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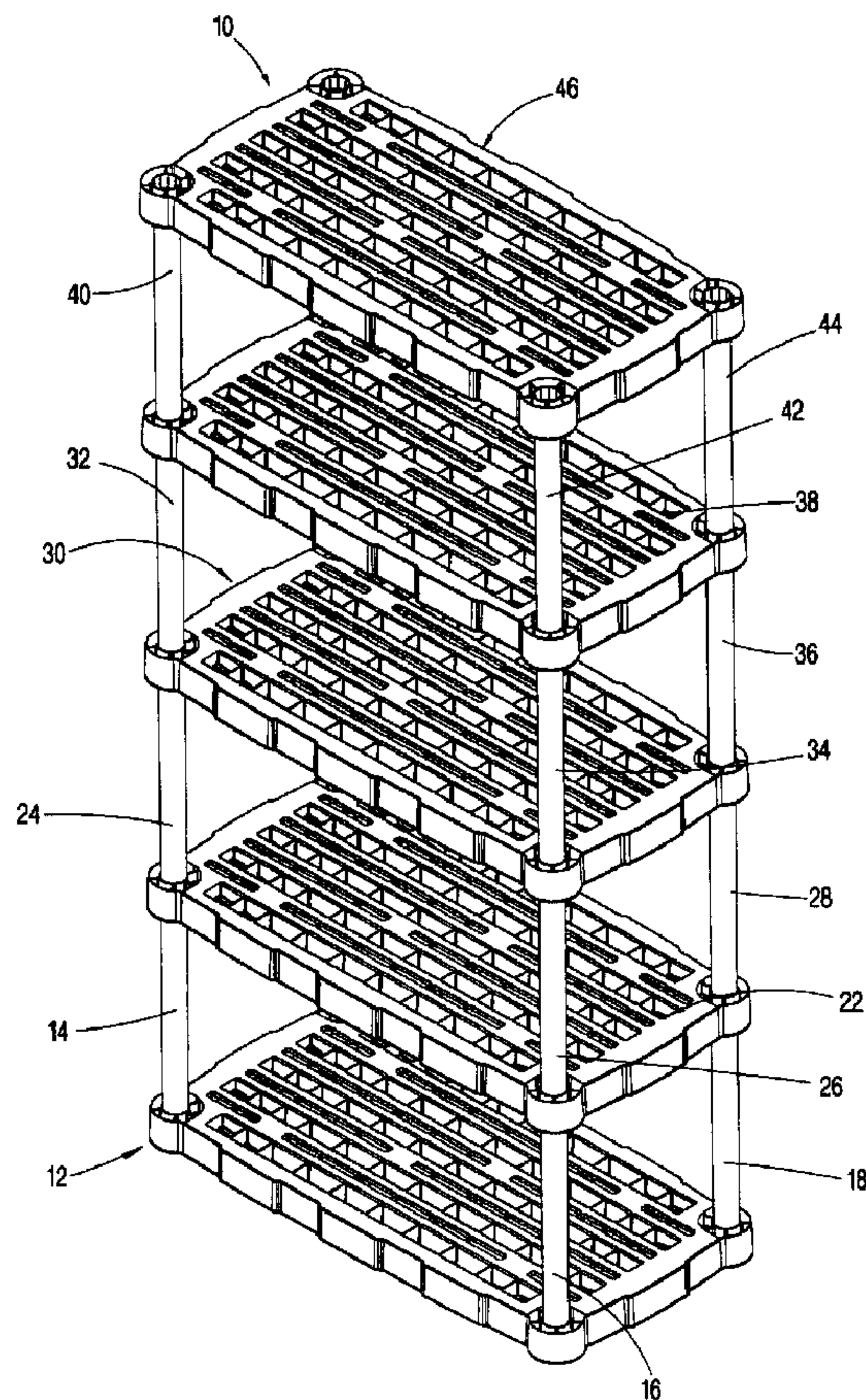
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(54) Title: SHELVING SYSTEM



(57) Abrégé/Abstract:

A shelving system is provided for use in the storage of various articles. Specifically, the shelving system includes a panel having a plurality of rail members formed with the panel. The rail members have an curvilinear lower portion. Preferably, the curvilinear lower

(57) **Abrégé(suite)/Abstract(continued):**

portion distributes greater material proximate regions in the panel which experience greater stress. Similarly, the rail members of this invention also have an upper portion having a depth extending away from said panel. Preferably, the amount of depth of the upper portion of each rail member is designed to distribute greater material proximate regions in the panel which experience greater strain once loaded. Lastly, the molded shelving of this invention includes a plurality of socket members including support members designed to transmit stress away from the sockets, thereby reducing stress concentrations adjacent the socket members.

Abstract of the Disclosure

A shelving system is provided for use in the storage of various articles.

Specifically, the shelving system includes a panel having a plurality of rail members formed with the panel. The rail members have an curvilinear lower portion. Preferably, the curvilinear lower portion distributes greater material proximate regions in the panel which experience greater stress. Similarly, the rail members of this invention also have an upper portion having a depth extending away from said panel. Preferably, the amount of depth of the upper portion of each rail member is designed to distribute greater material proximate regions in the panel which experience greater strain once loaded.

10 Lastly, the molded shelving of this invention includes a plurality of socket members including support members designed to transmit stress away from the sockets, thereby reducing stress concentrations adjacent the socket members.

SHELVING SYSTEM

Generally, this invention relates to shelving. More particularly, this invention relates to a shelving system which minimizes material usage while also maximizing structural integrity.

5 Background of the Invention

It is well known in the art to provide shelving. Commonly, such shelving systems include a plurality of rectangular panels having four sockets integrally formed in the corners of the panels. Each successive panel is connected to an adjacent panel by four posts receivable within the sockets. Although such devices perform adequately, such
10 devices could be improved upon. Specifically, shelving of the above mentioned character often do not provide sufficient resiliency to deformation. Once the shelving is loaded, such shelving often allows for stresses to concentrate in the region surrounding each of the sockets. Secondly, once loaded not only are stresses concentrated in the regions surrounding each of the sockets, but strain often concentrates towards the geometric
15 center of each panel. Accordingly, such panels often bow once loaded. Together, the above described deficiencies reduce the maximum load that such shelving is capable of withstanding. If the maximum load is exceeded, the shelving may ultimately fail.

In order to overcome some of the above disadvantages other shelving devices have been suggested. For instance, U.S. Patent No. 5, 709,158 to Wareheim discloses
20 providing shelving having a beam structure disposed around the periphery of the panel

and a beam disposed along the median portion of the panel. Wareheim also discloses providing a plurality of diagonally oriented vertical braces.

Although the device to Wareheim advances the art, Wareheim has also been found to have several deficiencies. Specifically, the beam structure of Wareheim may increase
5 the structural rigidity of such panel members. However, the beam structure is substantially linear in shape. In contrast, the strain realized within each panel is commonly nonlinear. With a linear distribution of material, some regions may have an insufficient amount of rigidity due to an insufficient amount of material disposed within a particular region. Similarly, other regions of the panel may have adequate rigidity with
10 an optimum amount of material usage. While still other regions may prove to have an necessarily high amount of rigidity with a corresponding waste of material. In summary, a linear distribution of material is an inefficient use of material within such panels.

A second disadvantage found in the device to Wareheim is that stresses are allowed to concentrate adjacent each of the sockets. Although the diagonally disposed
15 vertical support ribs assist in reducing the stress concentration, a substantial amount of stresses are still allowed to concentrate in this region thereby limiting the load capable of being applied to such panels or requiring additional material to be added around such sockets.

Accordingly, one skilled in the art can appreciate that several advances could still
20 be made in the art. Specifically, it would be desirable to have a shelving system that reduces the strain realized within each panel. It would be desirable to have a panel which

optimizes material usage thereby providing a shelving system which is capable of bearing a maximum load while also requiring a minimum amount of material. It would further be desirable to reduce the stresses realized adjacent each of the socket members.

Summary of the Invention

5 It is an object of this invention to provide a shelving system having a plurality of molded panels.

 It is a further object of this invention to provide a panel having increased rigidity thereby reducing strain and the corresponding deformation of the panel.

 It is still a further object of this invention to provide a panel which maximizes
10 structural rigidity while also minimizing the amount of material usage.

 It is an additional object of this invention to provide a panel which distributes stresses adjacent each of the socket members.

 In accordance with a preferred embodiment of this invention, these and other objects and advantages are accomplished as follows.

15 The present invention provides a shelving system having at least one panel. The panel has a longitudinal direction and a transverse direction transverse relative to the longitudinal axis. The panel further includes a plurality of rails. The plurality of rails includes at least a first rail member and a second rail member. The first rail member and the second rail member each have an upper portion extending downward a depth from the
20 panel. One novel aspect of this invention is that the second rail has a depth approximately greater than the depth of the first rail.

Additionally, each rail of the plurality of rails includes a lower portion, the lower portion of each rail extends downward away from said upper portion. Preferably, the lower portion terminates at a curvilinear lower edge. Preferably, the curvilinear lower edge has a parabolic shape. However, one skilled in the art can best appreciate that the lower peripheral edge of this invention may have various other shapes without departing from the novel aspects of this invention.

Further, this invention includes at least one socket disposed on each panel. Each socket includes a plurality of walls. Preferably, the socket includes at least an inner wall and an outer wall circumferentially disposed around the inner wall. The socket includes at least one support member disposed between the inner wall and the outer wall. Preferably, the support member is at least one reinforcement flange. In addition, the socket also preferably includes a floor member disposed between the inner wall and the outer wall in a parallel orientation relative to the panel. Lastly, the shelving system of this invention includes a plurality of posts. Each post preferably having a bottom portion and a top portion each being receivable within a corresponding socket.

The above disclosed shelving system provides several advantages. As best appreciated by one skilled in the art, several panels may be interconnected together to form the shelving system. The number of panels may be determined by the requirements of a particular user or the constraints experienced in a particular environment. Accordingly, the user of this invention is provided with a substantial amount of versatility.

Another advantage found in this invention is that strains realized within the structure may be minimized while also reducing overall material usage. The strains realized with a particular panel are reduced by placing additional material in regions which experience greater strain. In shelving, strain is commonly concentrated at the geometric center of each panel. Accordingly, this invention reduces strain while reducing material usage by concentrating additional material towards the geometric center of each panel. Specifically, this advantage is achieved through the novel rail structure of this invention.

This invention contemplates use of at least a first rail and a second rail. The first rail member of this invention has an upper portion having a first depth and a second rail member having a second depth. Accordingly, the second rail may be placed at a location which experiences greater strain whereas the first rail may be positioned in a location which experiences lesser strain. Further, each rail has a lower portion having a generally curvilinear lower edge having a vertex. Accordingly, a greater amount of material is concentrated at the vertex once again reducing strain proximate the vertex while also reducing material usage at other regions which do not experience such strain.

Another advantage of the present invention is that this device disperses stresses proximate the socket members. The shelving system of this device includes an inner wall surrounded by an outer wall. The outer wall is interconnected to the inner wall by a plurality of support members and a floor member. Stresses realized within the panel are communicated into the outer wall. From the outer wall the stresses are communicated

into the inner wall. Finally, the inner wall in turn communicates the stresses into the corresponding post. Accordingly, the panel of this invention provides greater durability while also reducing the amount of material necessary.

Other objects and advantages of this invention will be better appreciated
5 from the following detailed description.

Brief Description Of The Drawings

The above and other advantages of this invention will become more apparent from the following description taken in conjunction with the accompanying drawings, in which:

10 Figure 1 shows a perspective view of a shelving system of this invention;

Figure 2 shows a fragmentary exploded view of a first post and a first socket of a first panel of the shelving system;

Figure 3 shows a top plan view of the first panel;

Figure 3a shows a fragmentary view of the first socket of the first panel; and

15 Figure 4 shows a bottom perspective view of the first panel of this invention;

Figure 5, shows a front cross-section view of the first panel cut along line 5--5 of Figure 3; and

Figure 6, shows a side cross-section view of the first panel cut along lone 6--6 of Figure 3.

Detailed Description of the Invention

As best appreciated with reference to Figure 1, the present invention provides a shelving system (10) having a modular structure. The shelving system (10) includes a plurality of panels and a plurality of posts interconnecting the panels. Preferably, the

5 plurality of panels is a first panel (12) having a first post (14), second post (16), third post (18) and a fourth post, not shown, each extending upward away from the first panel (12) .

Next, a second panel (22) is disposed on top of the first post (14), second post (16), third post (18) and fourth post (20). Then a fifth post (24), sixth post (26), seventh post (28), and eighth post, not shown, is disposed on top of the second panel (22). A third panel

10 (30) is disposed over the fifth post (24), sixth post (26), seventh post (28) and eighth post, not shown. Then a ninth post (32), tenth post (34), eleventh post (36), and twelfth post, not shown, is disposed over the third panel (30). A fourth panel (38) is then placed over the ninth post (32), tenth post (34), eleventh post (36) and twelfth post, not shown. Then a thirteenth post (40), fourteenth post (42), fifteenth post (44), and sixteenth post, not

15 shown, is disposed on top of the fourth panel (38). Lastly, a fifth panel (46) is disposed on top of the thirteenth post (40), fourteenth post (42), fifteenth post (44) and a sixteenth post, not shown. One skilled in the art can best appreciate that the above described shelving system is described in terms of a preferred embodiment and that the teachings of the instant invention may be applied to shelving systems which utilize either a greater

20 number or lesser number of panels. Furthermore, one skilled in the art can best appreciate that the terms upper, lower, bottom, top, as used herein are merely used for

clarification purposes and are not intended to be used to in anyway limit the scope of this invention.

With particular reference to Figures 2, 3a and 4, the first panel (12) is described in detail. However, it should be understood that the second panel (22), third panel (30),

5 fourth panel (38) and fifth panel (46) has a similar construction as the first panel (12).

The first panel (12) has a longitudinal direction and a transverse direction. The transverse direction being transverse relative to the longitudinal direction. The first panel (12)

includes one longitudinal edge (48) and another longitudinal edge (50) oppositely

disposed relative to the one longitudinal edge (48) in the transverse longitudinal direction.

10 The first panel (12) further includes a one side edge (52) and another side edge (54). The another side edge (54) being oppositely disposed relative to the one side edge (52) along the longitudinal direction. The first panel (12) further includes one longitudinal skirt (56) depending from the one longitudinal edge (48), and another longitudinal skirt (58)

depending from the another longitudinal edge (50), one side skirt (60) depending from the

15 one side edge (52), and another side skirt (62) depending from the another side edge (54).

The first panel (12) of this invention further includes a plurality of rails.

Preferably, the plurality of rails is a first rail (64) disposed adjacent the one longitudinal skirt (56) and extending in the longitudinal direction of the first panel (12). Extending

adjacent to the first rail (64) is a second rail (66) disposed in the longitudinal direction of

20 the first panel (12). Extending adjacent to the second rail (66) is a third rail (68) disposed

in the longitudinal direction of the first panel (12). Next, a fourth rail (70) is disposed

adjacent to the third rail (68) and extends in the longitudinal direction of the first panel (12). Lastly, a fifth rail (72) is disposed adjacent the fourth rail and extends in the longitudinal direction of the first panel (12). Although the plurality of rails as described above preferably discloses five rails oriented in the longitudinal direction of the first panel (12), either more or less rails may be utilized or various other orientations of the rails rather than in the longitudinal direction may be employed without departing from the novel aspects of this invention.

As seen in Figure 6, each rail of the plurality of rails includes a pair of opposed faces having a plurality of holes disposed along the length of each rail of the plurality of rails. As seen in Figure 6, the first rail (64) has a pair of opposed faces (74a) having a plurality of holes (76a) disposed therethrough. The second rail (66) has a pair of opposed faces (74b) having a plurality of holes (76b) disposed therethrough. The third rail (68) has a pair of opposed faces (74c) having a plurality of holes (76c) disposed therethrough. The fourth rail (70) has a pair of opposed faces (74d) having a plurality of holes (76d) disposed therethrough. Lastly, the fifth rail (72) has a pair of opposed faces (74e) having a plurality of holes (76e) disposed therethrough.

The first panel (12) further includes a plurality of openings. Specifically, the first panel (12) has a plurality of openings (78a) between the first rail (64) and second rail (66), a plurality of openings (78b) between the second rail (66) and the third rail (68), a plurality of openings (78c) between the third rail (68) and the fourth rail (70), and a plurality of openings (78d) between the fourth rail (70) and the fifth rail (72).

Figure 4 and Figure 5 shows the fourth rail (70) of this invention. However, it should be understood that the unique aspects as shown with reference to the fourth rail (70) apply equally to the first rail (64), the second rail (66), the third rail (68), and the fifth rail (72). The fourth rail (70) has one end (84) disposed proximate to the one side edge (52) of the first panel (12). The fourth rail (70) includes another end (86) disposed proximate the another side edge (54) of the first panel (12). The fourth rail (70) further includes a fourth upper portion (80d) and a fourth lower portion (82). The fourth upper portion (80d) is preferably disposed adjacent the first panel (12). The fourth lower portion (82) is preferably disposed adjacent the fourth upper portion (80d). Preferably, the fourth upper portion (80d) and the fourth lower portion (82) are integrally formed with the first panel (12). However, one skilled in the art can appreciate that various other attachment mechanisms may be equivalently employed in practicing this invention.

Preferably, as shown in Figure 6, the fourth upper portion (80d) is globally rectangular in shape and bounded by the first panel (12), the one end (84), the another end, and a chord, not shown, interconnecting the fourth upper portion (80d) and the fourth lower portion (82). The first upper portion (80a) has a first depth measured from the first panel (12) to the chord, not shown. Ideally, as best appreciated with reference to Figure 6, the depth of the second upper portion (80b) on the second panel (22) is approximately greater than the depth of the first upper portion (80a). The depth of the third upper portion (80c) of the third rail (68) is approximately greater than the depth of the second upper portion (80b) of the second rail (66). The depth of the fourth upper

portion (80d) of the fourth rail (70) is approximately less than the depth of the third upper portion (80c). The depth of the fifth upper portion (80e) is approximately less than the depth of the fourth upper portion (80d). Most preferably, the depth of the first upper portion (80a) is approximately equal to the depth of the fifth upper portion (80e), and the
5 depth of the second upper portion (80b) is approximately equal to the depth of the fourth upper portion (80d).

Another unique aspect regarding the plurality of rails may be best appreciated with reference to Figures 5 and 6. The fourth lower portion (82) of the fourth rail (70) has a curvilinear lower edge (88). Preferably, the curvilinear lower edge (88) is parabolic
10 in shape having a vertex (90). Most preferably the vertex (90) is disposed at approximately a midpoint between the one end (84) and the another side end (86). However, one skilled in the art can best appreciate that the material usage as described above regarding the novel rail structure of this invention disposes the maximum amount of material at approximately the geometric center of each panel and smoothly tapers
15 towards the one longitudinal edge (48), the another longitudinal edge (50), the one side edge (52), and the another side edge (54) of each panel. Similarly, it has been found that the strain distribution in each panel has approximately the same distribution.

Each panel of this invention includes a plurality of sockets. As best appreciated with reference to Figure 4, the first panel (12) preferably includes a first socket (92)
20 disposed proximate the one longitudinal edge (48) and one side edge (52), a second socket (94) disposed proximate the one longitudinal edge (48) and another side edge (54),

a third socket (96) disposed proximate the another longitudinal edge (50) and the another side edge (54), and a fourth socket (98) disposed proximate the another longitudinal edge (50) and the one side edge (52). Preferably, the second panel (22), the third panel (30), the fourth panel (38), and the fifth panel (46) each have four sockets similarly disposed.

5 The unique socket of this invention is best appreciated with reference to the first socket (92) as shown in Figure 3a. The first socket (92) includes an inner wall (100) and an outer wall (102) circumferentially disposed around said inner wall (100). Preferably, the inner wall (100) and outer wall (102) are each approximately cylindrical in shape. The inner wall (100) is interconnected to the outer wall (102) by a plurality of support
10 members. Preferably, the support members are a first support member (104), a second support member (106), a third support member (108), a fourth support member (110), and a fifth support member (112). Each of the support members are radially disposed around the circumference of the inner wall (100). The inner wall (100) has an upper edge (114) and an oppositely disposed lower edge (116). Disposed between the upper edge (114)
15 and the lower edge (116) is a circumferential lip (118). In addition, a floor member (120) is disposed between the inner wall (100) and the outer wall (102). Preferably, the floor member (120) is parallelly oriented relative to the first panel (12). Most preferably, the floor member (120) is disposed at approximately at a midpoint between the upper edge (114) and the lower edge (116) of the inner wall (100). The floor member in another
20 preferred embodiment includes a first opening (122) disposed between the first support member (104) and the second support member (106), a second opening (124) between the

second support member (106) and the third support member (108), a third opening (126) between the third support member (108) and fourth support member (110), a fourth opening (128) between the fourth support member (110) and the fifth support member (112), and a fifth opening (130) between the fifth support member (112) and the first
5 support member (104). The inner wall (100) has an upper portion (132) and a lower portion (134). The upper portion has a plurality of upper ribs (136). Similarly, the lower portion has a plurality of lower ribs (138). In a preferred embodiment, the panel (12) preferably includes at least one gusset, not shown, interconnecting at least one of the sockets (92, 94, 96, or 98) to at least one of the skirts (56, 58, 60 or 62).

10 As best appreciated with reference to Figure 2, this invention utilizes a plurality of posts. Specifically, as shown in Figure 2, the first post (14) includes a shaft (138) having a top portion (140). The top portion (140) includes a top inner surface (142) and outwardly disposed top outer surface (144). The top portion (140) terminates at a top peripheral edge (146). Oppositely disposed along the shaft (138) relative to the top
15 portion (140) is a bottom portion (152). The bottom portion (152) includes a bottom outer surface (154) and a bottom inner surface, not shown, inwardly disposed relative to the bottom outer surface (154). The bottom portion (152) terminates at a bottom peripheral edge (158). Preferably, the bottom outer surface (154) includes a plurality of post ribs (160) radially disposed around said bottom outer surface (154). Additionally,
20 the first post (14) includes a lower portion (148) adjacent the bottom portion (152). The lower portion (148) includes a lower outer surface (150). Preferably, a post shoulder

(162) is disposed between the bottom portion (152) and the lower portion (148). In a preferred embodiment, each post of the plurality of posts is cylindrical in cross-section. However, various other cross-sections could be utilized without departing from the novel aspects of this invention. One skilled in the art can appreciate the above described structure with particular reference to the first post (14) is equivalently applicable to the structure of all of the plurality of posts.

In use, the user of this invention may insert a post within a particular socket. As seen in Figure 3a, the first post (14) is insertable within the first socket (92). The user will depress the first post (14) into the socket (92) until the post shoulder (162) abuts the circumferential lip (118). Once the first post (14) is so oriented the lower outer surface (150) securely abuts against the upper portion (132) of the inner wall (100). Similarly, the second post (16) is inserted into the second socket (94); the third post (118) is inserted into the third socket (96); the fourth post (20) is inserted into the fourth socket (98).

Next, the second panel (22) is inserted onto each of the posts (14, 16, 18, and 20).

Specifically, the top portion (140) of the first post (14) is inserted into the lower portion (134) of the first socket (92) of the second panel (22). Similarly, the second post (16) is inserted into the second socket (94); the third post (18) is inserted into the third socket (96); and the fourth post (20) is inserted into the fourth socket (98). If it is desired for the shelving system to have an additional shelf, the fifth post (24) may be inserted into the first socket (92) of the second panel (22), the sixth post (26) may be inserted into the second socket (94) of the second panel (22); the seventh post (28) may be inserted into

the third socket (96) of the second panel (22); and the eighth post, not shown, may be inserted into the fourth socket (98) of the second panel (22). Specifically, with particular reference merely to the fifth post (24), the fifth post (24) is inserted into the second socket (94) until the post shoulder (162) of the fifth post (24) abuts the circumferential lip (118) of the first socket (92) of the second panel (24). In addition, the bottom outer surface (154) of the fifth post (24) is receivable within the top inner surface (142) of the first post (14). Accordingly, additional support is provided to the shelving system (10) of this invention. The preferred embodiment of this invention discloses a shelving system (10) having five panels interconnected by a plurality of posts. However, one skilled in the art can appreciate that support structures may be assembled having either more or less panels than the number of panels specifically disclosed herein without departing from the novel aspects of this invention.

One advantage of the above disclosed invention is that the panels of this invention utilize a plurality of rails to minimize strains realized within each panel while also minimizing the amount of material necessary. This advantage is achieved by uniquely placing the additional material in locations where strain is maximized in each panel. This advantage is achieved by two separate mechanisms: varying the depth of each different rail and varying the amount of material disposed along each rail. Preferably, the amount of material is thereby maximized at the geometric center of each panel. The geometric center exhibits the greatest amount of strain within each panel once loaded. However, to minimize the amount of material utilized excess material is removed from those regions

which experience lesser strain. One skilled in the art can appreciate that various other embodiments of this invention may be utilized. For instance, the rails may be oriented in a transverse direction rather than along the longitudinal direction or even along a direction skewed relative to the longitudinal direction or the transverse direction. In addition, if in a particular application it is found the strain distribution differs from that disclosed above, the novel rail structure of this invention may be similarly modified to once again dispose the maximize amount of material in regions proximate the regions which experience maximum strain and minimize the material usage in regions which experience minimum strain.

Another advantage taught by this invention is the utilization of a novel socket structure. As seen in Figure 3a, the socket (92) of this invention reduces stresses in the region surrounding the socket (92). The stresses realized around the socket (92) is transmitted through the outer wall (102) radially inward along the floor member (120) and the plurality of support members (104, 106, 108, 110, 112) into the inner wall (100). The inner wall (100) in turn transmit the stresses into the first post (14). Accordingly, the novel socket structure of this invention reduces the likelihood of failure in the region surrounding each socket.

Still another advantage of this invention is the unique placement of the floor member within each socket. As shown in Figure 3a, the floor member (120) of the first socket (92) is disposed at approximately the midpoint between the upper edge (114) and the lower edge (116). This location of the floor member (120) is uniquely positioned for

use in molded plastic shelving. In fabricating molded plastic shelving, each panel is integrally formed with a plurality of sockets and rails. This operation is performed by the interface of two metal die elements which are forced together defining the other boundaries of the panel. Once forced together, the cavity defined therein is injected with
5 a plastic material. Next, the dies are cooled to set the molded panel. However, those skilled in the art can appreciate that in order to form deep depressions in a mold requires a die having a metal portion which extends a greater distance inward into the cavity from one of the dies. However, use of a die having a metal portion which extends a greater distance into the mold may present cooling problems since a greater surface area of the
10 metal die needs to be cooled. Accordingly, the present invention places the floor member at approximately the midpoint of the socket thus allowing for optimum cooling from both dies and minimizing the surface area of either of the dies.

While this invention has been described in terms of a preferred embodiment, it is apparent that other forms could be adopted by one skilled in the art, for example by
15 modifying the appearance or structure of the panel, or by substituting appropriate materials. Accordingly, the scope of this invention is to be limited only by the following claims.

CLAIMS

What is claimed is:

1. A shelving system comprising:
 - 5 a panel having a longitudinal direction and a transverse direction, said panel including a plurality of rail members disposed adjacent said panel, each rail member of said plurality including a lower portion, said lower portion having curvilinear lower edge disposed a distance from said panel.
2. A shelving system as recited in claim 1, wherein each panel of said plurality further
10 includes an upper portion disposed between said panel and said lower portion.
3. A shelving system as recited in claim 2, wherein said panel and said plurality of rail members are integrally formed.
4. A shelving system as recited in claim 1, wherein said lower portion is parallelly disposed relative to said longitudinal direction of said panel.
- 15 5. A shelving system as recited in claim 2, wherein said plurality of rail members includes a first rail member and a second rail member, said second rail member being disposed adjacent said first rail member, said first rail member having a first upper portion having a first depth disposed between said panel and said first lower portion, said second rail member having a second upper portion having a second depth, said second depth being
20 approximately greater than said first depth.
6. A shelving system as recited in claim 5, wherein said plurality of rail members further comprises:
 - a third rail member disposed adjacent said second rail member, said third rail member including a third upper portion having a third depth, said third depth being
25 approximately greater than said second depth;
 - a fourth rail member disposed adjacent said third rail member, said fourth rail member including a fourth upper portion having a fourth depth, said fourth depth being approximately less than said third depth; and

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a fifth rail member disposed adjacent said fourth rail member, said fifth rail member including a fifth upper portion having a fifth depth, said fifth depth being approximately less than said fourth depth.

7. A shelving system as recited in claim 6, wherein said first depth is approximately equal said fifth depth, and wherein said second depth is approximately equal said fourth depth.

8. A shelving system as recited in claim 7, wherein said first upper portion, said second upper portion, said third upper portion, and said fifth upper portion each have a globally rectangular shape.

9. A shelving system as recited in claim 1, wherein each rail member of said plurality has a first end and second end, said second end being oppositely disposed in the longitudinal direction of said panel, said lower portion of each panel having a vertex disposed between said first end and said second end of each rail member of said plurality.

10. A shelving system as recited in claim 9, wherein each rail member of said plurality further includes a vertex disposed between said first end and said second end of each rail of said plurality of rail members.

11. A shelving system as recited in claim 10, wherein each rail member of said plurality of rail members has a midpoint disposed approximately equidistant between the first end and the second end of each rail member of said plurality of rail members, said vertex of said curvilinear lower edge being disposed at approximately said midpoint of each rail member of said plurality of rail members.

12. A shelving system comprising:

a panel having a longitudinal direction and a transverse direction disposed transverse relative to said longitudinal direction, said panel including a plurality of rail members disposed adjacent said panel, said plurality of rail members including a first rail member and a second rail member, said second rail member being disposed adjacent said first rail member, said first rail member having a first

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upper portion having a first depth, said second rail member having a second upper portion having a second depth, said second depth being approximately greater than said first depth, each rail member of said plurality further including a lower portion, said lower portion having curvilinear lower edge disposed a distance from said panel.

13. A shelving system as recited in claim 12, wherein said plurality of rail members includes a first rail member and a second rail member, said second rail member being disposed adjacent said first rail member, said first rail member having a first upper portion having a first depth disposed between said panel and said first lower portion, said second rail member having a second upper portion having a second depth, said second depth being approximately greater than said first depth.

14. A shelving system as recited in claim 13, wherein said plurality of rail members further comprises:

a third rail member disposed adjacent said second rail member, said third rail member including a third upper portion having a third depth, said third depth being approximately greater than said second depth;

a fourth rail member disposed adjacent said third rail member, said fourth rail member including a fourth upper portion having a fourth depth, said fourth depth being approximately less than said third depth; and

a fifth rail member disposed adjacent said fourth rail member, said fifth rail member including a fifth upper portion having a fifth depth, said fifth depth being approximately less than said fourth depth.

15. A shelving system as recited in claim 14, wherein said first depth is approximately equal said fifth depth, and wherein said second depth is approximately equal said fourth depth.

16. A shelving system as recited in claim 15, wherein said first upper portion, said second upper portion, said third upper portion, and said fifth upper portion each have a globally rectangular shape.

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17. A shelving system as recited in claim 12, wherein each rail member of said plurality has a first end and second end, said second end being oppositely disposed in the longitudinal direction of said panel, said lower portion of each panel having a vertex disposed between said first end and said second end of each rail member of said plurality.

5 18. A shelving system as recited in claim 12, wherein each rail member of said plurality further includes a vertex disposed between said first end and said second end of each rail of said plurality of rail members.

19. A shelving system as recited in claim 18, wherein each rail member of said plurality of rail members has a midpoint disposed approximately equidistant between the first end and the
10 second end of each rail member of said plurality of rail members, said vertex of said curvilinear lower edge being disposed at approximately said midpoint of each rail member of said plurality of rail members.

20. A shelving system comprising:

a plurality of panels, each panel having a longitudinal direction and a transverse
15 direction, said transverse direction being transversely disposed relative to said longitudinal direction, each panel of said plurality comprising a plurality of rail members disposed on said panel, said plurality of rail members including a first rail member and a second rail member, said second rail member being disposed adjacent said first rail member, said first rail member having a first
20 upper portion having a first depth, said second rail member having a second upper portion having a second depth, said second depth being approximately greater than said first depth, each rail member of said plurality of rail members further including a lower portion adjacent said upper portion, said lower portion terminating at a curvilinear lower edge; each panel of said plurality of
25 panels further comprising a plurality of sockets disposed on said panel, each socket of said plurality comprising an inner wall and an outer wall, said outer wall being circumscribing said inner wall, said outer wall being distanced from said inner wall, said socket further including a plurality of support members radially disposed and interconnecting said inner wall to said outer wall, and a

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floor member disposed parallelly relative to said panel and interconnecting said inner wall to said outer wall.

21. A shelving system comprising:

a panel having a longitudinal direction and a transverse direction, said panel including

5 a plurality of rail members depending from an underside of said panel, the depth dimension of said rail members increasing from relatively shallow respective depths at opposite first and second ends of each said rail member to a relatively greater maximum depth between said ends of said rail member;

10 the maximum depth dimension of a central one of said plurality of rail members disposed substantially at a center portion of said panel underside is relatively greater than the maximum depth dimension of at least one of said rail members adjacent thereto; and

each rail member of said plurality including a curvilinear lower edge disposed a distance from said panel.

15 22. A shelving system comprising:

a plurality of panels, each said panel having a longitudinal direction and a transverse direction,

20 said panel including a plurality of rail members connected to said panel, each rail member of said plurality including a lower portion, said lower portion having curvilinear lower edge disposed a distance from said panel.

23. A shelving system as recited in claim 22, wherein each rail member of said plurality further includes an upper portion disposed between said panel and said lower portion.

24. A shelving system as recited in claim 23, wherein said panel and said plurality of rail members are integrally formed.

25 25. A shelving system as recited in claim 23, wherein said plurality of rail members includes a first rail member and a second rail member, said second rail member being disposed adjacent said first rail member, said first rail member having a first upper portion having a first depth between said panel and a first rail lower portion, said second rail member

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having a second upper portion having a second depth, said second depth being greater than said first depth.

26. A shelving system as recited in claim 25, wherein said plurality of rail members further comprises:

- 5 a third rail member disposed adjacent said second rail member, said third rail member including a third upper portion having a third depth, said third depth being greater than said second depth;
- a fourth rail member disposed adjacent said third rail member, said fourth rail member including a fourth upper portion having a fourth depth, said fourth depth being
- 10 less than said third depth; and
- a fifth rail member disposed adjacent said fourth rail member, said fifth rail member including a fifth upper portion having a fifth depth, said fifth depth being less than said fourth depth.

27. A shelving system as recited in claim 26, wherein said first depth is substantially equal

15 said fifth depth, and wherein said second depth is substantially equal said fourth depth.

28. A shelving system as recited in claim 27, wherein said first upper portion, said second upper portion, said third upper portion, and said fifth upper portion each have a rectangular shape cross-section.

29. A shelving system as recited in claim 22, wherein each said lower portion is parallelly

20 disposed relative to said longitudinal direction of said panel.

30. A shelving system as recited in claim 22, wherein each rail member of said plurality further includes a vertex in said curvilinear lower edge disposed between a first end and a second end of each rail of said plurality of rail members.

31. A shelving system as recited in claim 30, wherein each rail member of said plurality of

25 rail members has a midpoint disposed approximately equidistant between the first end and the second end of each rail member of said plurality of rail members, said vertex of said

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curvilinear lower edge being disposed at approximately said midpoint of each rail member of said plurality of rail members.

32. A shelving system comprising:

a plurality of panels, each said panel having a longitudinal direction and a transverse
5 direction disposed transverse relative to said longitudinal direction, said panel
including a plurality of rail members connected to said panel, said plurality of
rail members including a first rail member and a second rail member, said
second rail member being disposed adjacent said first rail member, said first
10 rail member having a first depth, said second rail member having a second
depth, said second depth being greater than said first depth, each rail member
of said plurality further including a lower portion, said lower portion having
curvilinear lower edge disposed a distance from said panel.

33. A shelving system as recited in claim 32, wherein said plurality of rail members further comprises:

15 a third rail member disposed adjacent said second rail member, said third rail member
including a third depth, said third depth being greater than said second depth;
a fourth rail member disposed adjacent said third rail member, said fourth rail member
including a fourth depth, said fourth depth being less than said third depth; and
a fifth rail member disposed adjacent said fourth rail member, said fifth rail member
20 including a fifth depth, said fifth depth being less than said fourth depth.

34. A shelving system as recited in claim 33, wherein said first depth is approximately equal said fifth depth, and wherein said second depth is approximately equal said fourth depth.

35. A shelving system as recited in claim 34, wherein said first, said second, said third,
25 and said fifth rail members each have a rectangular shaped cross-section.

36. A shelving system as recited in claim 32, wherein said curvilinear edge of each rail member of said plurality further includes a vertex in said curvilinear lower edge disposed between a first end and a second end of each rail of said plurality of rail members.

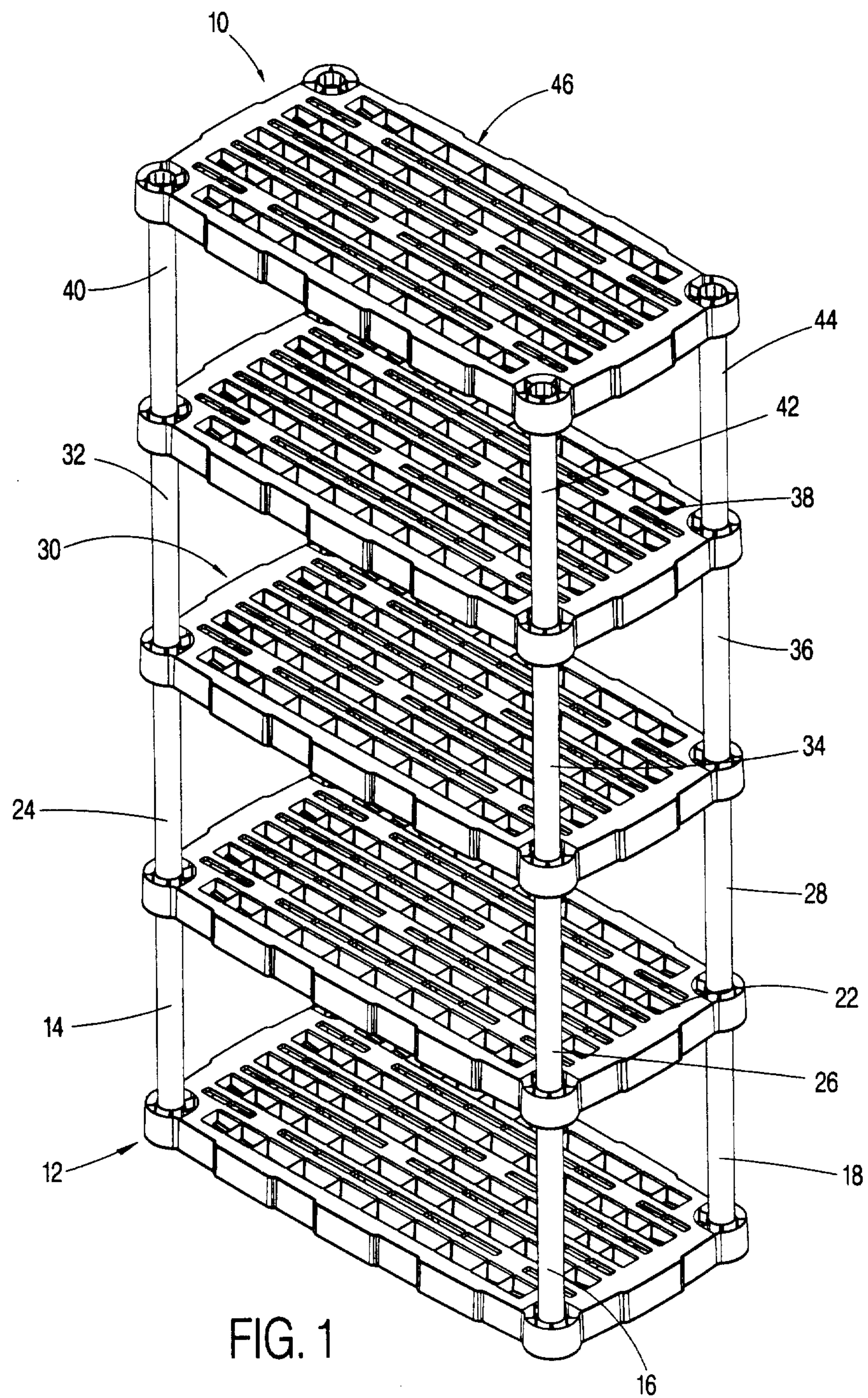
- 25 -

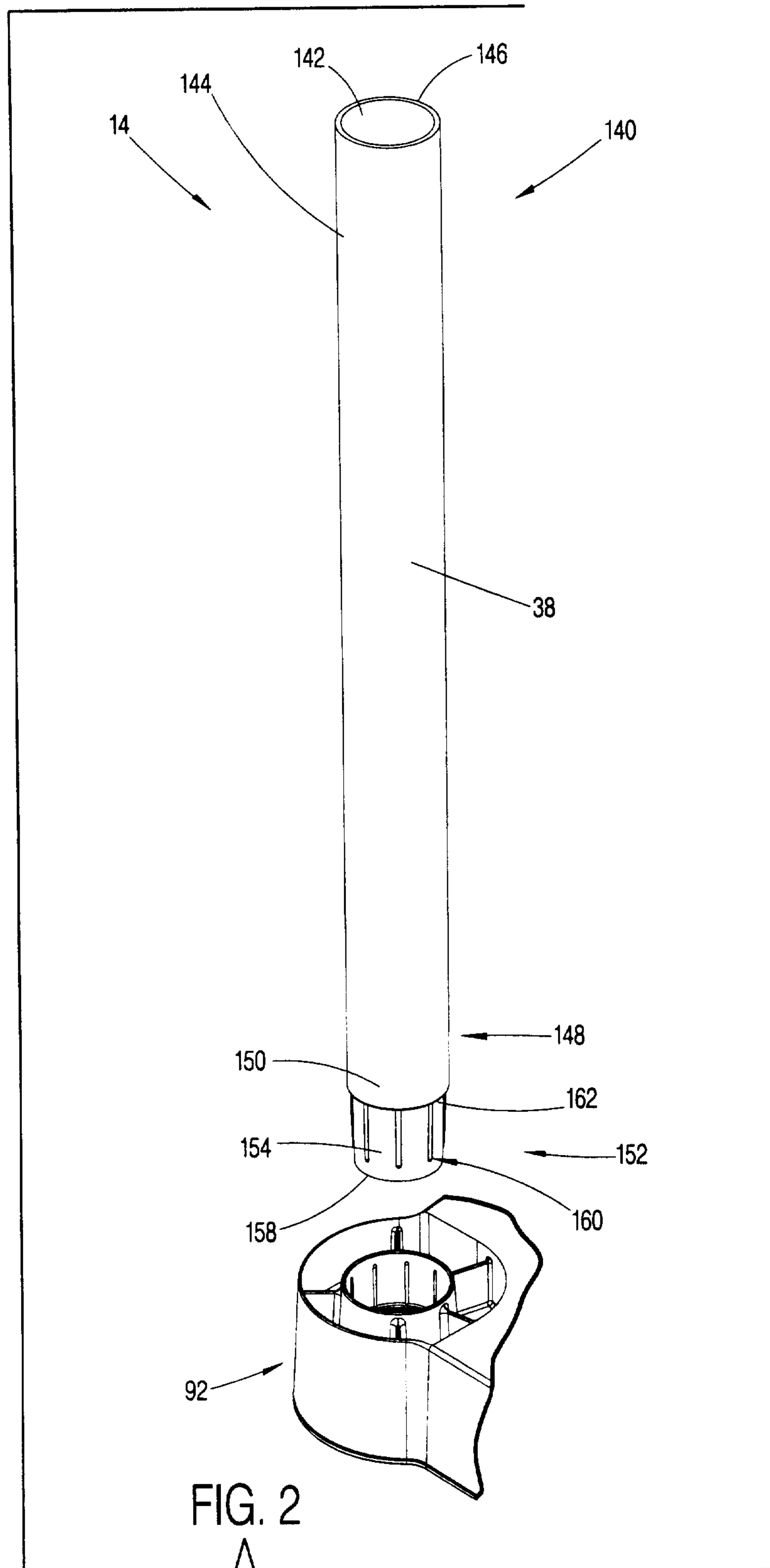
37. A shelving system as recited in claim 36, wherein each rail member of said plurality of rail members has a midpoint disposed approximately equidistant between the first end and the second end of each rail member of said plurality of rail members, said vertex of said curvilinear lower edge being disposed at approximately said midpoint of each rail member of said plurality of rail members.

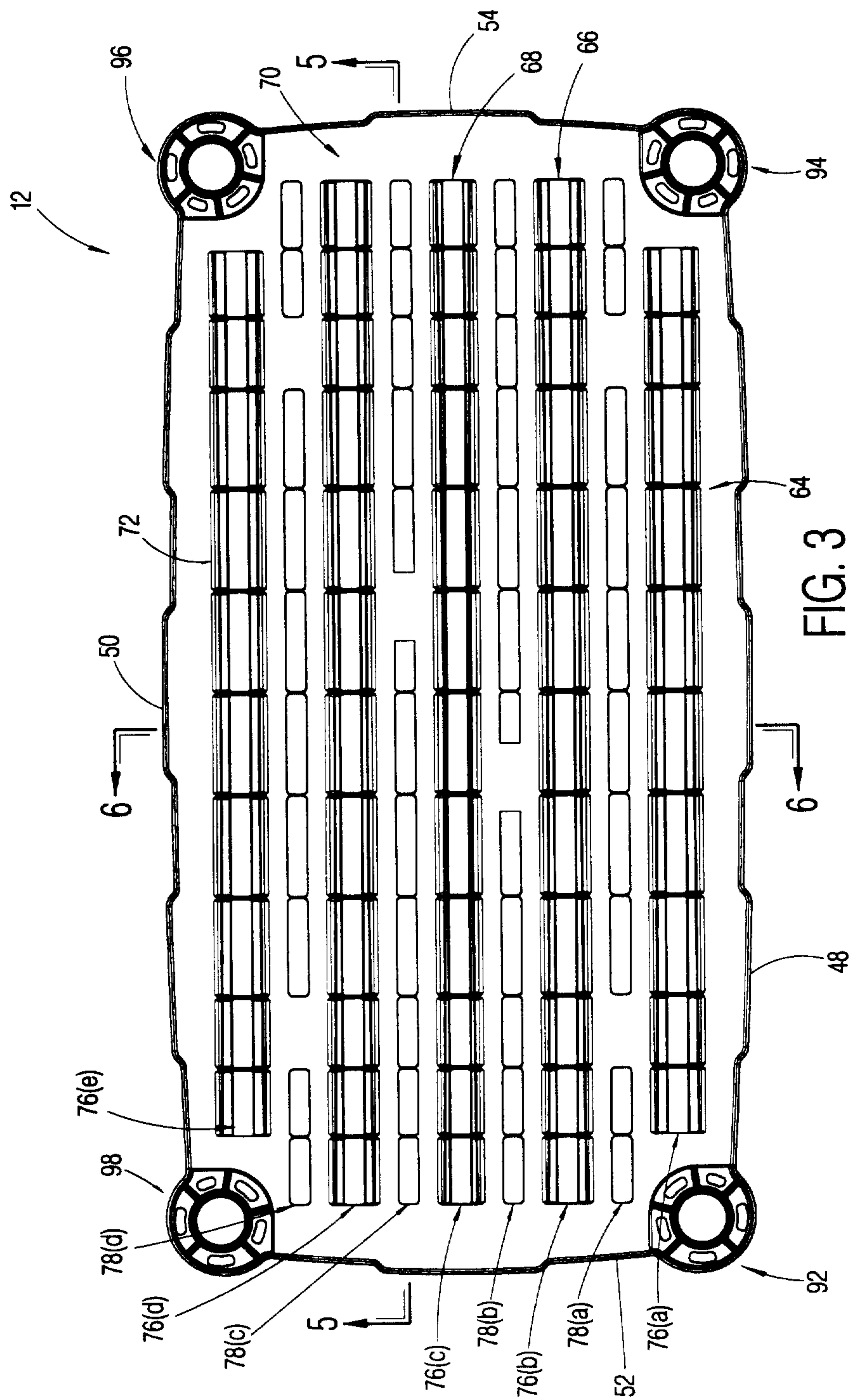
38. A shelving system comprising:

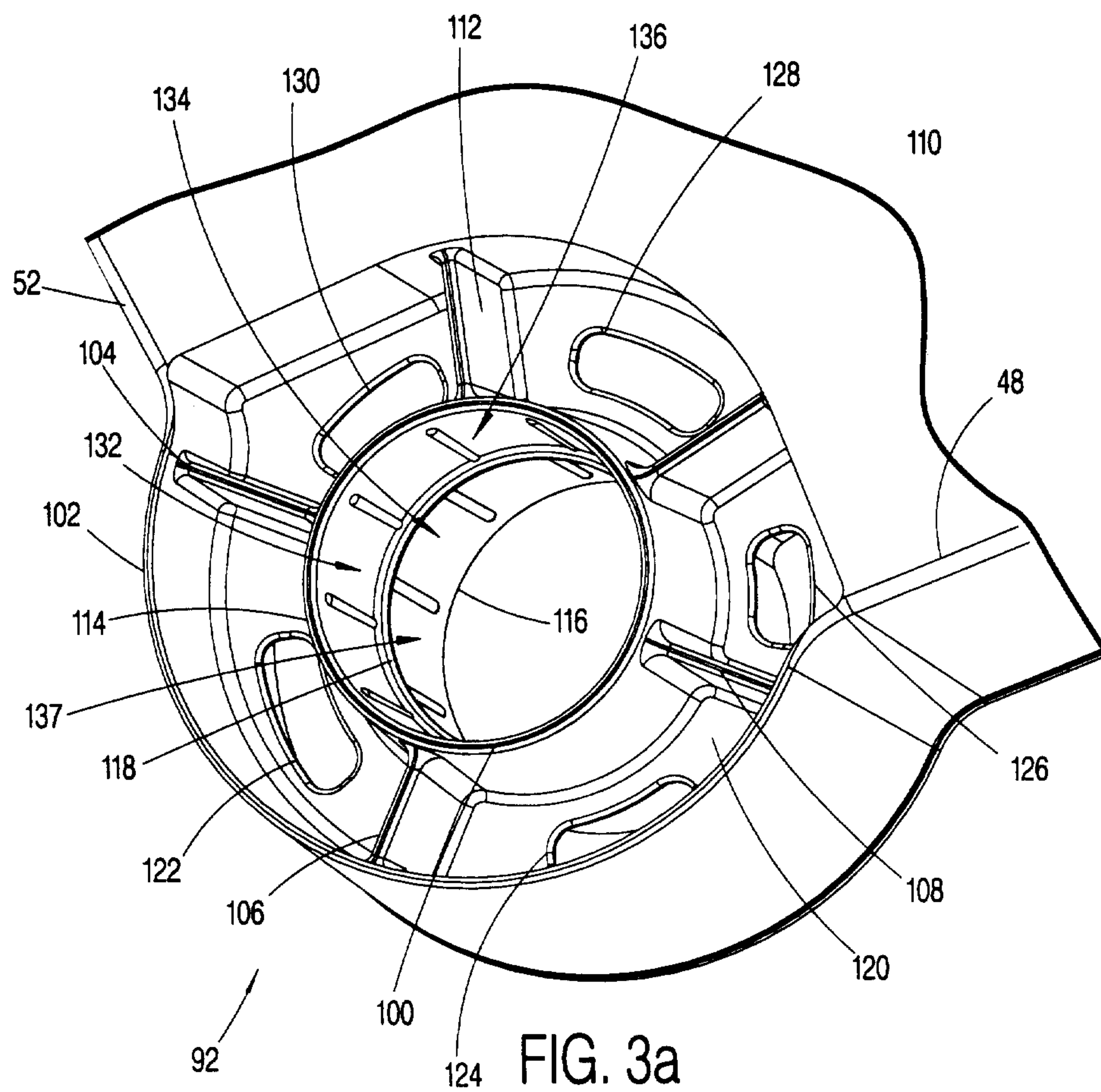
a plurality of panels, each panel having a longitudinal direction and a transverse direction, said transverse direction being transversely disposed relative to said longitudinal direction, each panel of said plurality comprising a plurality of rail members disposed on said panel, said plurality of rail members including a first rail member and a second rail member, said second rail member being disposed adjacent said first rail member, said first rail member having a first depth, said second rail member having a second depth, said second depth being greater than said first depth, each rail member of said plurality of rail members further including a lower portion, said lower portion terminating at a curvilinear lower edge;

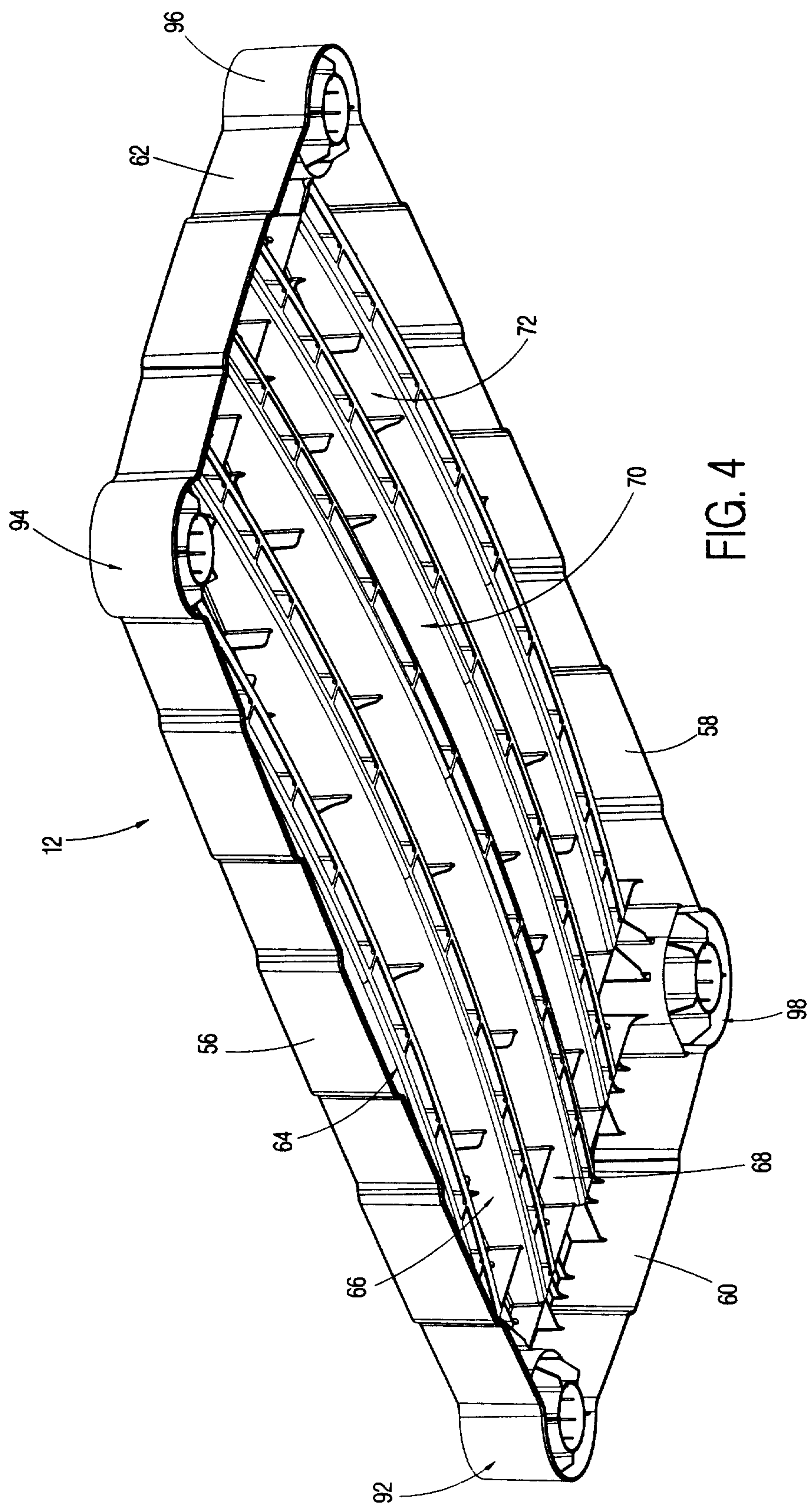
each panel of said plurality of panels further comprising a plurality of sockets disposed on said panel, each socket of said plurality comprising an inner wall and an outer wall, said outer wall circumscribing said inner wall, said outer wall being distanced from said inner wall, said socket further including a plurality of support members radially disposed and interconnecting said inner wall to said outer wall, and a floor member disposed parallelly relative to said panel and interconnecting said inner wall to said outer wall.

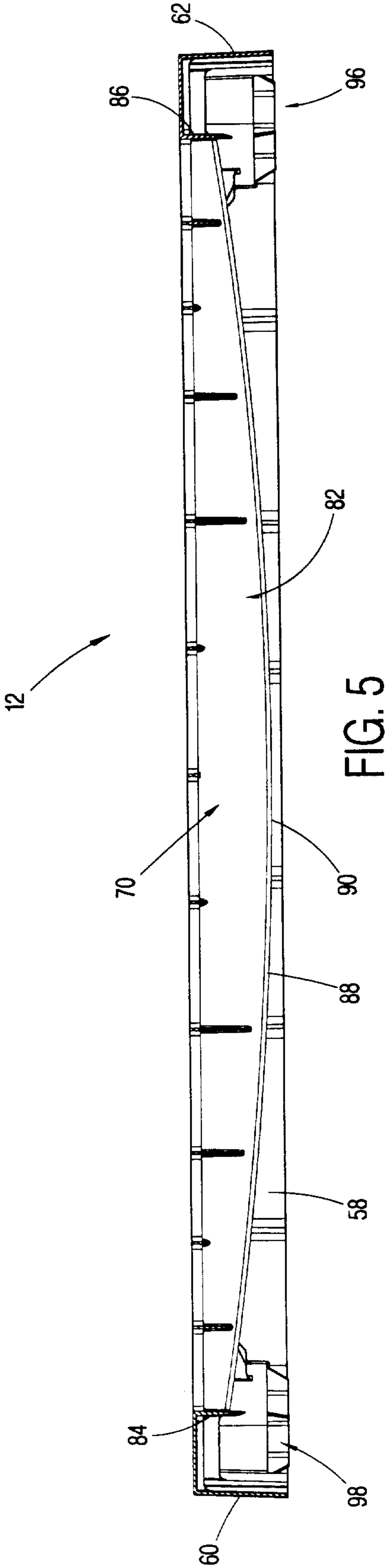












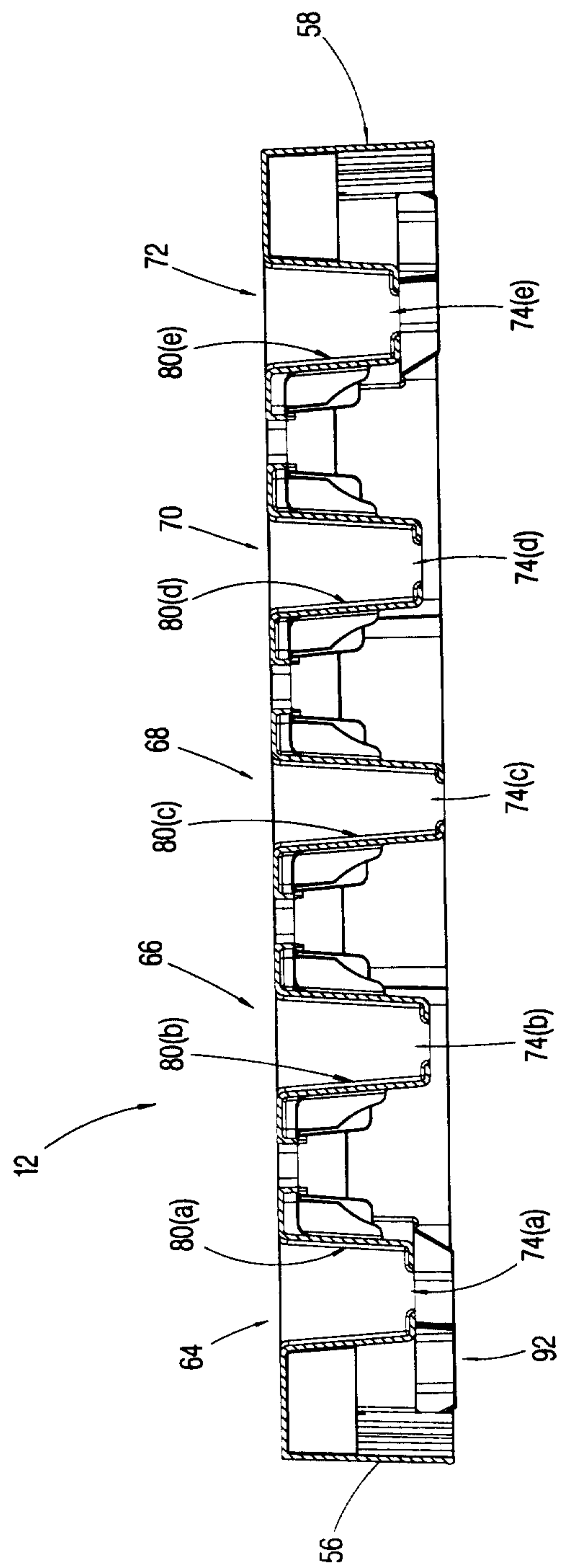


FIG. 6

