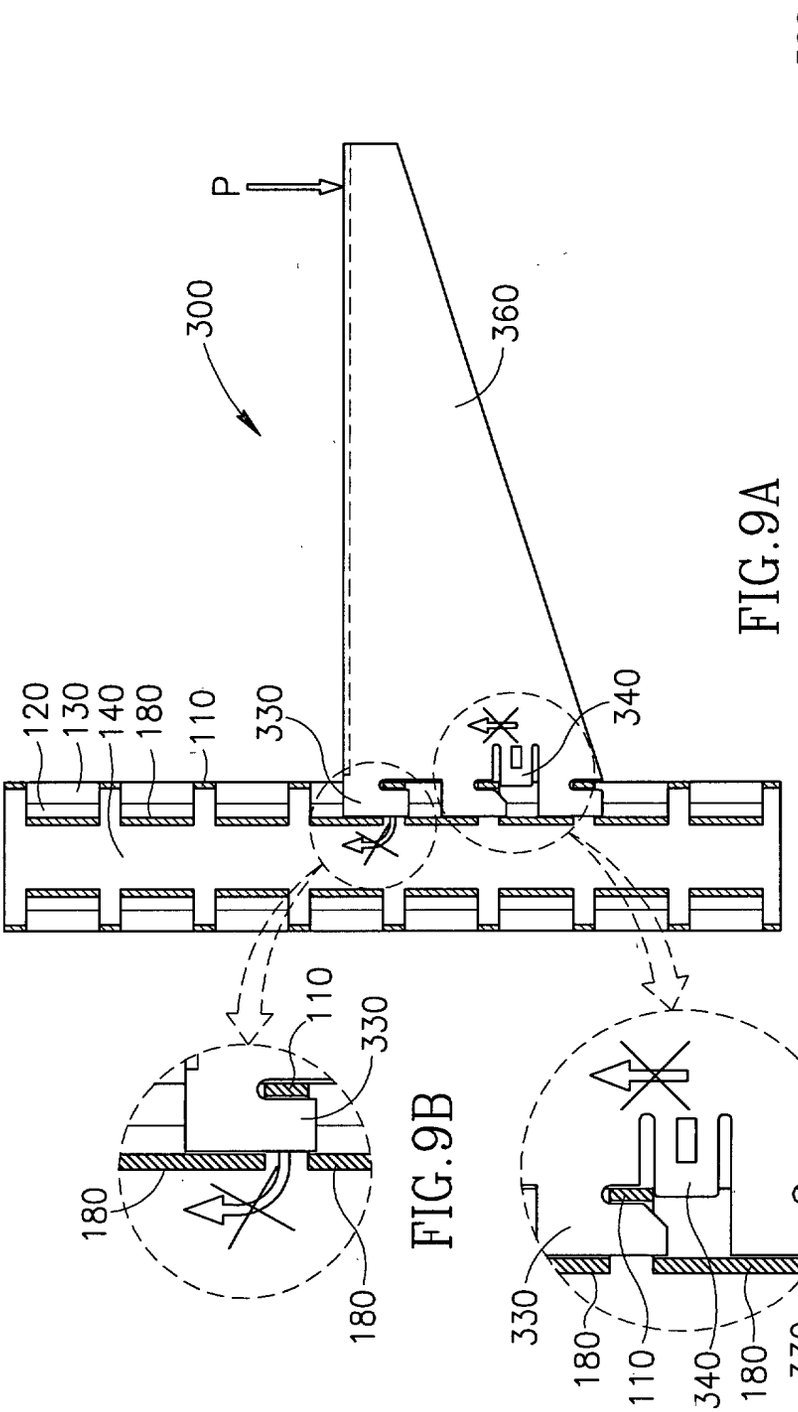

FIG.9A

FIG.9B

FIG.9C

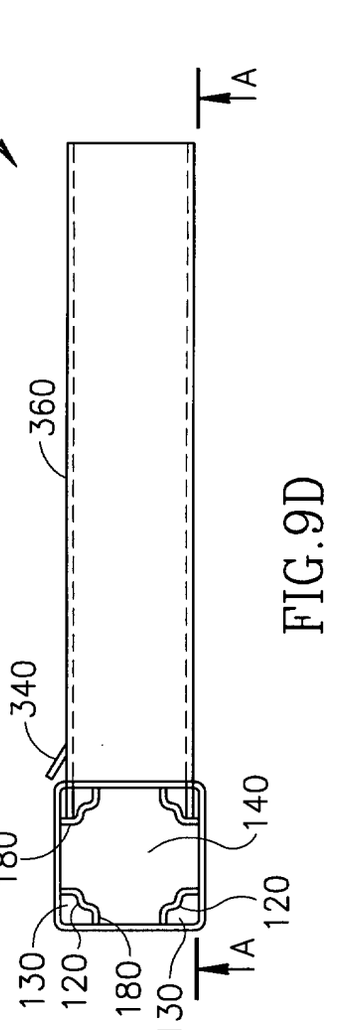

FIG.9D

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EUROPEAN SEARCH REPORT

Application Number
EP 02 25 7498

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Y	EP 0 572 447 A (E Z RECT MFG) 8 December 1993 (1993-12-08) * figures 4,5 *	6-11, 13-15	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	31 January 2003	Alff, R

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