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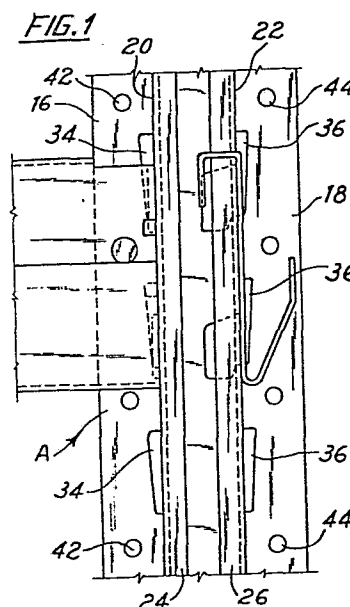
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(54) **Metallic shelving provided with multiple interlocking means, and components designed for producing this shelving.**

(57) A metallic carrying structure, especially useful as shelving means, of the kind comprising independent supporting shelves, wherein the stringers, the cross-members and the brace-members are provided with end hook means integrally formed with, or mechanically fitted to the body thereof without any welding being required.



TITLE MODIFIED

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DESCRIPTION of the invention having the title :

"METALLIC CARRYING STRUCTURE PROVIDED WITH MULTIPLE INTER-
LOCKING MEANS, PARTICULARLY SUITABLE FOR USE AS SHELVING
IN SHOPS, OFFICES, STORES AND THE LIKE; AND METALLIC
COMPONENTS DESIGNED FOR OBTAINING AND FORMING SAME STRUCTURE"

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This invention relates to a metallic carrying structure
provided with multiple interlocking means, particularly
suitable for use as shelving in shops, offices, stores and
the like, as well as to the metallic components designed
for achieving and forming said structure.

In the field of metallic combined-element structures, parti-
cularly of the type set forth, it is known that a serious
technical problem is involved when manufacturing and forming



the uprights, the stringers and the cross-members, as well as when these components are to be secured to one another in order to obtain the assembling and erecting of the structure which must possess sufficient rigidity and stability properties. The various manufacturers have approached the problem to solve it according to a number of different ways but, up to now, the combined metallic structures have lent themselves to some critics, mainly as regards the manner and systems of fastening the horizontal and vertical elements together.

In the case that is of particular interest to the purposes of this invention, that is, the case where the metallic structure, once this latter has been assembled in order to accomplish its functions, substantially comprises uprights, stringer-, cross-members, and load supporting shelves, the stringer- and cross-members are generally manufactured each into three pieces, namely a first central elongated piece or bar-member and two further end-pieces which are fastened by welding to the bar-member. At the end of the working operation, each stringer and each cross member has its central bar member provided with the two associated end-hook means, which latter have to be fitted into the corresponding, conveniently shaped windows formed in the upright members, in order to obtain the metallic structure in the assembled and erected state. It is generally not possible,



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while the structure is being mounted, to interchange the stringers and the cross members, even though these elements may be equal in longitudinal size, and this due to the fact of the frequently recurrent differences in both the hook means carried by said elements -which hook means are not the same for the stringers and the cross members- and the windows in the uprights which are designed to receive the associated hook means.

From the above, it should be easy to appreciate, for the above type of structure, the main drawbacks that are connected with the shelving construction concerned. To sum up, these drawbacks reside in the relative difficulty in obtaining the stringers and cross members with the hook means welded thereto, in the relative difficulty peculiarly involved in this type of working operation and, therefore, in the comparatively high cost of the finished product, as well as in the differences between the attachments employed for the stringers and the cross members and, therefore, the differences in the windows cut in the upright members, which differences do not permit interchangeability of the cross members and stringers, thus in turn increasing the cost of finished product.

The object of this invention is to obviate to the above drawbacks and other difficulties. To this end, the invention consists of a metallic carrying structure, particularly

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useful as shelving structure for use in shops, offices, stores and the likes, of the type including elements which can be combined and fastened together, characterized in that in said structure, which is of the kind wherein the shelves or load supporting flat members are independent of said elements and can be made to rest on the horizontal elements of the structure, said horizontal elements, that is to say the stringers and the cross members, are constructed and shaped so as to have hooks means at their ends which are either directly obtained from the body of said elements, or separate from said body to which they are fitted by any suitable mechanical joining means, the hooks being able, during the step when the assembling and erecting of the structure are carried out, to lockingly fit, by means of congruently shaped portions thereof, into associated windows congruently formed in the vertical or upright elements, whereby each horizontal element can have its central body or bar-shaped portion configurated to the most appropriate shape irrespectively of its own ends or hook-shaped portions, which are either directly obtained from each element or mechanically fastened thereto, said hooks means being also shaped to permit them to lockingly cooperate with the corresponding windows in the uprights, preferably in such a manner as to enable the various stringers (the horizontal front elements) to be exchangeable with one



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another, and also the cross members (the horizontal, transverse or depth elements) to be interchangeable, as well as to permit exchangeability of a stringer with a cross member, and conversely.

It should be apparent that the basic principle of the invention as defined above may lend itself to many changes in the embodiment thereof, in relation to both the structural configuration of the single components of the metallic shelving and the type of the employed materials, as well as with regard to the manufacture processes carried out to obtain formation and shaping of the various components, of the concerned parts thereof, and of the windows cut in the uprights (vertical elements), all of the above changes being able to be made without departing from the scope of the invention, provided that the said technical principle is utilized, and this irrespectively of the fact that the shelving is employed for supporting loads which are small, mean, or high and very high in weight. According to a first embodiment of the invention, which is particularly suitable when used to support low loads, each upright element is provided with at least a series of aligned front windows and at least a series of aligned side windows, each window of the first series being advantageously of a quadrilateral configuration and provided with notches at its ends, whereas each horizontal



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element has an appropriate cross-section of its body, from the opposite ends of which there is obtained by bending, punching or the like operation, at least a hook formation, the plane of which hook is perpendicular to the main plane of the associated element, each of said hooks being provided with a lower slot which is designed to be located in a respective portion of the corresponding window in the upright element, when the metallic structure is being assembled, and this in order to achieve the most favourable mode of interlocking between a hook and a window; the structure being able to be completed, if desired, by means of rivets, nails, fastening pins or the like fasteners which can be fitted into corresponding holes formed in both the ends of each horizontal element and the associated flanges of the upright element, to thus increase safe locking in position of the various components and, therefore, ensure increased stability of the structure.

According to another form of the invention, each horizontal element is constituted by coupling and mechanically fastening together, at least a central body or bar-shaped member and at least a hook provided at each of the opposite ends of said bar; there being preferably provided for each end of the bar one pair of oppositely disposed hooks which are fastened, in a facing relationship to one another, to the

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each comprised of a plate or the like having at least one wing or flange which is bent over with respect to its own main plane, said plate being provided with holes or the like for the mechanical connection to said end of the central bar; each flange of the hook being first inserted in a direction perpendicular to the associated part -provided with a corresponding hole- of the upright element, to be then rotated in such a manner as to cause it to be parallel to, and tightly fitted against said part of the upright, while the main plane of the hook, which was previously parallel, has become now perpendicular to same part of the upright, so that between each oppositely facing pair of flanged hooks, so clamped to the upright, there can be inserted the associated end of said central bar of the corresponding horizontal element, which end is then mechanically locked by, for example, threaded means or the like, against said flanged hooks, that are thus securely held in place in the respective upright window, the concerned horizontal element constituting thereby a single one-unit which is effective for connecting, stiffening and supporting the metallic structure, to the formation of which structure said horizontal element cooperates together with the other horizontal elements, which are equal or different with respect to one another and the vertical elements.

According to a further feature of the invention, in a metal-

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lic structure particularly suitable for ensuring high carrying capacities, each hook consists of a length of an angle iron or the like, comprised of at least a web and a flange of preferably flat constitution, which can fit to any type of vertical structural section or upright member capable to achieve a tight engagement with said hook, and which are provided with openings giving passage to means designed for ensuring interlocking of said hook and said upright member, as well as with lugs or the like which are bent outwardly with respect to the upright, and which are designed for cooperation with means permitting the associated end of the central bar of the horizontal element to be mechanically fastened in position, so as to have same element constructed in its integrity.

According to still another feature of the invention, the flanged hooks which are able to be fastened to the upright member, can cooperate each with metallic diagonal sections serving as means for bracing and strengthening, in a transverse direction, said structure, said hooks being capable to cooperate with the corresponding profile sections by the aid of mechanical locking means, such as threaded means, said profiled elements being only constituted by cross members.

According to a further feature of the invention, the flanged hooks which are able to be fastened to the upright



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member, are each provided with a number of openings in the web portion thereof, some of said openings being to cooperate with means effective for locking in position the associated ends of profiled bracing elements, and some other with means for locking in place the associated ends of the structural side elements, namely the cross elements.

The above and other features of this invention will be ready apparent from the following description when taken in connection with the annexed drawings which show, as a non restrictive example only, some embodiments of the invention, and in which:

- Figure 1 is a partial rear view, in vertical elevation, of a metallic structure according to the invention, and showing a first embodiment of both the horizontal elements and the upright member, as well as of the associated hooks, this embodiment being particularly useful when normal

loads are to be supported;

- Figure 2 is a horizontal cross-section view of the structure in fig. 1;

- Figure 3 is a partial side view, in vertical elevation, of the structure according to figures 1 and 2, as seen in the direction of arrow X in figure 2;

- Figure 4 is a perspective view showing part of a metallic upright member the same as depicted in the above figures;

- Figure 5 is a partial, perspective view of the upright



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member in fig. 4, also showing associated parts of two horizontal elements of the structure, these latter elements, which are still in a disconnected condition, being equal to one another, the lower element being disposed in the coupling-permitting direction, in preparation of becoming a stringer member, and the upper element being disposed in the coupling direction, in preparation of becoming a cross-member;

- Figure 6 is a partial perspective view showing the coupling of a particular type of universal hook with a plain wall upright element, this hook and the associated central bar members (not shown) being especially suitable for supporting high loads together with the related structure;

- Figure 7 is a partial view of the structure, showing a stringer formed by mechanically coupling two hooks, the same as those shown in figure 6, with the central bar member;

- Figures 8 and 9 are views of the concerned hook, taken in the directions of the arrows Y and Z respectively, in figure 6;

- Figure 10 is a diagrammatic sectional view of an other type of mechanical locking system to hold the associated end of the central bar-shaped portion of a stringer locked against the lugs extending from the hook viewed in fig. 6;

- Figures 11 to 16 are diagrammatic views taken in the direction of arrow Z in fig. 6 and showing the coupling



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of a central bar member having different cross-sections with respect to the associated hook locked against the respective upright member;

- Figure 17 is a perspective rear view, in vertical elevation, of part of an upright member, with plate-shaped, flanged hooks of which two non-restrictive embodiments are shown;

- Fig. 18 is a horizontal cross-sectional view through fig. 17, only showing the fastening of the oppositely disposed hooks to the upright element, and the mechanical locking in position of the hooks at the associated end of the central bar-like portion of an horizontal element (a cross-member in this case);

- Figure 19 is a cross-sectional view like that in fig. 18, wherein the hooks are each provided with a double flange;

- Figures 20 to 23 are different embodiments of the flanged hooks;

- Figures 24 to 26 are, respectively; a rear view in vertical elevation, a side view, and a horizontal cross-sectional view, of part of a structure, wherein the flanged hooks have their larger portion provided with a number of openings for holding in place both the associated end of a cross element and the end or ends of associated bracing iron-sections;

- Figure 27 is a perspective view of part of a metallic upright member according to a variation wherein all of the walls of the upright element are provided with associated

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rows of windows;

- Figure 28 is a perspective view of part of a metallic structure according to the invention modified as in figure 27, wherein the horizontal elements are congruently modified, in this case possibility being given of coupling the stringers at their front side and both the cross members and the bracing bars at their lateral sides; and
- Figure 29 is a perspective detail view showing diagrammatically the cooperation of a supporting shelf with the associated pair of stringers fastened by hooks to the upright members of the structure.

Referring now to the annexed drawings and firstly to figures 1 to 5 and fig. 29, there is shown in said figures a first embodiment of the main components of a metallic structure according to the invention, and, consequently, a first -though partial- embodiment of the structure itself which is in this case representative of a metallic shelving construction designed for supporting comparatively low loads.

Said components comprise the vertical or upright element A, the horizontal elements, that is the stringer B and cross-member C, the front side of the structure being as seen in the direction of the arrow V. The upright member A has in this case a hollow, T-shaped cross-section and it comprises, therefore, a front wall 10, two opposite parallel

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side walls 12, 14, two coplanar rear walls 16, 18 parallel to wall 10, two rear walls 20, 22 parallel to one another and perpendicular to wall 10, as well as two rear rims 24, 26 which are coplanar and parallel to rear wall 10. Said upright member A may be of any appropriate size, and may show changes in its proportions.

The front wall 10 of the upright element A is provided at its mid-portion with a row of aligned windows 28 which are of relatively wide, quadrilateral-shaped configuration, the vertical opposite sides of said windows 28 having notches 30, 32 cut out therein for permitting insertion of the associated front hook means carried by the stringers, as seen in figure 28 and explained later. In addition to the row of windows 28, the upright A is in this case provided with two parallel and opposite rows of windows 34, 36 which develop all along the length of the upright element and which are formed at the corners 38, 40 of same upright element.

Moreover, the walls 20, 22 and the walls 16, 18 have associated rows of aligned, conveniently spaced apart holes 42, 44 and 46, 48 formed therein, respectively. The windows 34-36 are designed for receiving the hook members carried by the horizontal elements, while the holes are designed to receive rivets, safety pins, or the like means which are effective for increasing safe interlocking of the various

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components whereby increased stability of the structure is also ensured.

According to an important feature of the present invention, each horizontal element B-C (the horizontal elements may be either equal to, or different from one another in both their shape and dimensions) has a central body or bar-like portion 50 the cross-section of which comprises, as is seen in figs 1, 3 and 5 for this example, a web 52 of comparatively great height, which will occupy a vertical position when the elements are clamped to the associated upright members, said web 52 being provided at its top side with a rim 54 having a bent-down edge 56, there being defined, therefore, a channel-like space 58 which extends all along the body 50, the web 52 having moreover, at its bottom side, a flange, rim or tile-shaped, upwardly directed portion 60 which terminates in a lip 62 that is parallel to bent portion 56 and thus to the web 52, the portions 54, 56 and 60, 62 being opposed to one another with respect to said web.

Each end 64 of the body 50 is so constructed as to include the hook means shown at F, in the example depicted, the upper and lower hooks F1 and F2 respectively, being integral with the bar-shaped portion 50 from which they have been obtained by bending the sheet material of element B, said hooks means extending from the web 52 in a

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direction towards the portion of this latter which is provided with rim 54 and the bent-down edge 56. The hooks F1 and F2 are coplanar and perpendicular to said web, and they are shaped in such a manner as to define, at the bottom of their bending edge, lower slots 70 which are designed to cooperate with the associated lower portions of windows 34, 36 when the elements B-C are being clamped to the upright element A. In this example, each end 64 of the web 52 has through holes 72 formed therein, which holes are designed to be brought in register with corresponding holes formed in the upright element when the horizontal members are clamped to this latter, so that, once the horizontal elements have been assembled and then attached to the upright members, it becomes possible to insert in the holes provided in said horizontal elements and thus in the holes cut in the upright element, drop-safe pins 80, the heads 82 of said pins being made to firmly rest against the corresponding portion of the horizontal elements, whereby safe locking in position of the structure is increased, as already said herein above.

As it should be ready apparent, the metallic shelving construction G, of which a partial, perspective view is diagrammatically shown in figure 29, is assembled, in a known manner, by causing the stringer members B and the cross members C to engage with the upright members A, while

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the flat members M are made to rest on the stringers B (and possibly on the cross members C, when the stringers and the cross members are coplanar); in this case, the stringers B supporting the load carrying, flat members by means of the tile-shaped portions 60, 62.

In order to get the stringer members B engaged with the upright members A, it merely requires to cause the pair of hooks F1 and F2 carried at each end of element B, to enter the corresponding pair of windows 34, 36, and then to fit, if necessary, the drop-safe pins 80 into the corresponding holes in both the stringer- and the upright members. Due to the particular configuration of the components shown, the hollow or empty space (existing between the hook F1 and the region where the rim 54, 56 commences) in each stringer element, will permit the walls 12, 16 and 14, 18 of each upright member to enter the above said cavities thus allowing the stringer members to become aligned to one another and as contained in a single, common front plane.

A similar procedure will be followed when the cross-members C are to be engaged with the upright members A, namely, the hooks F1, F2, which are the same as those discussed above, are caused to enter the corresponding windows 34, 36 in the upright members, which windows are offset with respect to the windows receiving the hooks

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carried by the stringer members, the remainder of the assembling operation being equal to what described herein above, as a result of which, at the end of said operation, there is obtained a rugged metallic structure wherein the stiffness is ensured by the coupling of the stringers and the cross members, with the upright members and the drop hooks, the stringers and the cross members being perpendicular to one another. As it can be seen and already explained, there exists no welding zone to connect the hooks to the central bar-shaped portion of the horizontal elements, in as much as, in the example shown, each of said horizontal element has been obtained as a single body unit, appropriately cut, shaped, bent and punched out, so as to obtain the respective stringer and the respective cross-member having the desired configuration which includes the central bar and the end hook means. Since the horizontal elements are equal to one another, they can be interchanged without any difficulty, and should the length of the stringers be the same as that of the cross members, then interchangeability could involve also the change from the stringers to the cross members and conversely.

By referring now to figures 27 and 28 (figure 28 showing the elements in a disconnected condition and the hooks means as being different from one another to give an illustrative example only), it will be seen that the metallic upright

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member A1 is of quadrilateral-shaped, hollow cross-section, whereby there exists the front wall 10, the side walls 12, 14 and the rear walls 24, 26, these latter walls being coplanar and separated from one another by the intervening longitudinal window 90 which extends all along the development in height of the upright member. All of the walls of upright element A1 are, in this case, provided with associated series or rows of windows designed for permitting connection with corresponding hooks carried by the horizontal elements. More precisely, the wall 10 has a row of front windows 28 which are of quadrilateral shape and include the notches 30, 32; the side wall 12 has a row of windows 29 equal to windows 28; the wall 14 a row of windows 31 which also are equal to windows 28; and the walls 24, 26 have rows of windows 33 and 35 respectively, which are elongated and narrow in shape.

In this case, the stringers B1 consist each of a central bar-shaped member 51 and are of L-shaped cross-section. The opposite ends 64 of each stringer B1 are provided each with a pair of hook means F3, F4, each of these hooks F3, F4 having a portion 96 coplanar to the web 52 and a portion 98 which extends away from the web 52 in a rearwardly direction, that is, towards the flanges 100 of the central bar of the horizontal element. The portions 98 of the hooks F3, F4 are rearwardly displaced

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in position to the same extent, so that the associated lugs are coplanar and parallel to the web 52, the amount by which the front surface of each lug is rearwardly displaced in position with respect to the rear surface of the web 52 being substantially equal to the thickness of the wall 10 of upright member A1, which thickness is substantially the same for all of the walls 10, 12, 14, 24 and 26. As it can be seen from fig. 28, the pair of hooks F3, F4 provided at the end of each horizontal element show a C-shaped disposition, so that, the two C being turned up side down with respect to one another, the assembling of the stringers B1 can be effected by causing the hooks F3, F4 of a stringer to fit into the two corresponding upper windows 28, and the hooks F3, F4 of the next following stringer, to fit into the two corresponding lower windows 28 (when looking as at figure 28, the first stringer is the one at the right side, and the second stringer is the one at the left side).

In this manner, there is obtained the locking in position of all the front stringers that are required, as well as of the rear stringers which are to be fitted to the rear upright members of the shelving structure.

With regard to the cross-members, in the case shown in figure 28, use may be made of the flanged hooks M1 and M2, which are equal to one another, while the hooks M3

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and M4, that are also equal to one another, have been shown as a variation of the former ones.

Each hook M1, M2, M3, M4 consists of a metallic, quadrangular-shaped, main plate or flange 110 from an homogeneous end edge 112 of which the flanging 14 extends.

In the case of hooks M1, M2 the flanged portion is, for each concerned hook, formed of a pair of bent-out edges, whereas, in the case of hooks M3, M4 there is a single bent-out portion only.

Each plate 110 is provided, in the case of the hooks M1, M2, with holes 120, 122, 124, and, in the case of hooks M3, M4, with holes 124 only.

During assembling operations, each cross member is obtained, as better shown in figures 18, 25 and 26, by fastening, to the ends of the central bar-like portion, the hooks M1, M2 or the hooks M3, M4, said fastening operation being carried out by the aid of threaded means such as bolts or the like which are effective for mechanically locking the hooks against the associated ends, which is effected by utilizing the holes 124 in the hooks and the corresponding holes in said ends. The fastening of the hooks to the ends concerned takes place after the hooks M1, M2 or M3, M4 have been fitted into the associated windows 33, 35, this being made by first inserting the flanges 114 in the openings (the plate 110 being then parallel to



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the walls 24, 26), and thereafter by causing the hooks to rotate inwardly until the flanges 114 are brought in tightly contact with the walls 24, 26 whereby the plates 110 are now occupying a position perpendicular to that of said walls, so that the plates 110 of each pair are parallel to one another to allow the associated end of the central bar-shaped member to be fastened in place by inserting same end between the plates and then bolting it down. The holes 120, 122 of the plates M1, M2 are for the locking in position of the associated ends of the diagonal members 130, 132 (fig. 25) which are designed for bracing the sides of the shelving structure. Figures 18 and 25 are clearly explanatory in this respect. As seen in fig. 18, in fact, once the above assembling is made, the horizontal element B -in this case a cross member- has its bar-shaped portion 50 perpendicularly disposed with respect to walls 16, 18 of the upright member A, with the ends thereof mechanically fastened to the hooks M1, M2, the flanges 114 of which hooks have been inserted in the corresponding openings in the walls 16, 18, the plates 110, as well as the central bar 50, being perpendicular to said walls 16, 18. In this case, the mechanical fastening of the hooks M1, M2 to said central bar 50, for the constitution of the structural element B, occurs under the action of the bolt 180, which passes, by its shank 182, through



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the holes in the flanges and the bar 50, to extend, by its ends, beyond the corresponding flange, thus allowing the nut 184 to be screwed and tightened down, and, consequently, the associated components to be locked in position.

Referring now to figures 6 to 16, there is shown in same figures an other form of the patented metallic structure which especially fit to applications where heavy loads are involved.

In this example, but also in a more general way, the upright member A4 is of quadrangular cross-section and includes the plain walls 10, 12, 14, 26, 24 and the rear opening 90 which separates the edges of the walls 24, 26 from one another, as already mentioned in connection with a previously discussed type of upright member. This plain wall upright member lends itself to be used with congruent types of hook means which are able to rest against the outside surface of said walls, provided they can dimensionally couple with same walls, and this irrespectively of the size of the loads to be supported by the structure.

In the examples shown in figures 6, 7, 8 and 9 each hook member P is a length of an appropriately dimensioned angle-iron having a web 186 and a flange 188 which are perpendicular to one another. The web 186 is provided with several lugs 190, in this case the three lugs shown having been obtained by punching and bending operations from the

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material of same web, the lugs being aligned along the vertical center-line of the web 186, with the intermediate-ly disposed lug being offset with respect to the two other ones by an amount which corresponds to the thickness of the central bar member 50 that is to be connected to the lugs, these latter being perpendicular to the web 186. The flange 188 is provided with through holes 192, in this case there being a pair of through holes which are shown together with their axes in the drawing. In corresponding relationship with the holes 192, the wall 10 of the upright member A4 has two rows of aligned holes 194 formed therein, that are also shown along with their axes in the figure, these holes 194 being equally spaced apart in the direction of their alignment.

In order to obtain the desired horizontal element, in this case the element B being a stringer in the structure, the central bar member 50 has a vertical web 196 of an appropriate thickness, and upper and lower flanges 198 and 200 respectively, that are perpendicular to web 196, so that in this case the cross-section of element B takes a double-T configuration, said bar member being preferably formed by punching and bending operations to impart to it the final configuration.

The ends 64 of the bar member B cooperate with the associated hook means P in such a manner as to have the

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three holes that are formed in said ends to be caused to coincide with the corresponding holes formed in the lugs 190, the web 186 being inserted between the lugs so that the upper and lower lugs remain on one side, and the middle lug on the other side of the web. Thereafter, the central bar member 50 is securely bolted down (the bolts being not shown) together with the hook means P, so that at the end of the assembling operation the stringer B is obtained. At this stage, the stringer can be mechanically fastened to the associated upright members A4 since the holes 192 are made to coincide with the holes 194 of the respective row of holes formed in the wall 10, the flanges being then locked in position on the upright members by the aid of threaded means, whereby at the end of the bolting operation there will be obtained the stringer B firmly coupled to the associated upright members A4. The same procedure is obviously repeated for all the stringers and the cross-members constructed in the manner shown.

Rather than by bolting, the connection between the hook means P and the upright member A4 could, in a more general manner, be achieved by using an interlocking arrangement such as viewed in figure 28 where the ends of the elements B1 are shown as lockingly fitted in the associated windows 28 provided in the wall 10 of the upright member A1.

With reference to figures 12 to 16, there is shown

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a cross-section of the structure which is similar to that of fig. 11 but with some structural variations of the bar member B, whereby the bar B12 is ~~shorter~~ in height than the bar member B; the bar B13 show fillet portions at the flanges 198, 200 thereof; the bar B14 has a cross-section in the form of a 'E'; the bar member B15 is of C-shaped cross-section; and the bar B16 has its cross-section which is in the form of a 'O', the above said variations congruently involving variations in the bearing arrangements with respect to the lugs 190 of the hook means.

Referring now to figure 10, an other type of mechanical connection is shown between the central bar member 50 and the associated side hook means P in order to achieve constitution of the horizontal element B10. According to this variation, connection between bar member 50 and the projections 191, corresponding to lugs 190, takes place by merely causing the associated bent-over portions of the ends of said bar member, to rest on the corresponding projections ~~formed on~~ the opposite hook means P, which latter are fastened to the upright members again by bolting means. In this case, then, the own weight of bar 50 and that of the load carried through the aid of the side member (not shown) together cooperate in ensuring connection between the bar and the hooks without the use of bolts, or the like means, being required for assembling the bar 50 to



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the hooks P. As a matter of fact the cross-section of bar 50 may vary in configuration in any suitable manner, depending also on the shape, number and arrangement of the projections 191 provided on the webs 186 of hooks P.

Resuming now briefly what already said in relation to the flanged hook means 10 of fig. 28, and referring to figg. 20 to 23, there is seen in same figures four possible, among many other, constructions of flanged hooks which are specially suited for connection with either brace-like or inclined central bar members, such as the members 130, 132 (fig. 25) in order to achieve strengthening bracing arrangements for the sides of the metallic structure, or for connecting them to central bar members in order to form cross elements, or also capable of forming composite elements comprised of both cross- and brace members.

More precisely, the hook means shown in fig. 20 as M, is provided with two opposite holes 120 for permitting mechanical fastening of the associated ends of brace members, and a middle hole 124 for allowing the associated ends of a cross member to be fastened in place; the flanged hook of fig. 21 has only one hole 124 cut therein which can be used for connecting the associated ends of either brace members or cross members, as well as the associated ends of both these members; the flanged hook of fig. 22 besides being provided with holes 120, 124 and flanges 114,



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it includes counter-flanges 115 which are perpendicularly disposed with respect to flanges 114 and bent-out in a direction extending away from the other side of the web 110 of hook M, there being here also provided a counter-flange 117 parallel to, but bent-out in the reverse direction of flanges 114; finally, the hook M in fig. 23 is provided with one hole 124 and includes the flange 114 for insertion thereof in an associated opening in a upright member, and the counter-flanges 115 parallel to one another and perpendicular to flange 114.

As seen in fig. 17, the upright member A₅ has here a quadrangular cross-section similar to that of upright member A₄ in fig. 6 but in this case no holes 194 are provided, instead of which there are aligned windows 195 cut in the walls 24, 26. At the upper side, there are shown flanged hooks M, the same as those of fig. 20, which are fitted in the corresponding openings 195 in the walls 24, 26 to arrive at the condition depicted fig. 18 wherein the hooks are connected mechanically to the middle bar member 50 by means of bolts 180, thus achieving formation of element B. At the bottom side, there are shown flanged hooks equal to the hooks fig. 21, with the flanges 114 thereof as fitted in the corresponding openings in the upright member, the above examples being only to illustrate the many possibilities -and the versatility features- offered for

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mounting the hooks and the stringers, as well as the cross-members and the brace members, with respect to the upright members.

The upright ^{A5}~~A4~~ could be the same as the upright A4 shown in figure 6, where it has been depicted the hook/upright connection for the fastening in place of the stringers.

Fig. 17 shows the flanged hooks M inserted in the corresponding openings 195 for permitting connection with the cross members and the diagonal bracing members. This figure 17 does not shows the front wall of the upright A5, which wall could be the same as that of the upright A4 in fig. 6 where, as already said, the openings in said wall have been depicted along with their axes, since the type of punching or cutting-out chosen may be any type whatever.

In fig. 19, there is shown an horizontal cross-sectional view as taken through a pair of opposite hooks M equal to the hook of fig. 22, wherein the flanges 117 of the two flanged, opposite hooks are effective for strengthening the locking effect -once the middle bar member 50 has been mounted- against stresses exerted in horizontal direction onto the hooks or the associated elements of the structure, or exerted on the load supported by the flat or shelf members H in the direction of arrow R or the reverse direction.

With reference, finally, to figures 24 to 26, there is shown an upright A similar to that of figs. 1 to 3, ORIGINAL

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which , in this case, instead of cooperating directly with the horizontal elements B-C (formed again in a one-piece unit as in figg. 1 to 3) it makes so with associated flanged hooks M, the same as those previously discussed, which are fastened to the middle bar members 50 of both the horizontal elements B-C and the diagonal elements 130, 132.

In fig. 26, the cross-member C is shown as being bolted by the means 180 to the hooks M that are provided with the holes 124 for permitting passage therethrough of the bolts, these latter also passing through the associated holes in the ends 64 of the cross-member C. Bolting is effected after the hooks M have been inserted by their flanges 114 in the openings 34 which are cut in aligned arrangement in the corners 38, 40 of upright element A. As previously explained, each flange 114 is fitted into the associated opening in the direction of arrow S and is then rotated to bring it from a position perpendicular to wall 10, to a position that is parallel to same wall, whereby the web 110 of the hook member is brought in a position perpendicular to said wall 10.

From the above description it should be ready apparent that the construction of the patented metallic structure, and the individual components thereof, is such as to obtain carrying structures having supporting capabilities in the low,

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mean, and high load ranges, and to achieve interchanging versatility of the various components of the structure, as well as to impart enhanced strength and stiffness properties thereto thus ensuring stability of the structure when mounted to form any one of its many possible versions. The feature according to which in a shelving arrangement having flat or shelf-members separated from both the stringers and the cross-members, no welded zones or points have been provided for the constitution of the horizontal elements, which can be either single one-piece units or composite units as illustrated, is of basic interest from the point of view of simplifying manufacture of the elements and their assembling together, even when construction of at least some of the horizontal elements should involve mechanical connection between a central web and the associated side looks.

The possibility of interchanging the various components of the shelving structure, consistent with the dimensioning of the parts concerned and their interconnectable construction, makes these shelving arrangements fit for a very large and diversified range of application requirements.

Obviously, many modifications and variation are possible, as regards the details of construction, without departing from the spirit and scope of the present invention.

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WHAT WE CLAIM IS :-

1. A metallic carrying structure, particularly useful as shelving structure for use in shops, offices, stores and the like, of the type comprised of elements which can be combined and fastened together, characterized in that, said structure being of the kind which includes load supporting, flat or shelf-members that are independent of, and can be made to rest on the horizontal elements of the structure, said elements, namely the stringer- and the cross-elements, are achieved and constructed so as to be provided at their ends with appropriate hook means which are either obtained directly from the body of same elements, or separate from said body to which they are fastened by the aid of any appropriate mechanical joining means, said hooks being caused, during step when the structure is assembled and erected, to lockingly fit, by congruently shaped portions thereof, into associated windows cut in the vertical or upright elements, in such a manner as to enable each horizontal element to have its own body or central bar member shaped according to any suitable configuration, independently of its ends or hooks, which are either obtained directly from each element or mechanically fastened thereto, said hook means being also so shaped as to allow them to interlockingly cooperate with the correspondings windows in the upright elements, and preferably

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in such a manner as to ensure interchangeability between the different stringer members (horizontal front elements), and between the various cross-members (horizontal, transverse or depth elements), as well as between a stringer and a cross-member, and conversely.

2. The structure according to claim 1, especially suitable for supporting loads in the comparatively low range of values, wherein each upright element is provided with at least a series of aligned front windows and at least a series of aligned side windows, each window of the first series being advantageously in the form of a quadrangle having end notches; whereas each horizontal element has a conveniently shaped cross-section of its own body, from the opposite ends of which there is obtained directly, by bending, punching or the like operation, at least a hook-formation the plane of which is perpendicular to the main plane of the associated element, each of the concerned hooks being provided with a lower groove or notch which is designed for fitting into an associated portion of the corresponding window in a upright element when the metallic structure is being assembled, and this to the purpose of obtaining the most favourable form of interlocking engagement between the hook and the window; the structure being able to be completed with additional means such as drop-safe pins or the like, which can be fitted

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into associated, corresponding holes formed in both the ends of each horizontal element and the associated flanges of the upright element, whereby increased safety of connection and, therefore, enhanced stability of the structure are obtained.

3. The structure according to claim 1, wherein each horizontal element is constructed by coupling and mechanically fastening together at least a central body or bar-member and at least a hook means provided at each one of the opposite ends of said bar member; preferably there being provided for each end of the bar member, a pair of opposed hooks which are fastened, in facing relationship, to the corresponding end of the bar member; each of said hooks being comprised of a plate or the like which has at least one flange, bent-over with respect to its main plane, and is provided with holes or the like for permitting mechanical connection with said end of the central bar member; each flange of the hook being first fitted in a direction perpendicular to the corresponding portion of the upright element provided with the associated hole, and the flange being then rotated so as to bring it in a position parallel to, and making tight contact with said portion of the upright element, while the main plane of the hook, which was previously parallel, becomes then perpendicular to said portion of the upright element, so that

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between each facing, opposed pair of flanged hooks, fitted to the upright element, there can be engaged the associated end of said central bar member of the associated horizontal element, which end is thereafter mechanically clamped, by, for example, threaded means or the like, to said flanged hooks that are then perfectly locked in the associated windows in the upright element, the concerned horizontal element being thus allowed to form a single one-piece unit effective for connecting, stiffening and supporting the metallic structure in the formation of which said horizontal element jointly cooperates with both the other horizontal elements, equal to, or different from one another, and the vertical elements.

4. The structure according to claim 1, wherein, said structure being particularly adapted for services in the high carrying capacity range, each hook is a length of an angle-iron or the like comprising at least one web and one flange provided with appropriate holes or tabs, which can fit to any type of structural profiled vertical or upright member able to be connected by interlocking arrangement or tight contact to said hook, and which are formed with either openings or tabs effective for permitting connection to an upright element, or with lugs or the like turned-over on the outside of the upright element and designed for cooperation with means which are able to permit mechanical fastening



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in position of the associated end of the central bar member of corresponding horizontal element in order to construct same element in its integrity.

5. The structure according to claim 1, wherein the flanged hooks which are able to be fastened to the upright element, can cooperate each with metallic, diagonal structural members designed for ensuring the bracing and stiffening, in a transverse direction, of the structure, said hooks being capable of cooperating with the associated structural members by the aid of mechanical locking means, such as threaded means, said structural members being only comprised of cross-members.

6. The structure according to claim 1, wherein the flanged hooks capable of being fastened to an upright element, are each provided, in their own web, with a number of openings, some of which are for the cooperation with the means ensuring locking in place of the associated ends of the structural bracing elements, and some other are for the cooperation with the means ensuring locking in position of the associated ends of the structural side elements, namely the cross-members.

7. A metallic structure, particularly a shelving structure comprised of combined elements, suitable for use in stores, offices and others, wherein said structure is substantially as described herein above with reference to, and as depicted

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in the annexed drawings.

- 1
8. A method of assembling and erecting a metallic, combined-element structure according to at least one of the preceding claims, wherein said method being based on the principle of connecting vertical, horizontal and diagonal elements, as well as load supporting flat members, together, the horizontal and/or diagonal elements, preferably comprised of metallic structural shapes which are interchangeable with respect to one another consistent with the different configurations and sizes of said elements, are provided either with joining hook means that are obtained directly from, and as an integral part of the central bar-members of said elements, or with hook means which are in the beginning separate from said central bar members, with which said hook means are then mechanically connected in order to achieve constitution of the associated elements.
9. The method according to claim 8, wherein said hook means are connected to the associated central bar members by bolting or the like operation.
10. The method according to claim 8, wherein said connection of the hook means with the central bar-members is achieved by merely causing said central bar members, that are congruently shaped to this purpose, to rest on corresponding regions or parts integral with, and directly obtained from said hook means.

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11. A metallic element which forms a component of a metallic structure according to at least one of claims 1 to 7, wherein said element, being comprised of a metallic structural shape capable of assuming the nature of an upright, a stringer, a cross-member, or a brace or diagonal member in said structure, is obtained (along with the associated means, such as hooks, holes, openings or others, allowing it to be connected to the other elements of the structure) as a single one-piece unit embodying said means, or in such a manner as to have that the hooks for fastening the element to the other parts of the structure, are mechanically locked together with the associated central bar-members of the corresponding elements, or still further in such a manner as to have the element simply resting, by its central bar-member, on the end hooks, these latter being in turn fastened to the other, congruent elements of the structure.

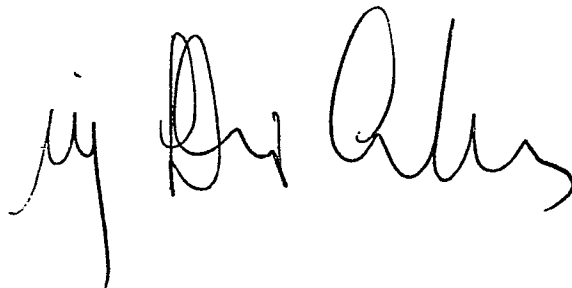


FIG. 1

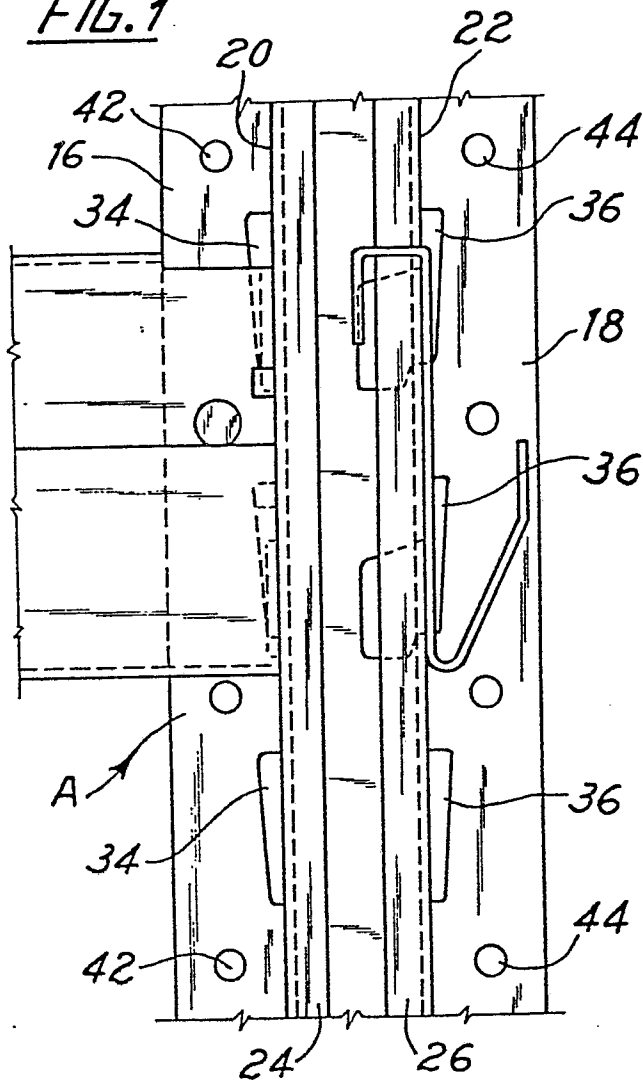


FIG. 3

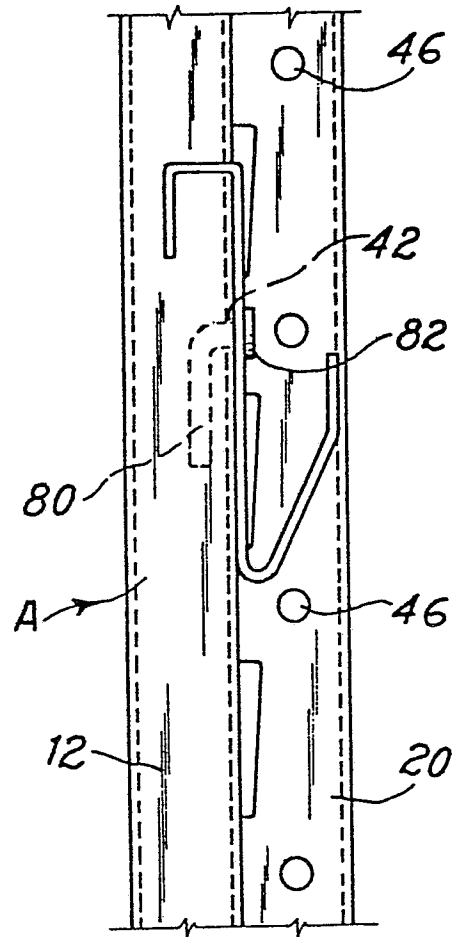


FIG. 2

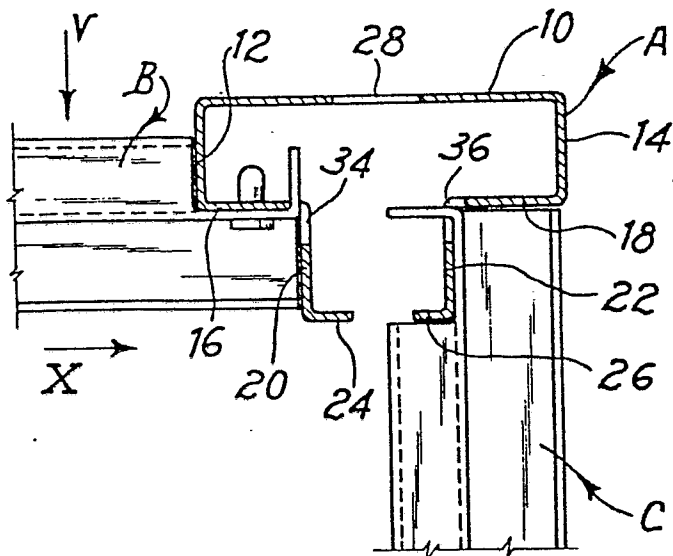
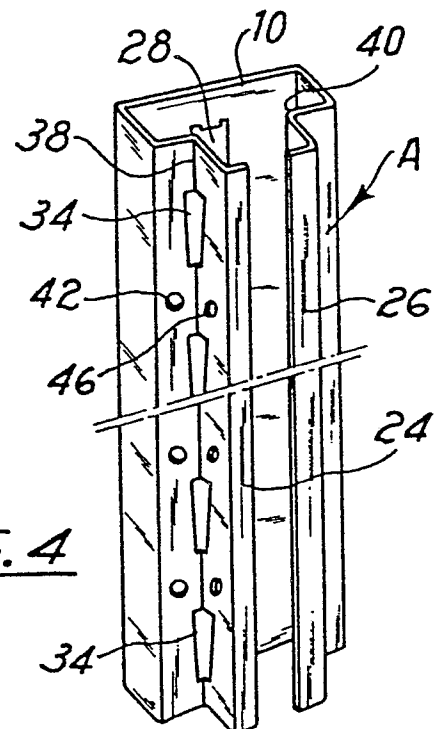
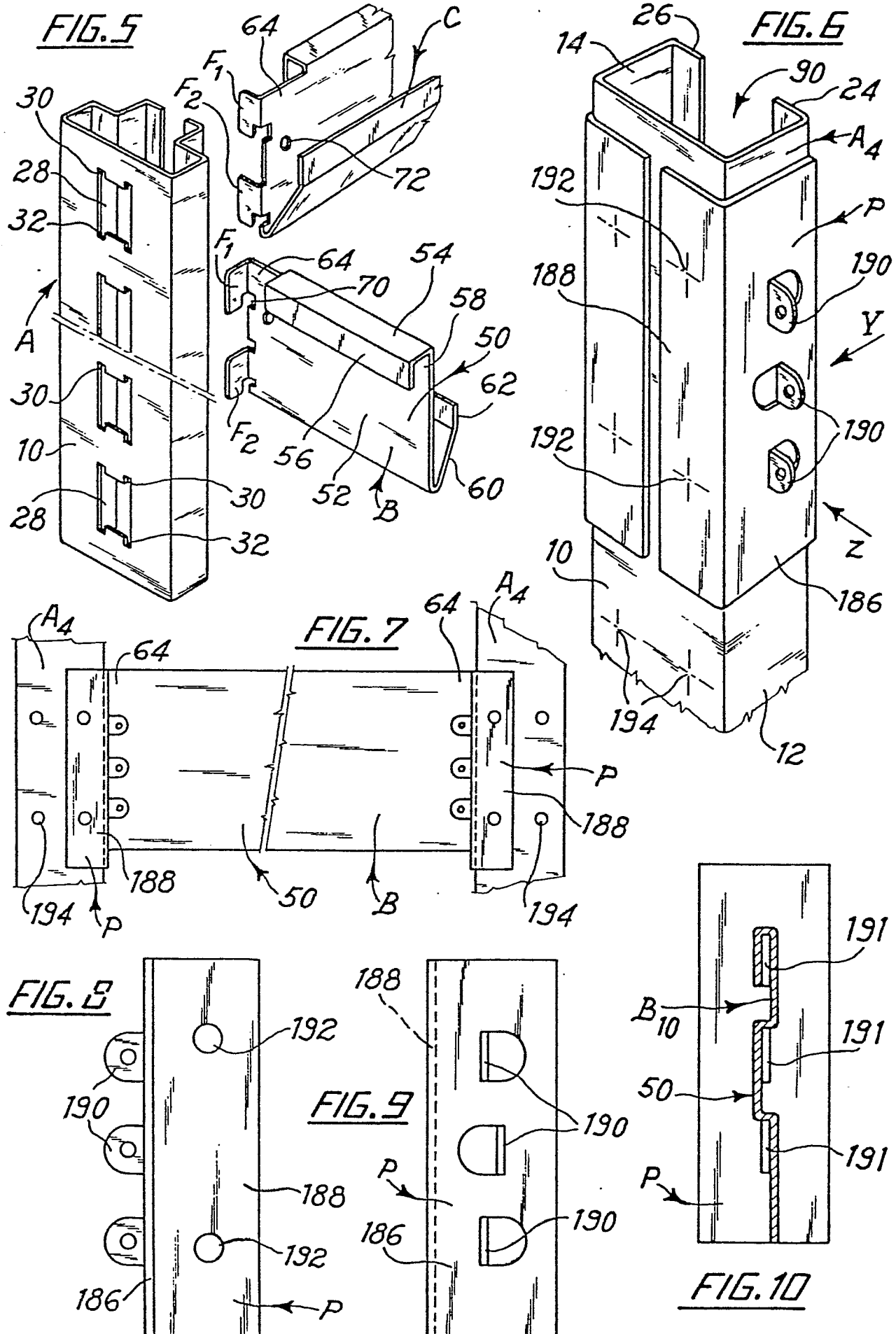


FIG. 4



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FIG. 17

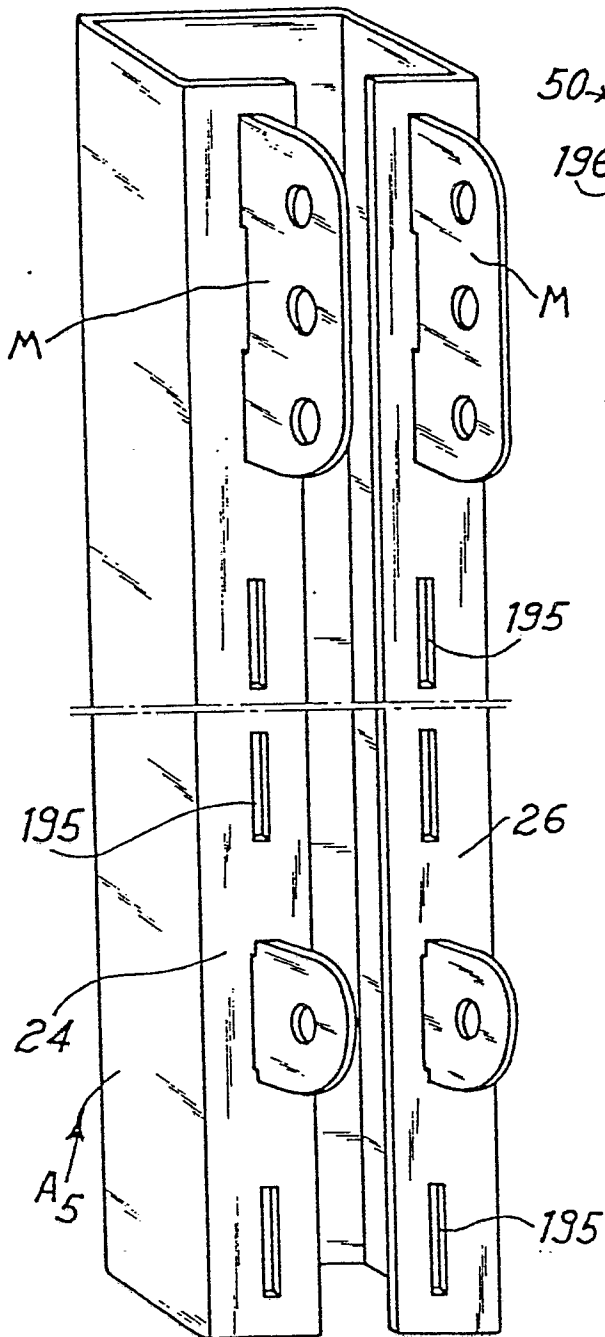


FIG. 11

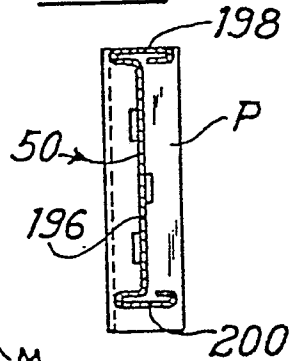


FIG. 12

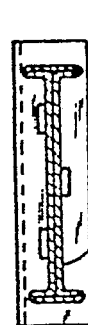


FIG. 13

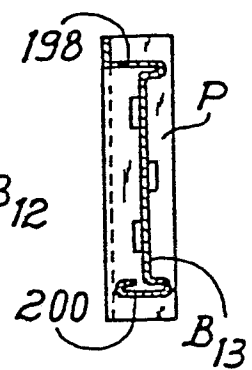


FIG. 14

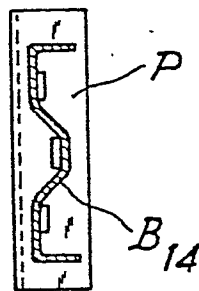


FIG. 15

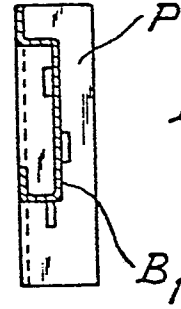


FIG. 16



FIG. 18

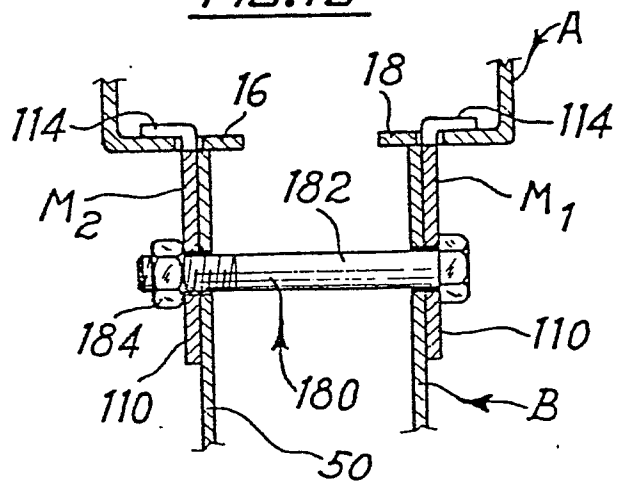


FIG. 20

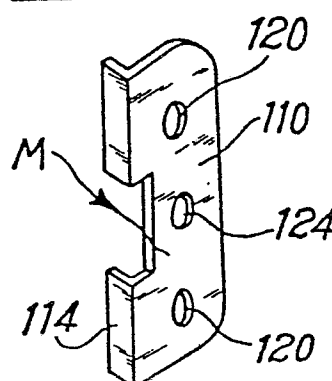


FIG. 21

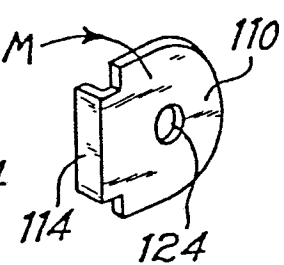


FIG. 24

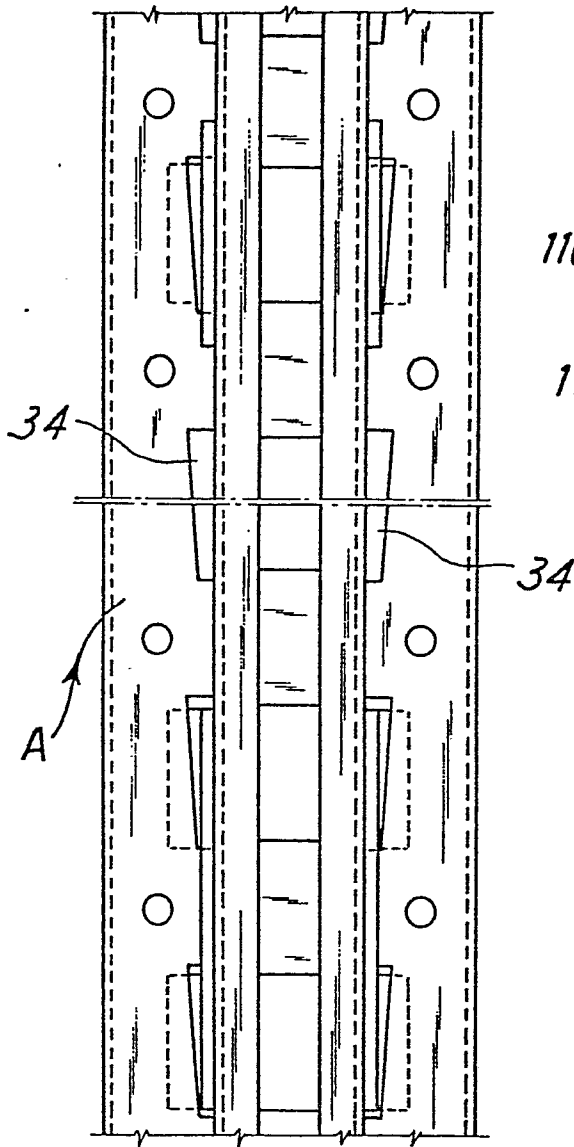


FIG. 22

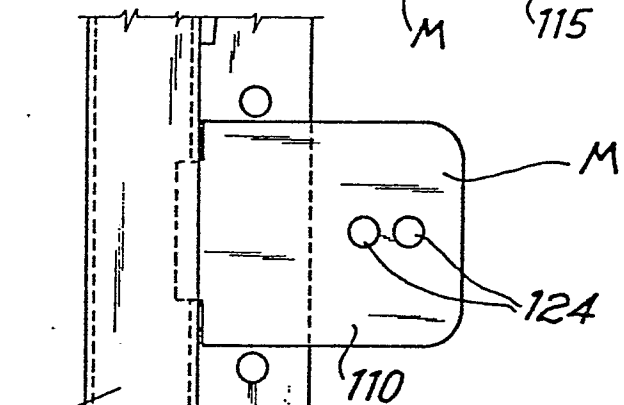
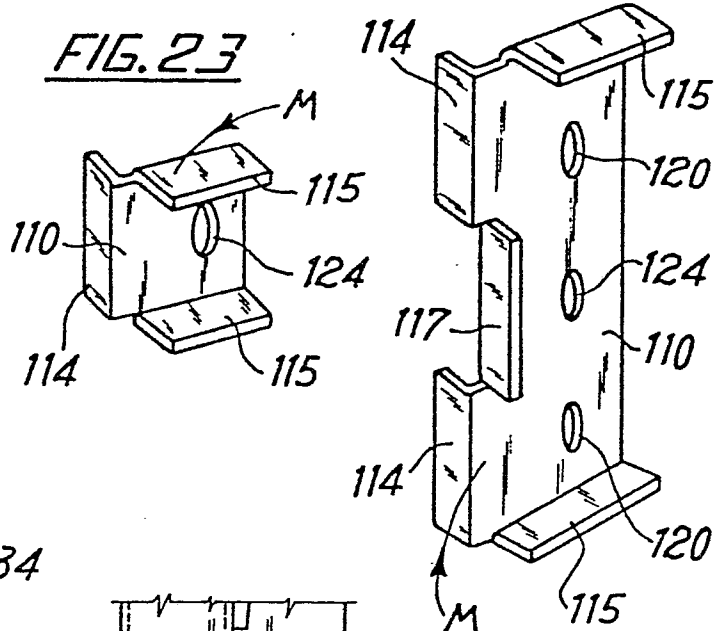
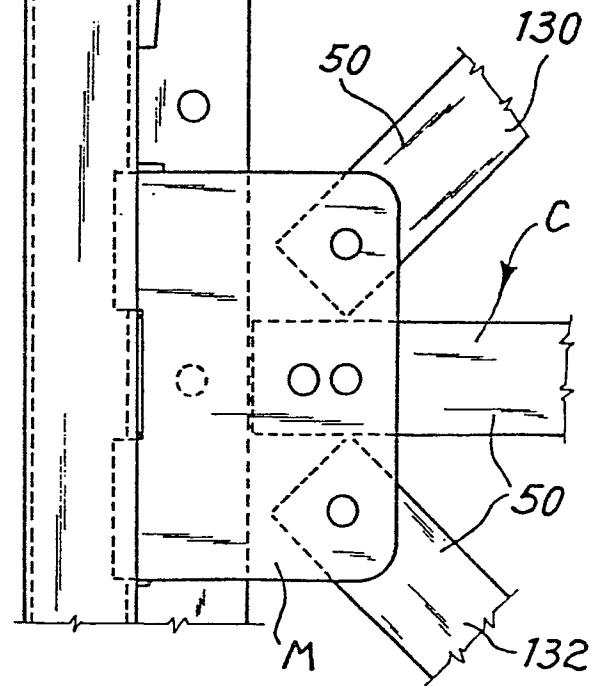
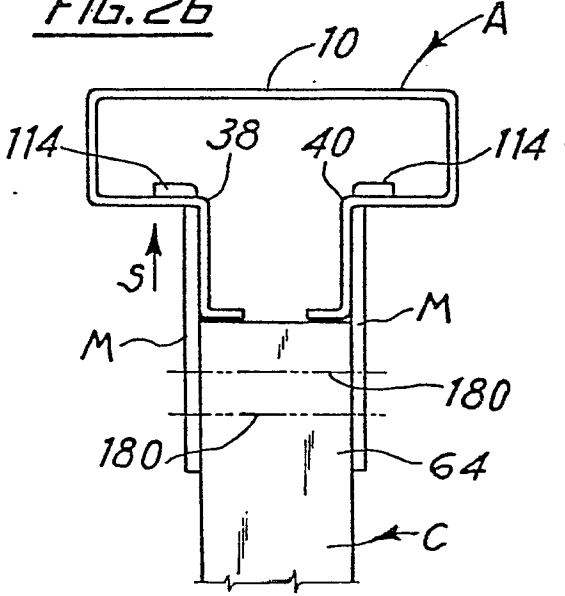


FIG. 25

FIG. 26



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FIG. 27

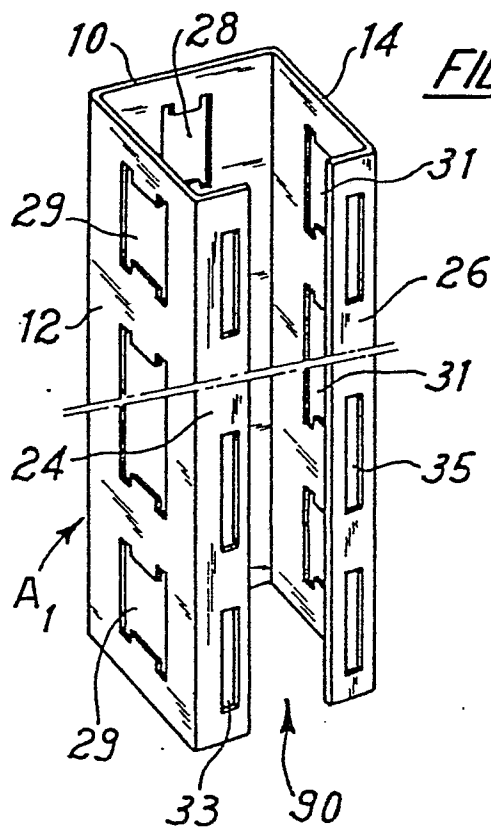


FIG. 28

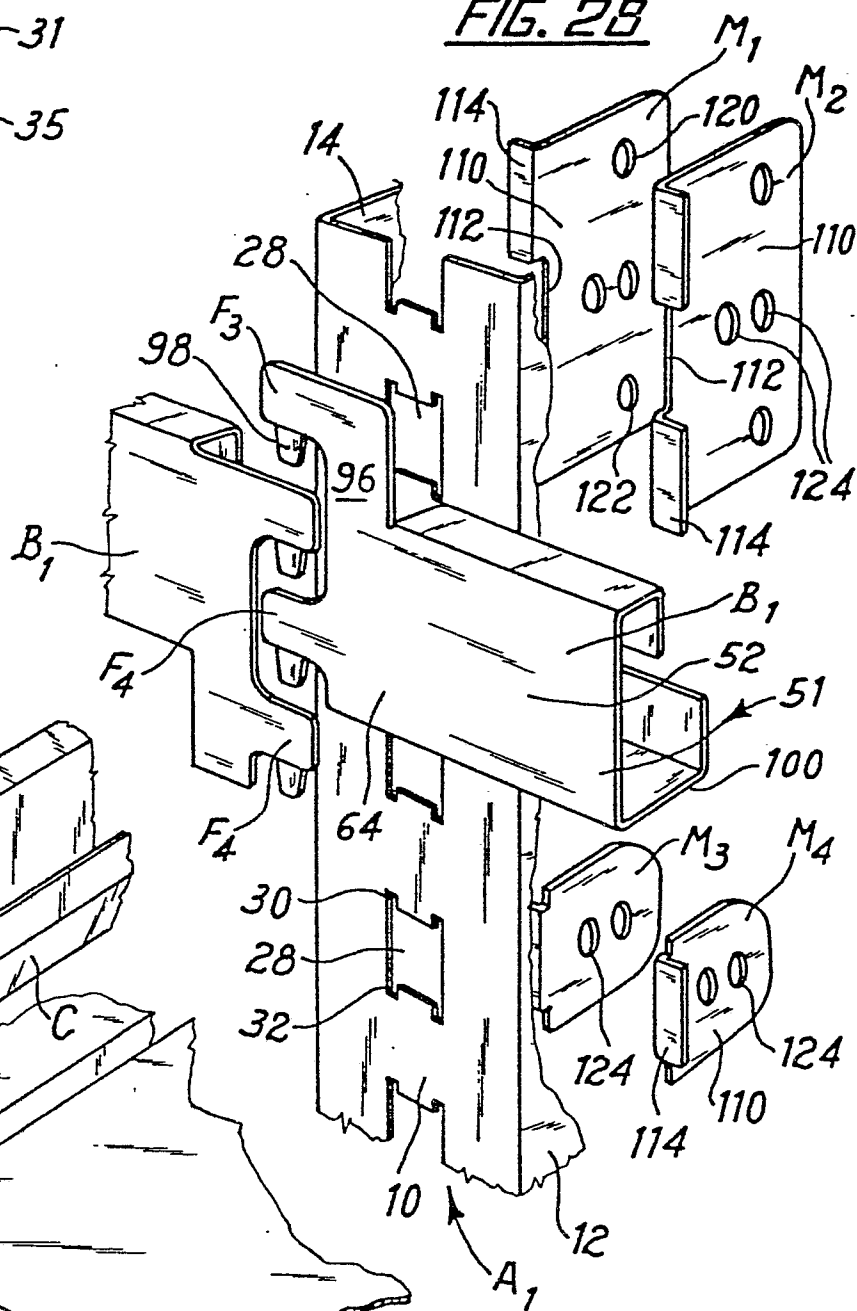


FIG. 29

