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(54) **TOP FRAME**

**Related U.S. Application Data**

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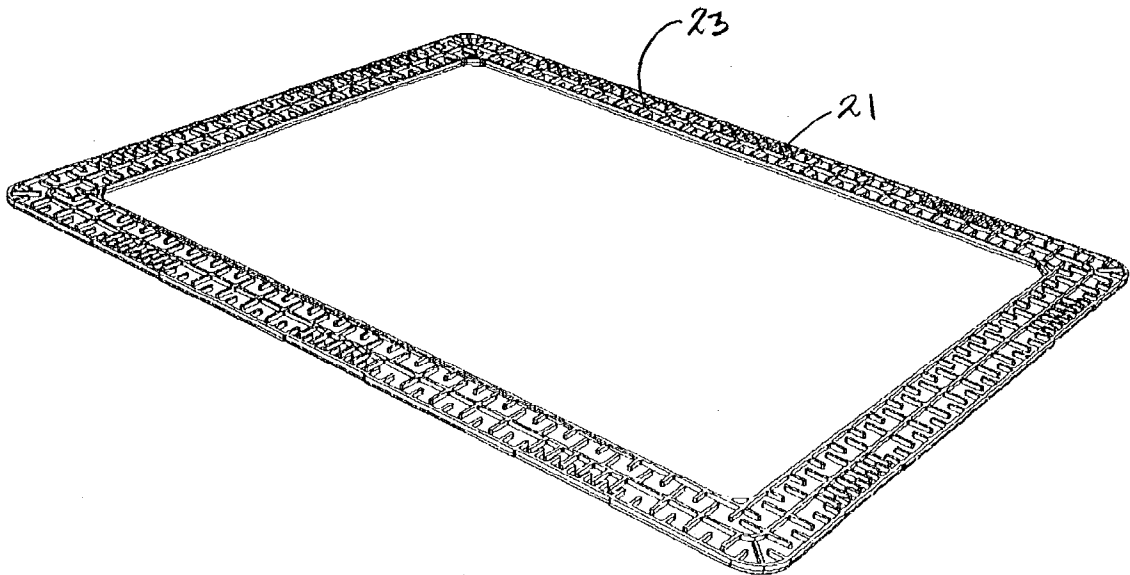
(52) **U.S. Cl. .... 108/55.1**

(21) Appl. No.: **10/431,625**

(22) Filed: **May 7, 2003**

(57) **ABSTRACT**

Top frames adapted for use with palletized goods are disclosed. The frames comprises either a single frame member, two frame members joined together, or several segments joined together.



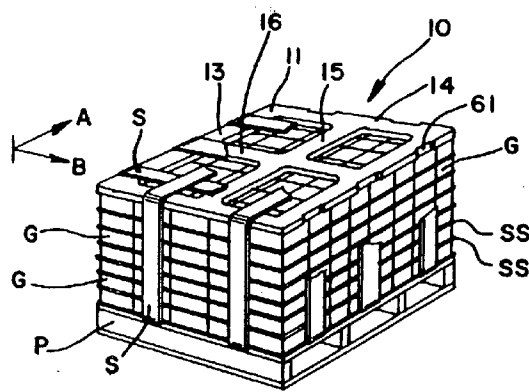


Figure 1

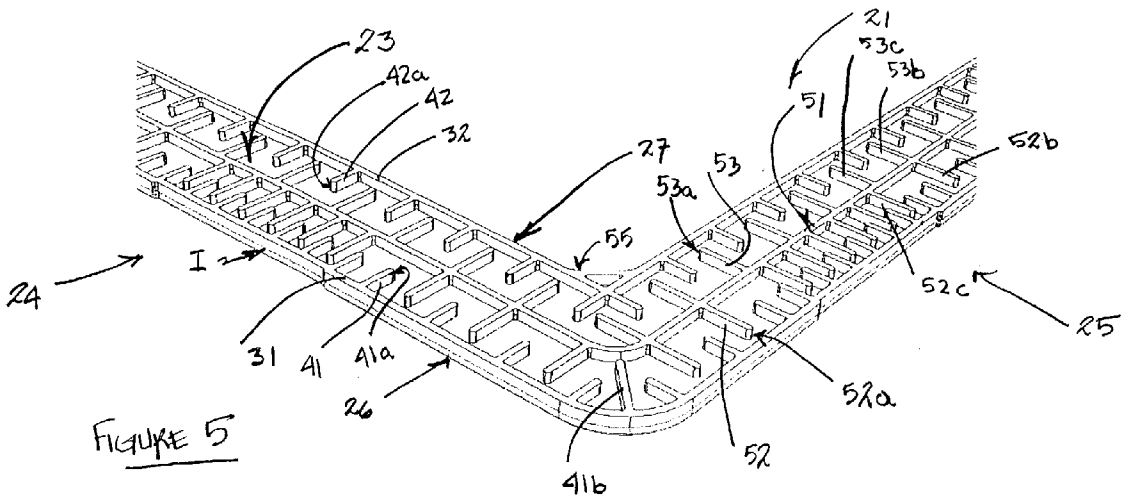


FIGURE 5

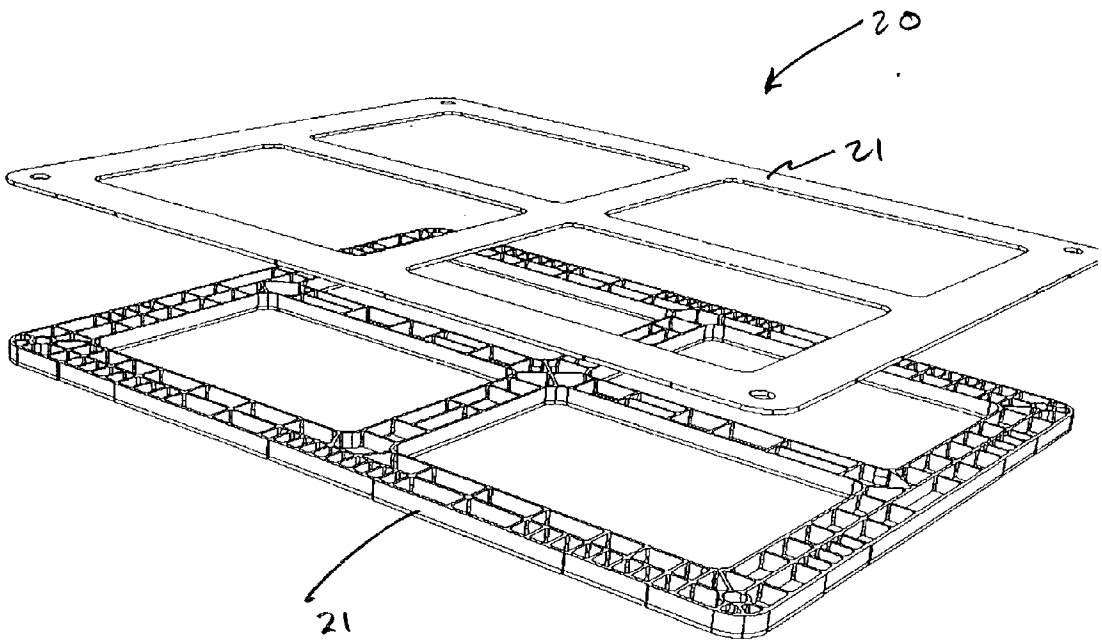


FIGURE 1A

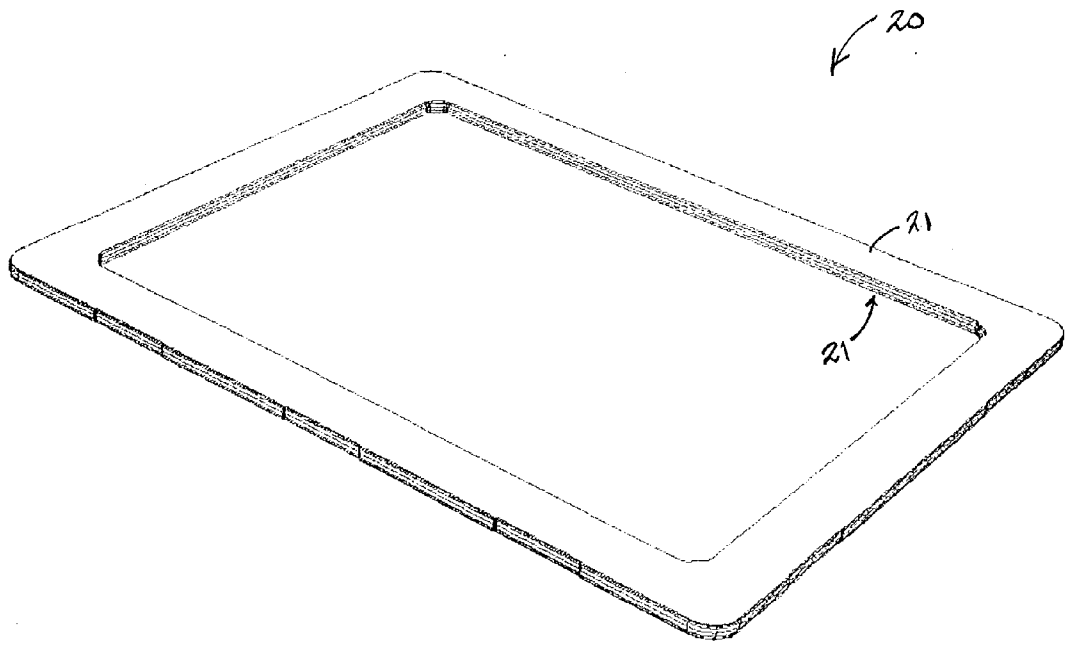


FIGURE 2

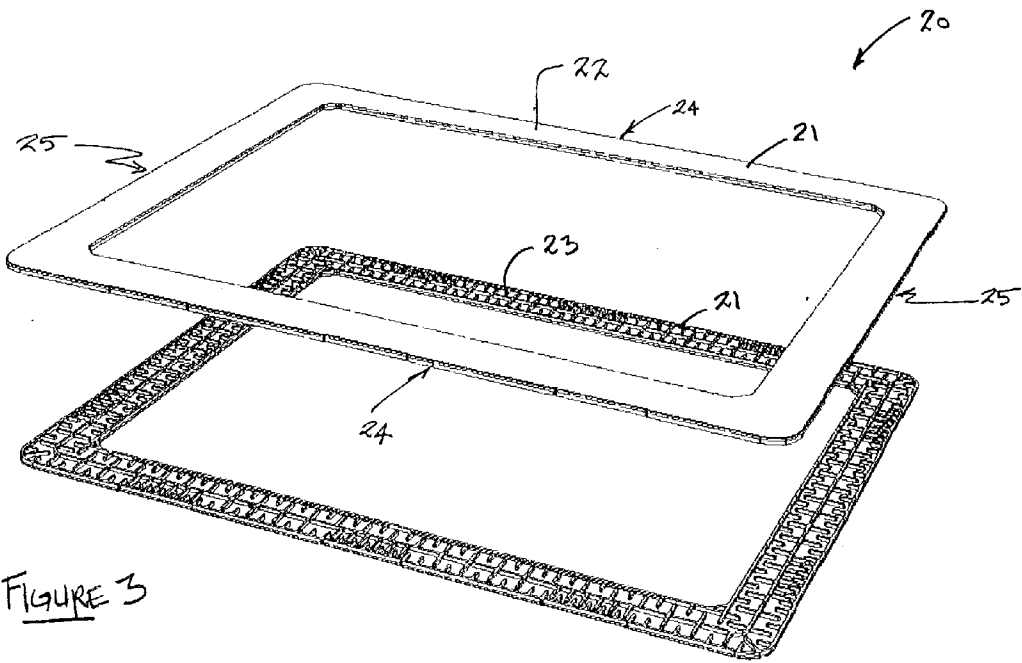


FIGURE 3

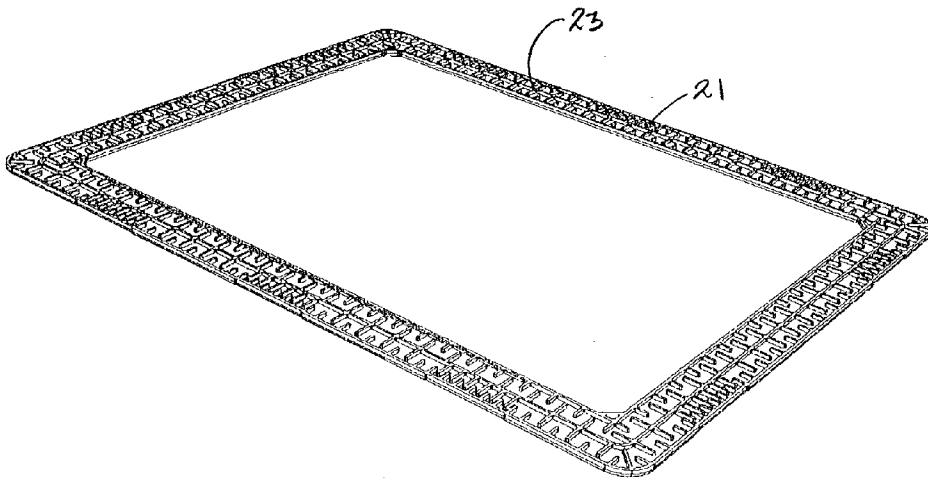


FIGURE 4

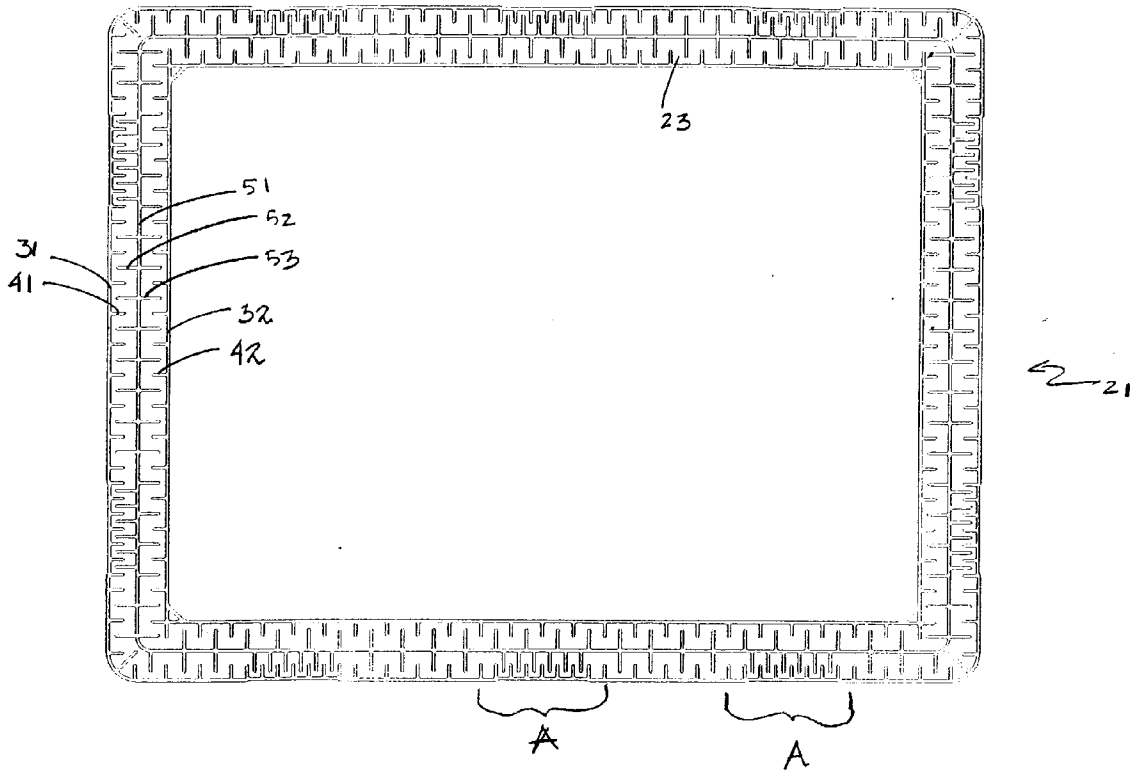


FIGURE 6

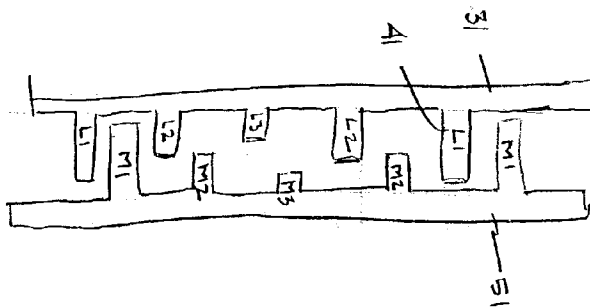


FIGURE 6A

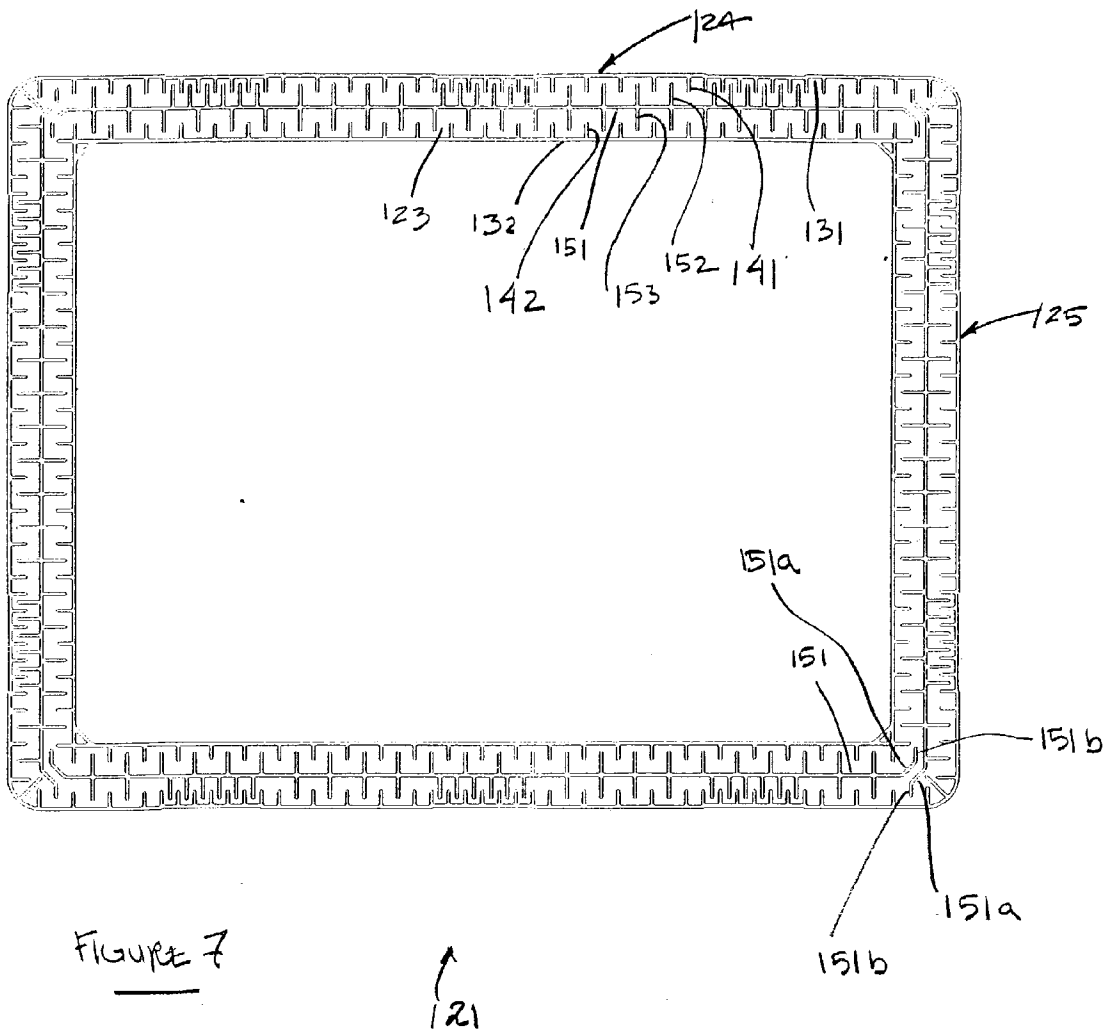


Figure 7

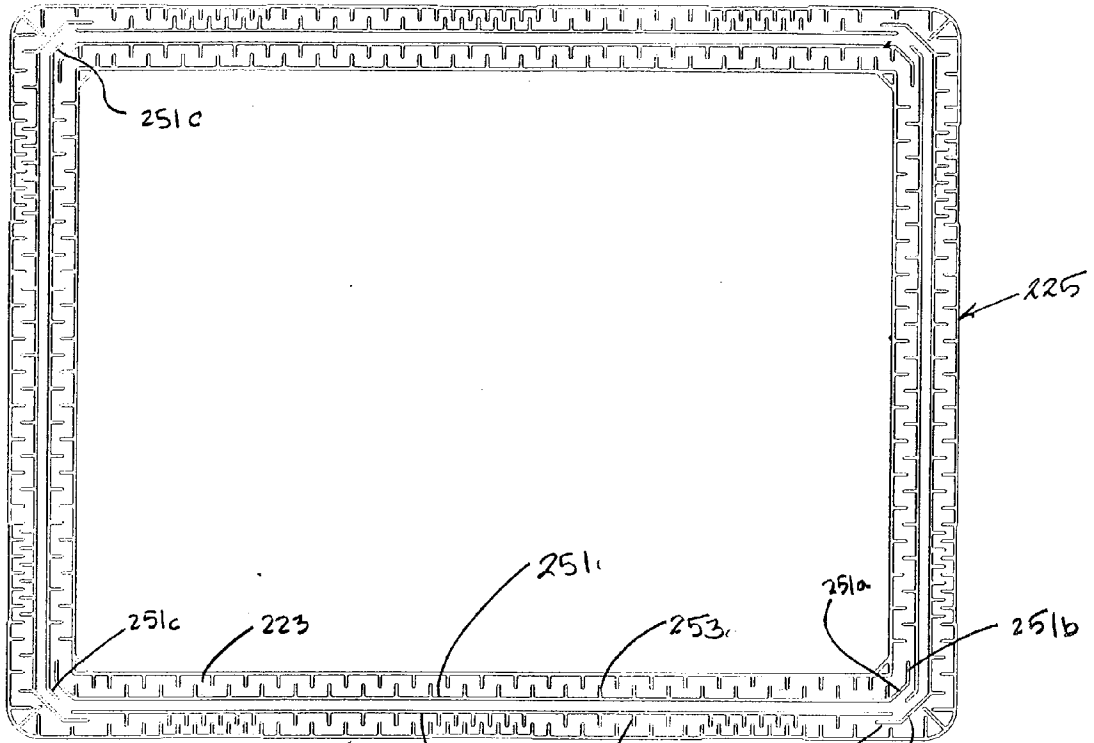


FIGURE 8

221





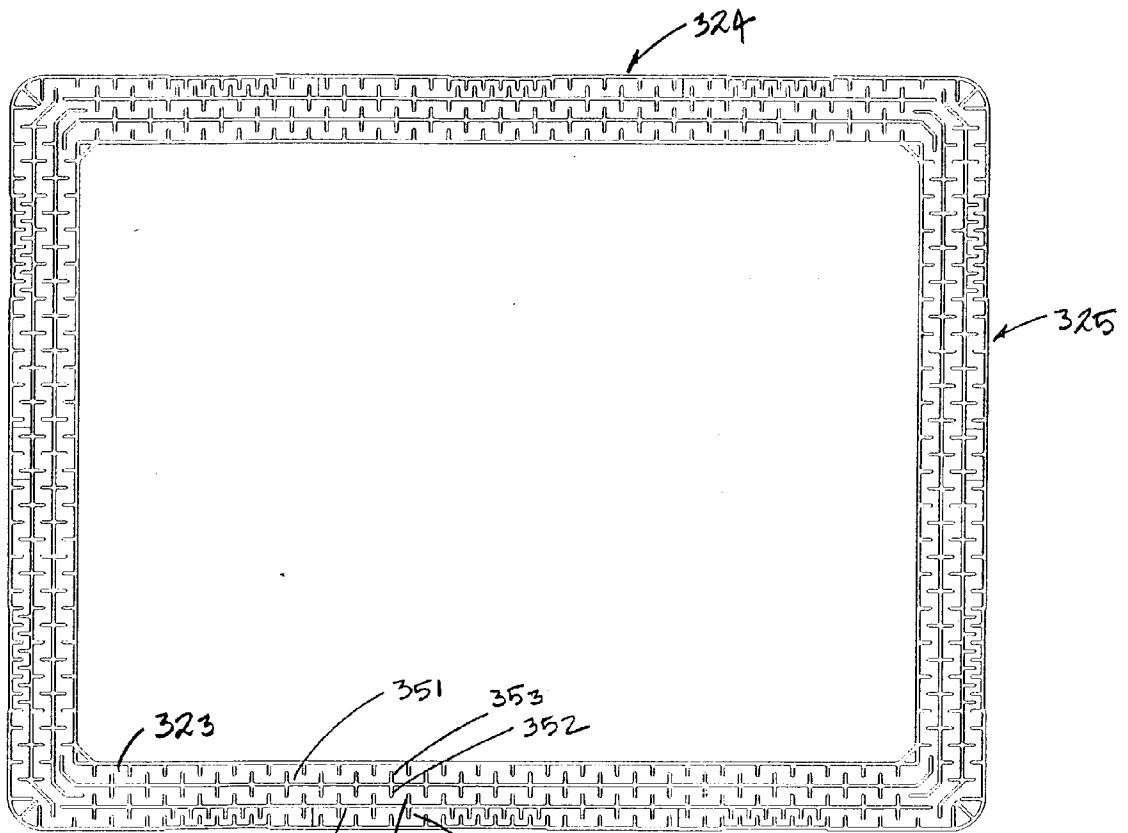


FIGURE 9

351

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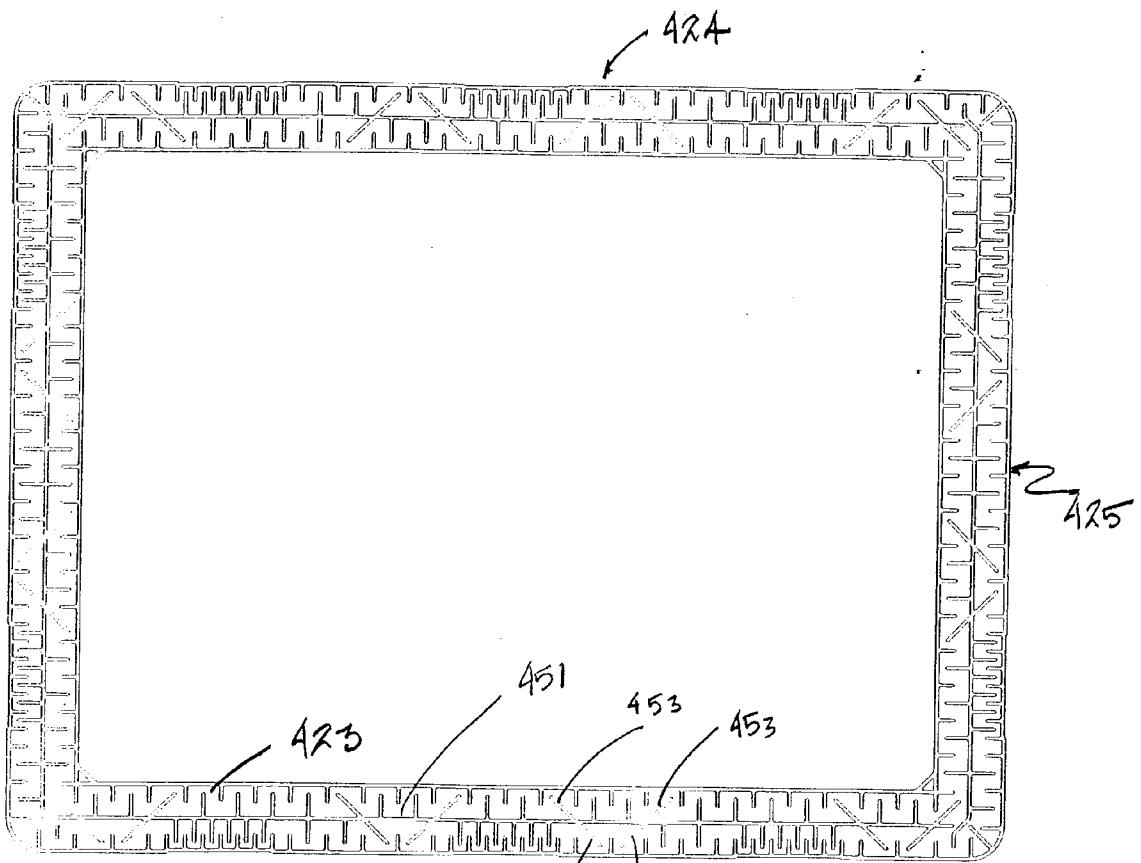


FIGURE 10

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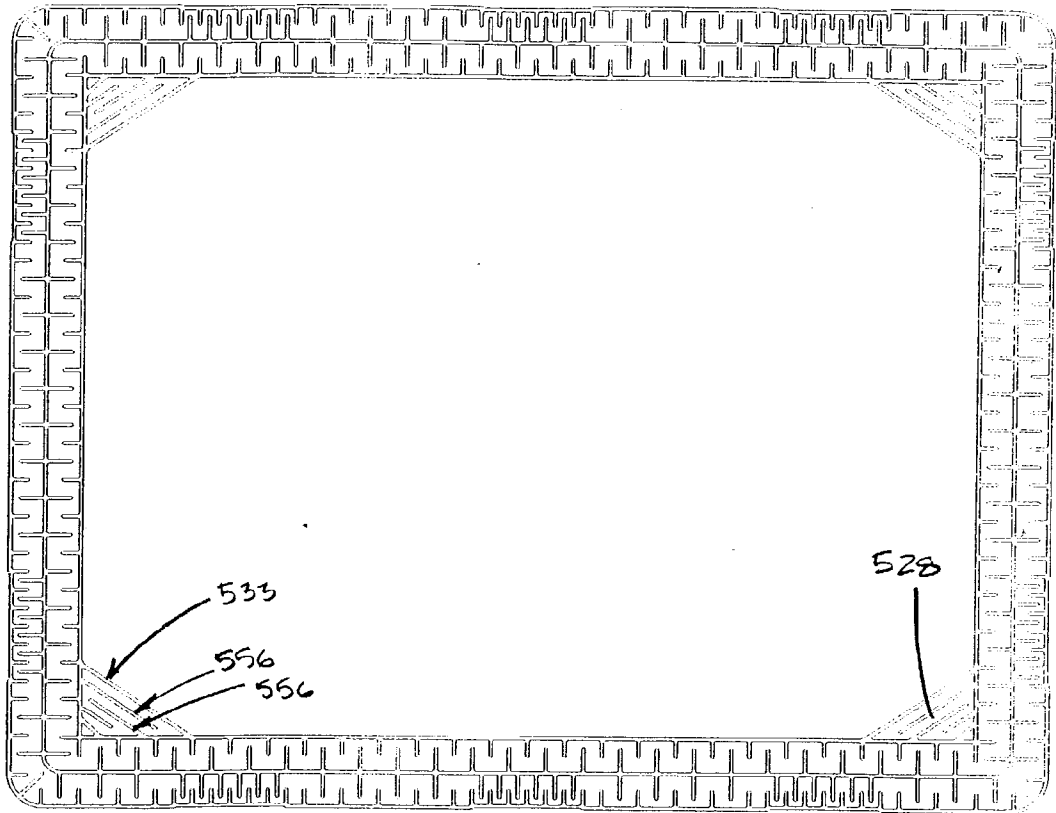


FIGURE 11

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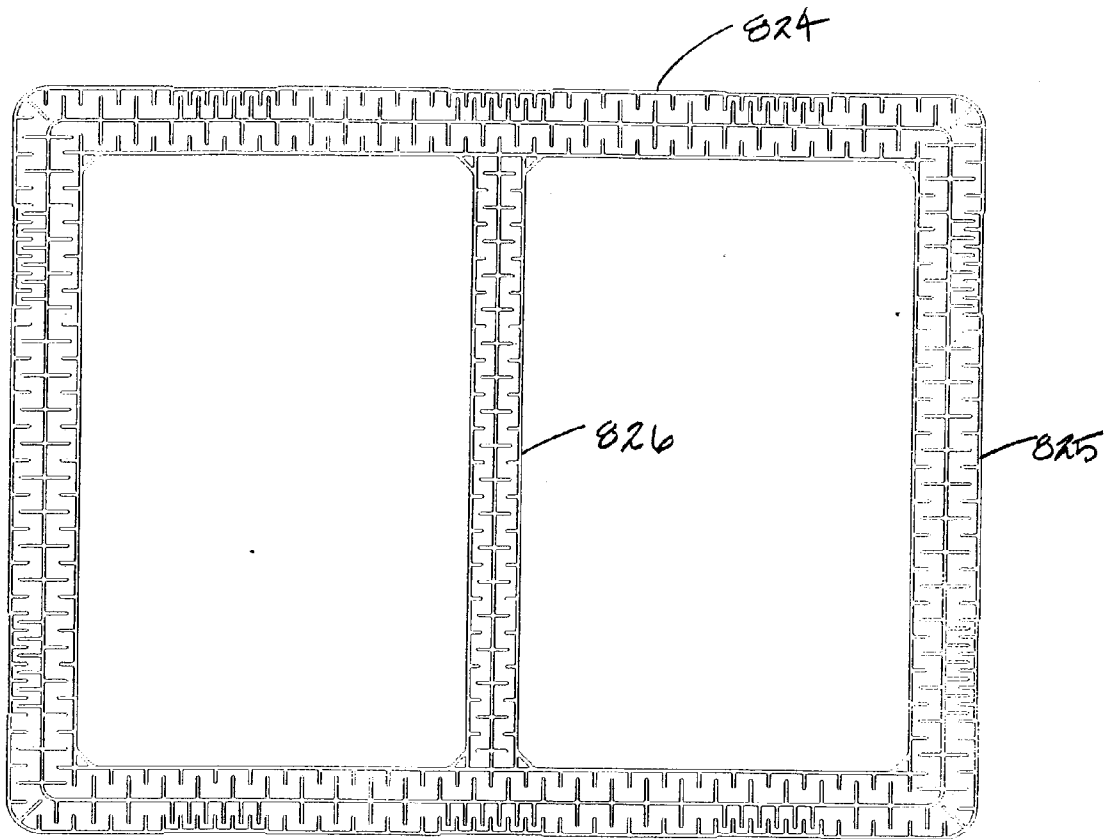


FIGURE 12

↑  
821

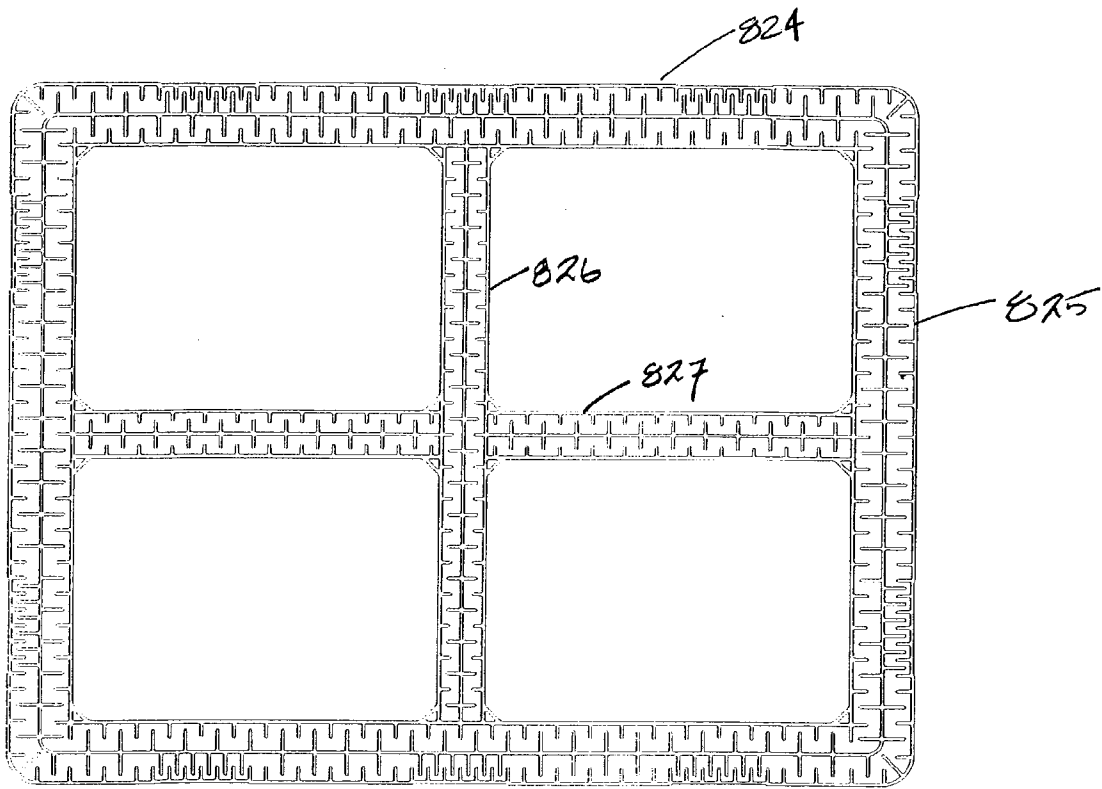


FIGURE 13

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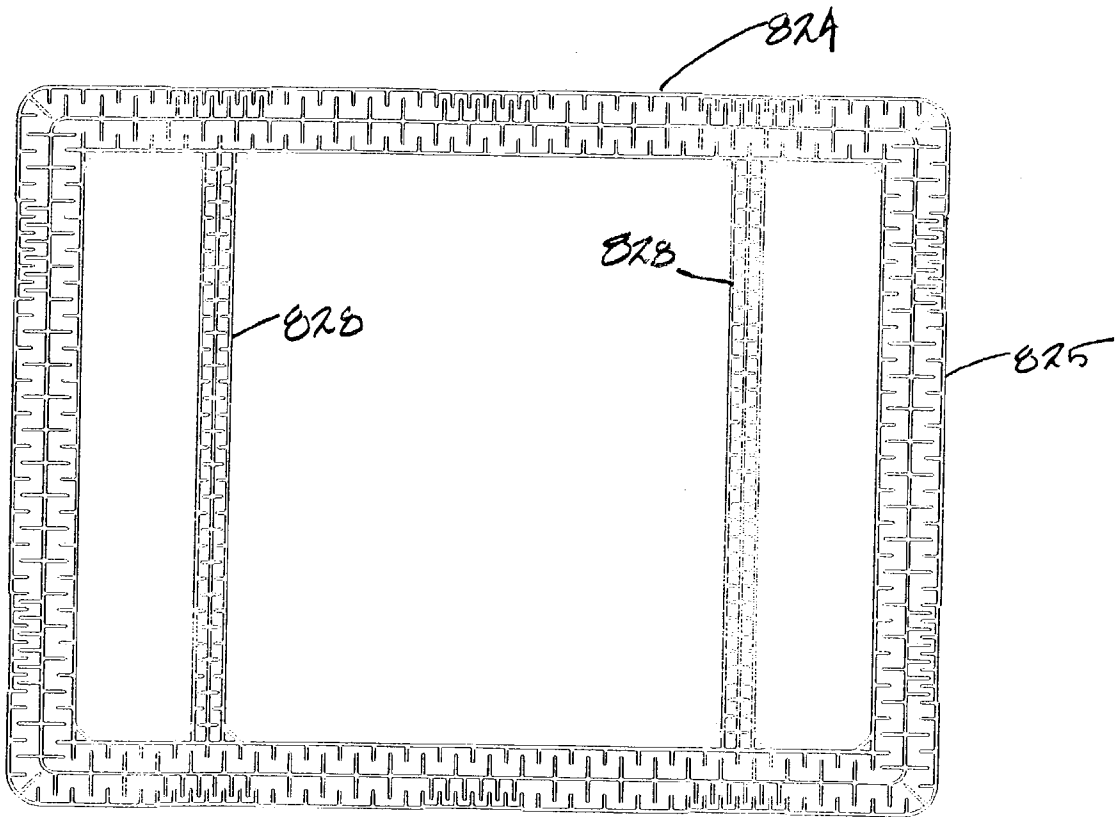
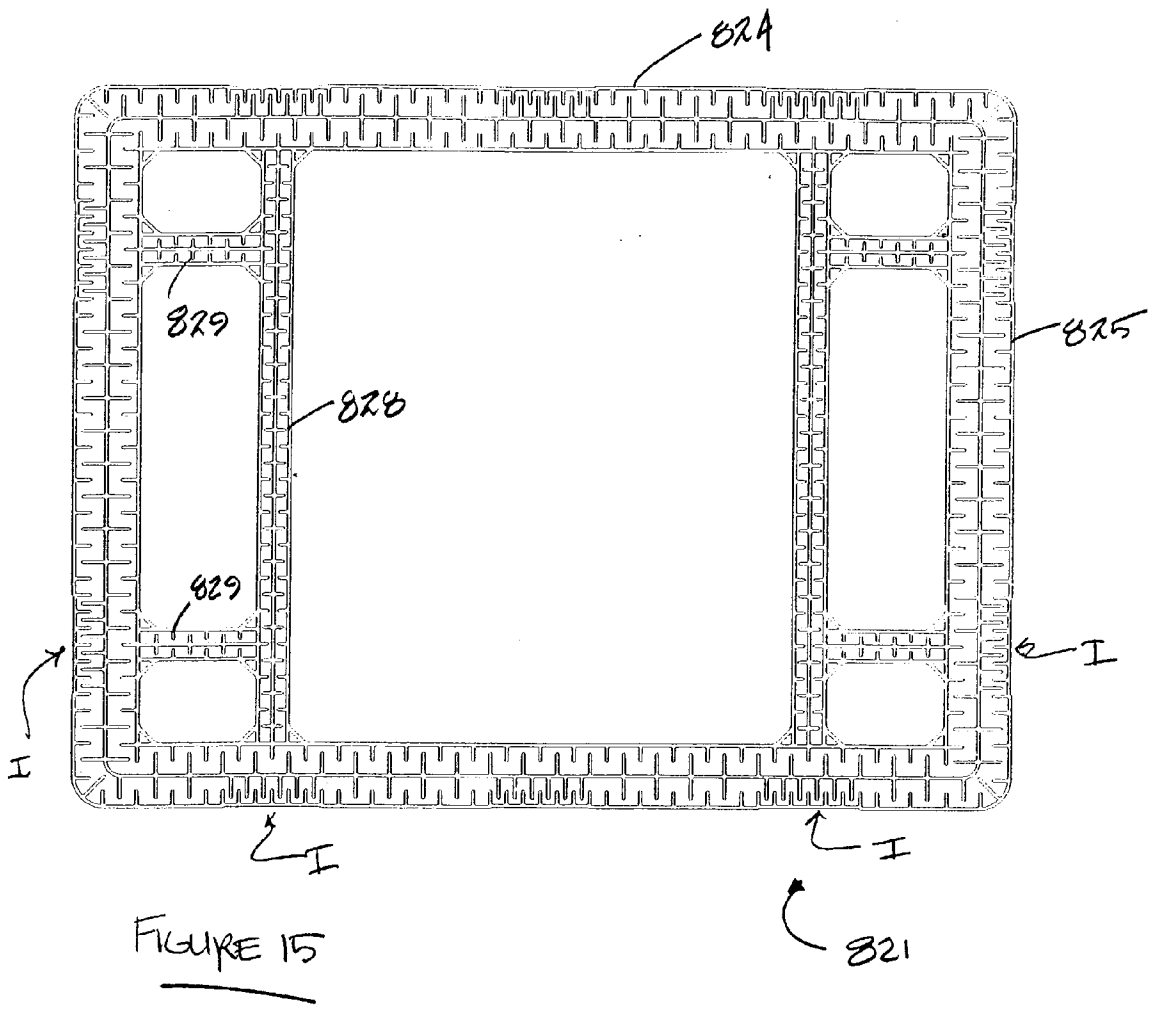


FIGURE 1A

821



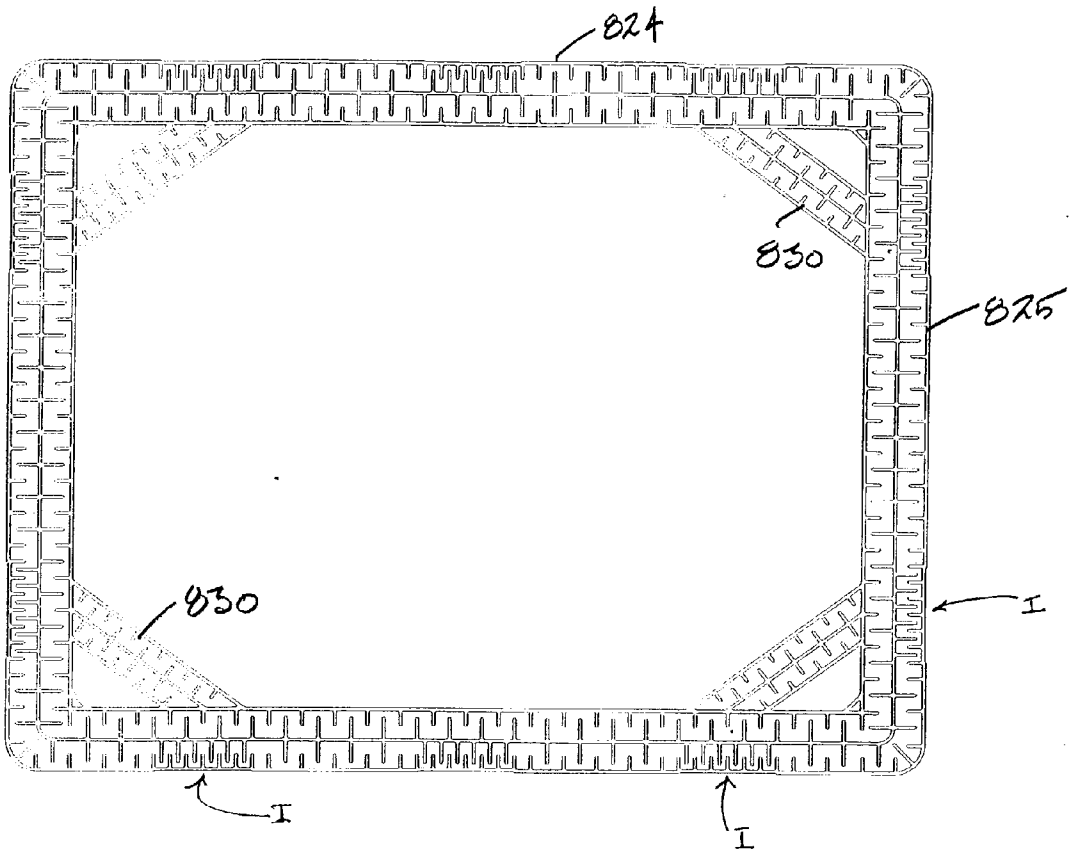


FIGURE 16



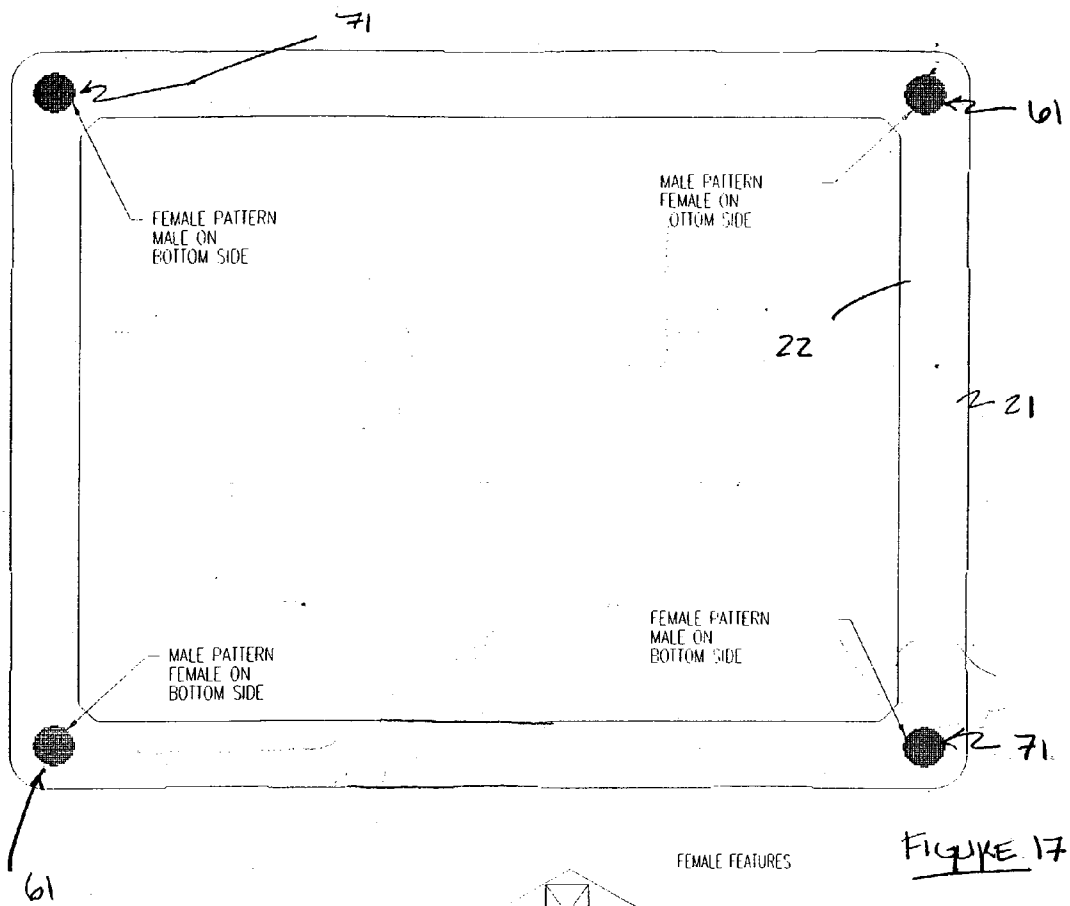


FIGURE 17

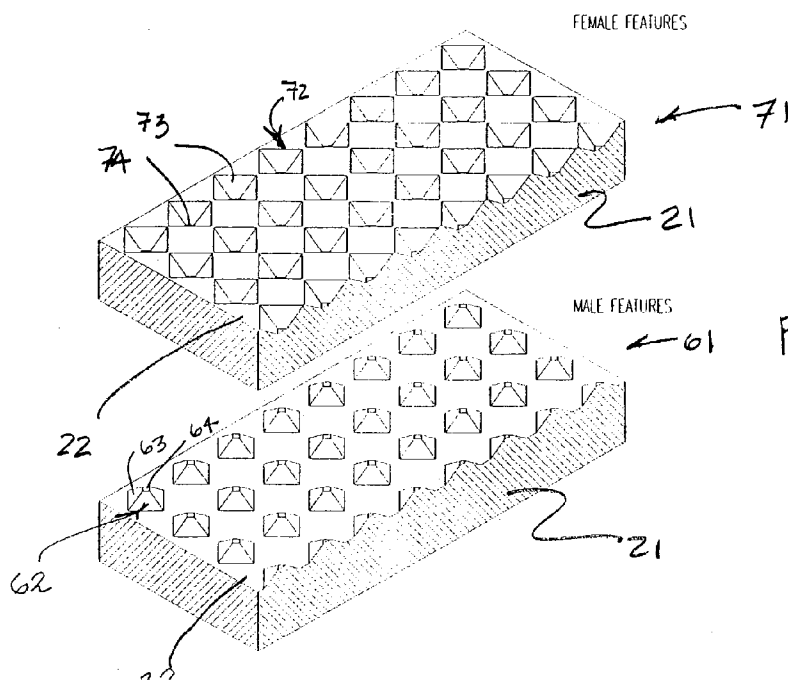


FIGURE 18

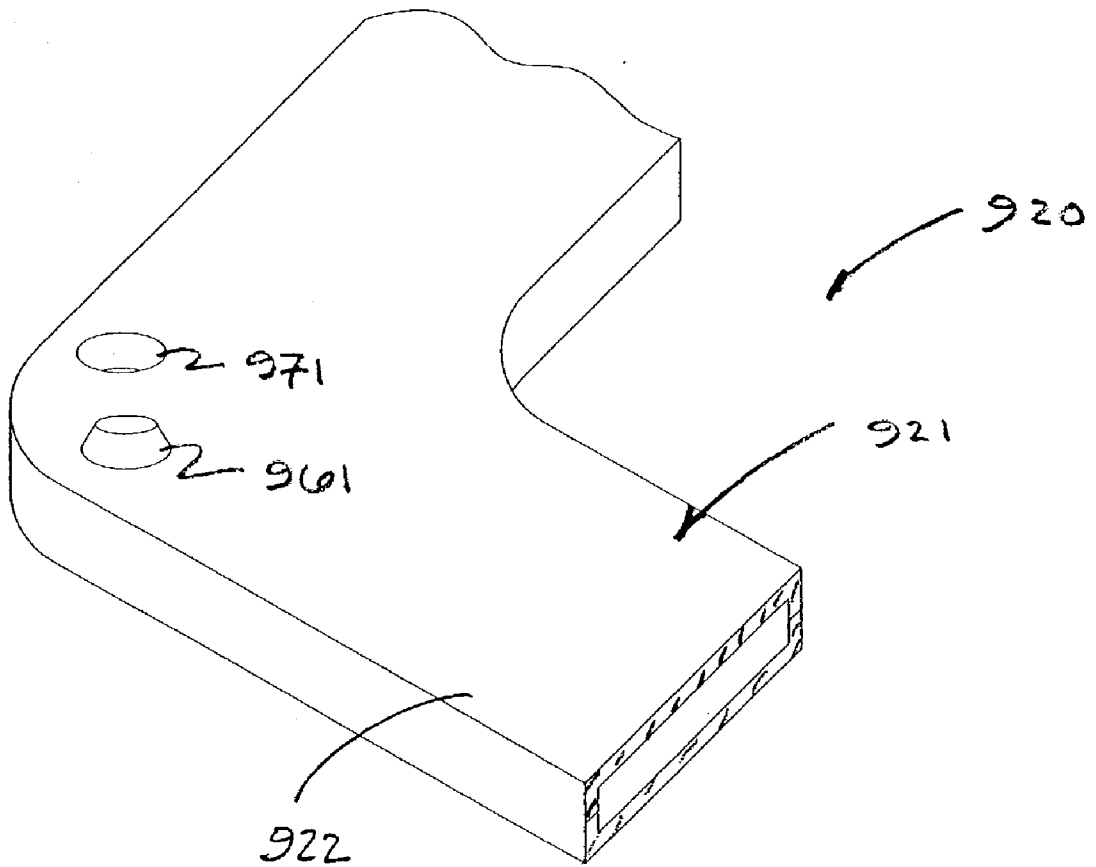
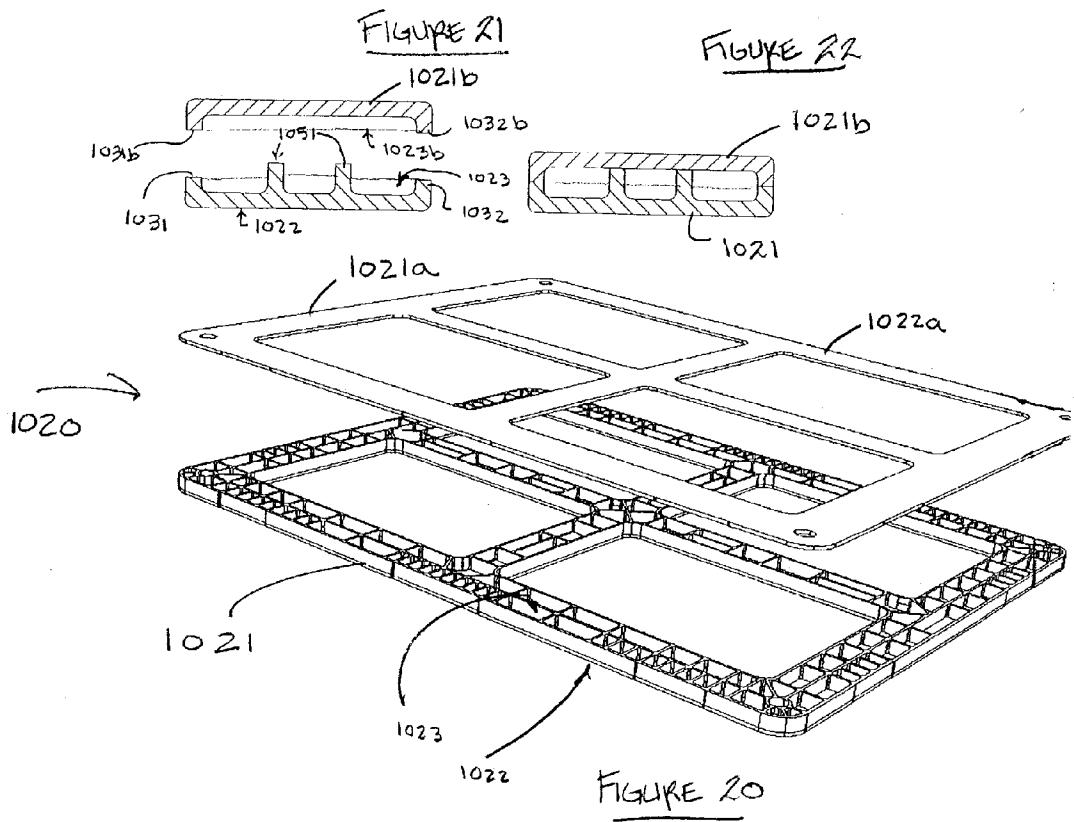


FIGURE 19



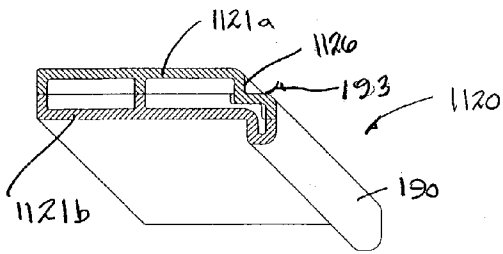


FIGURE 23

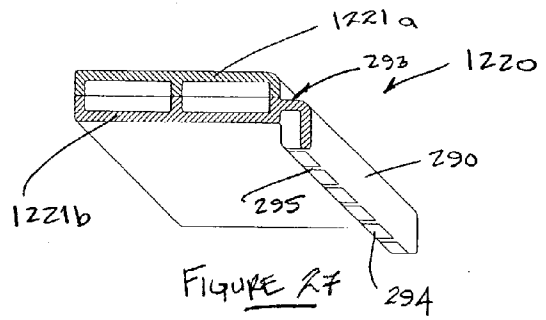


FIGURE 27

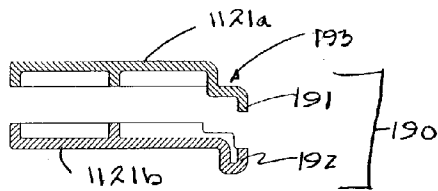


FIGURE 24

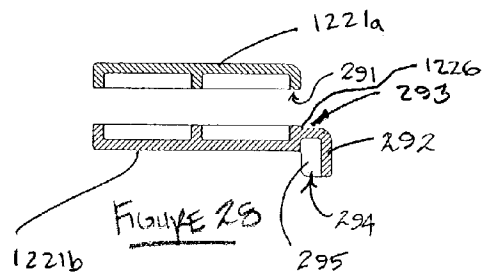


FIGURE 28

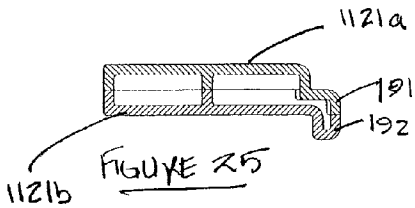


FIGURE 25

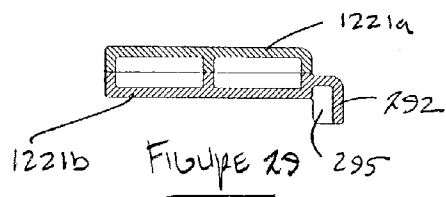


FIGURE 29

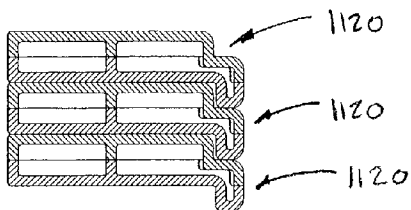


FIGURE 26

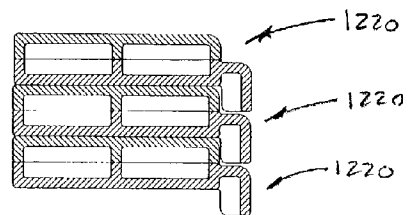


FIGURE 30

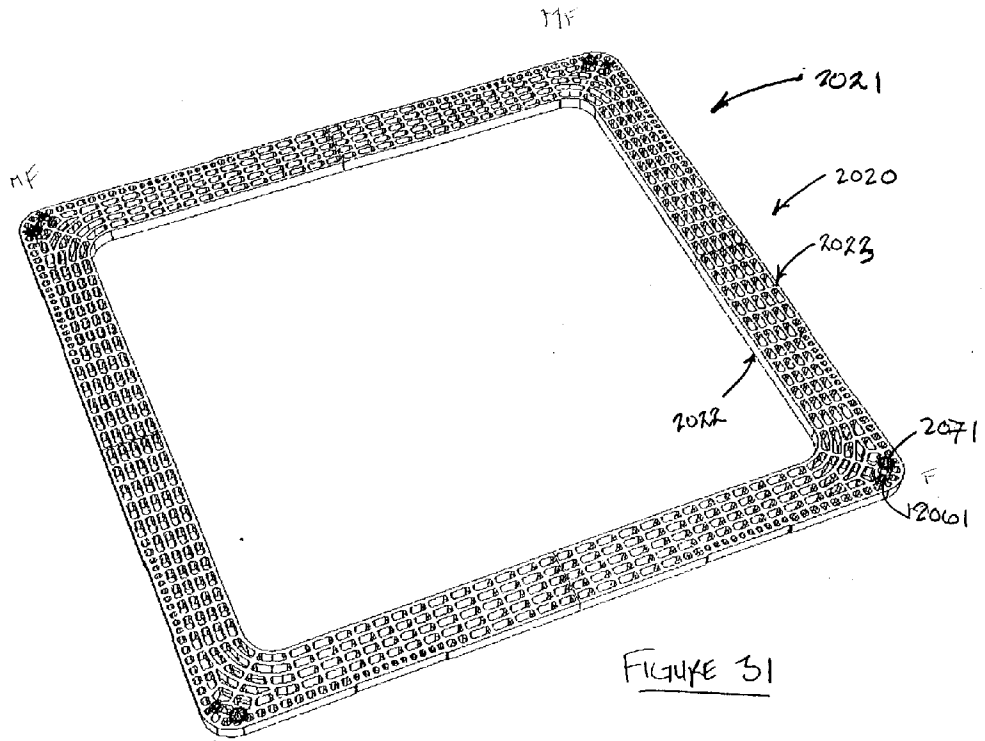


FIGURE 31

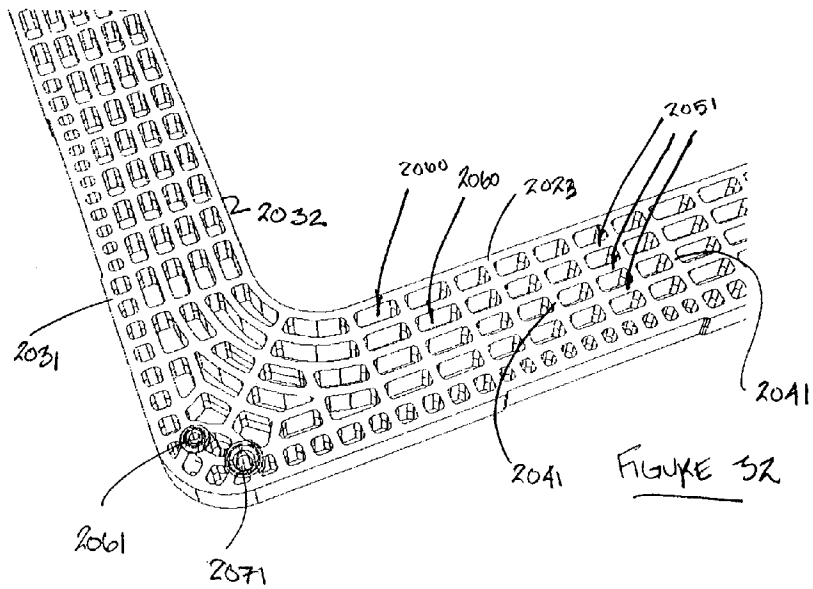


FIGURE 32

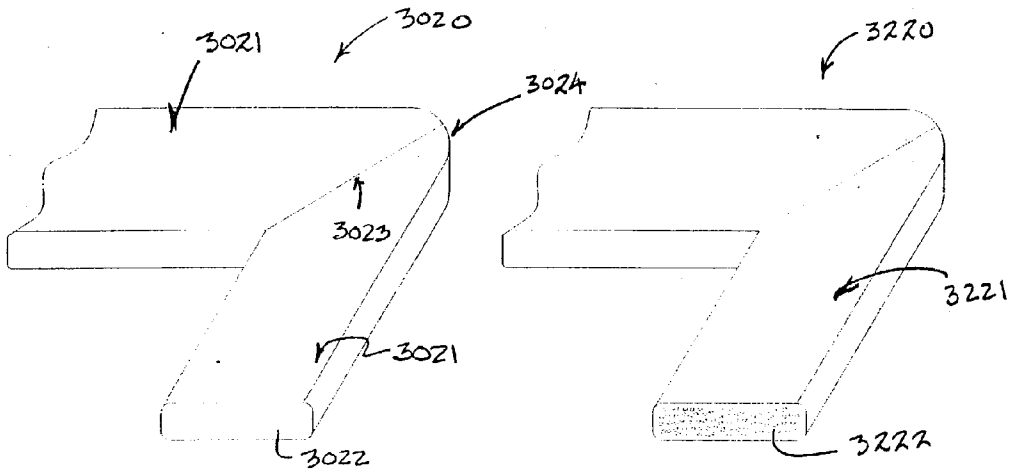


FIGURE 33

FIGURE 35

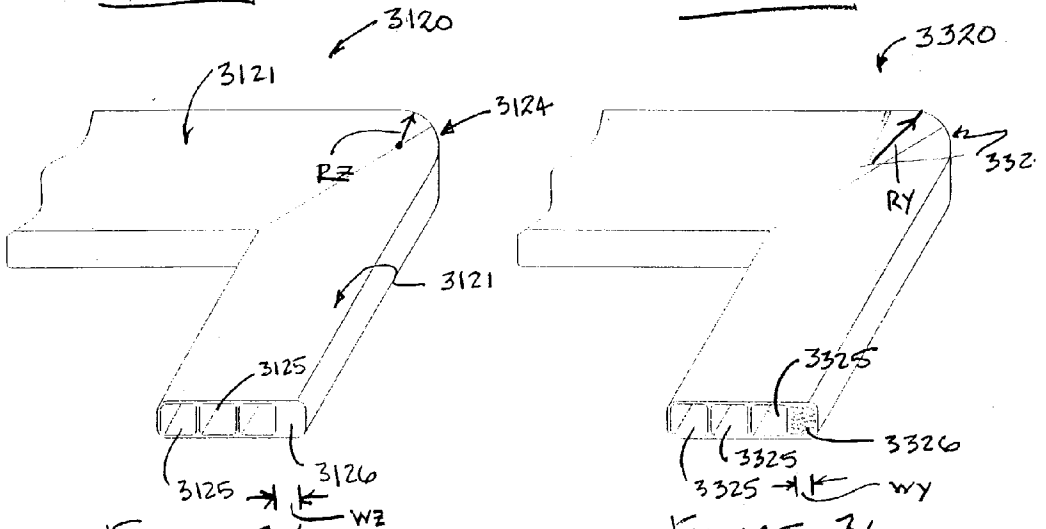
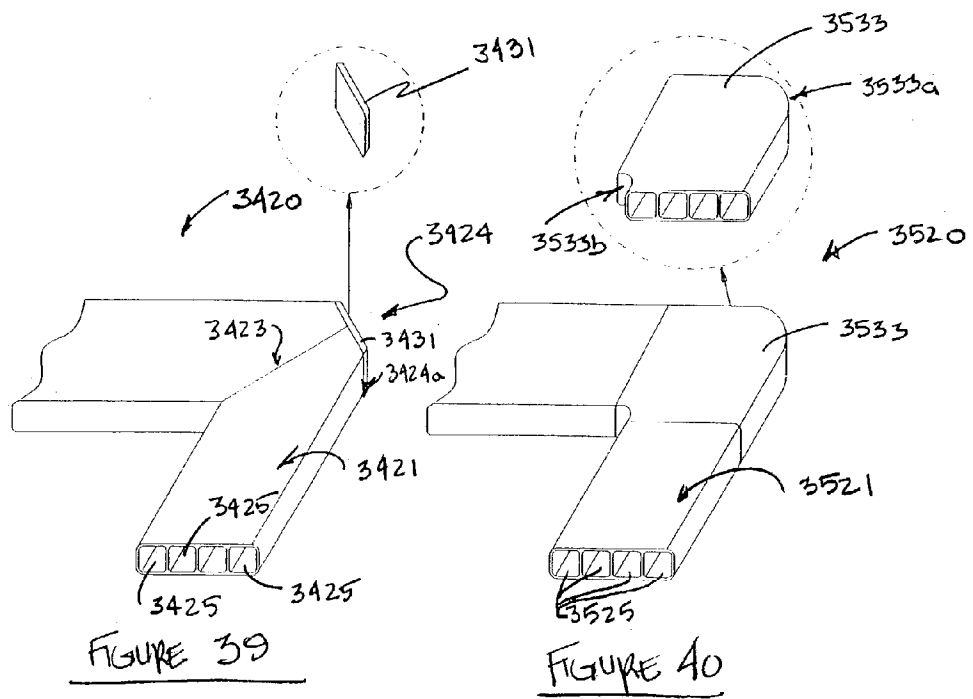
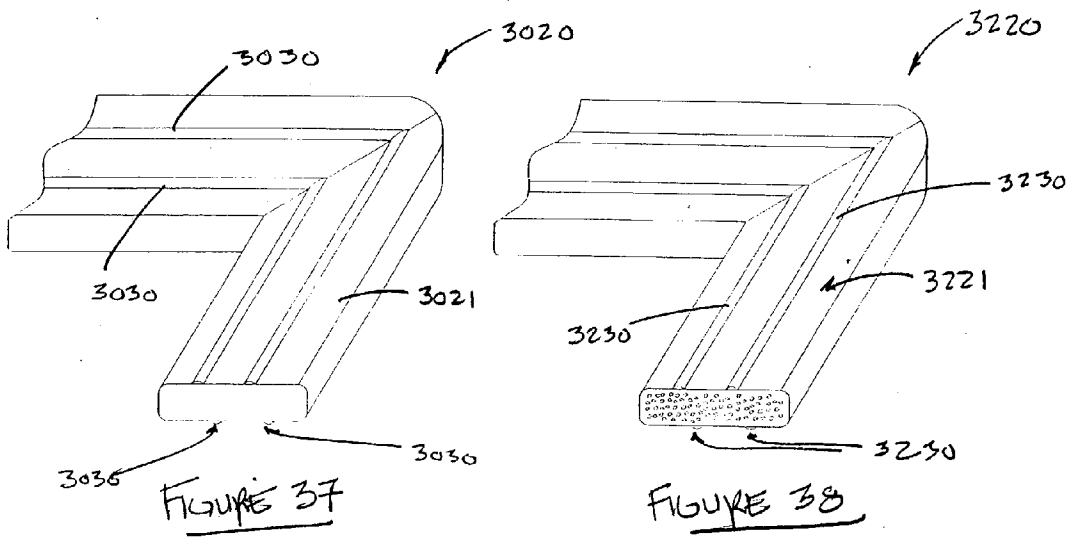


FIGURE 34

FIGURE 36



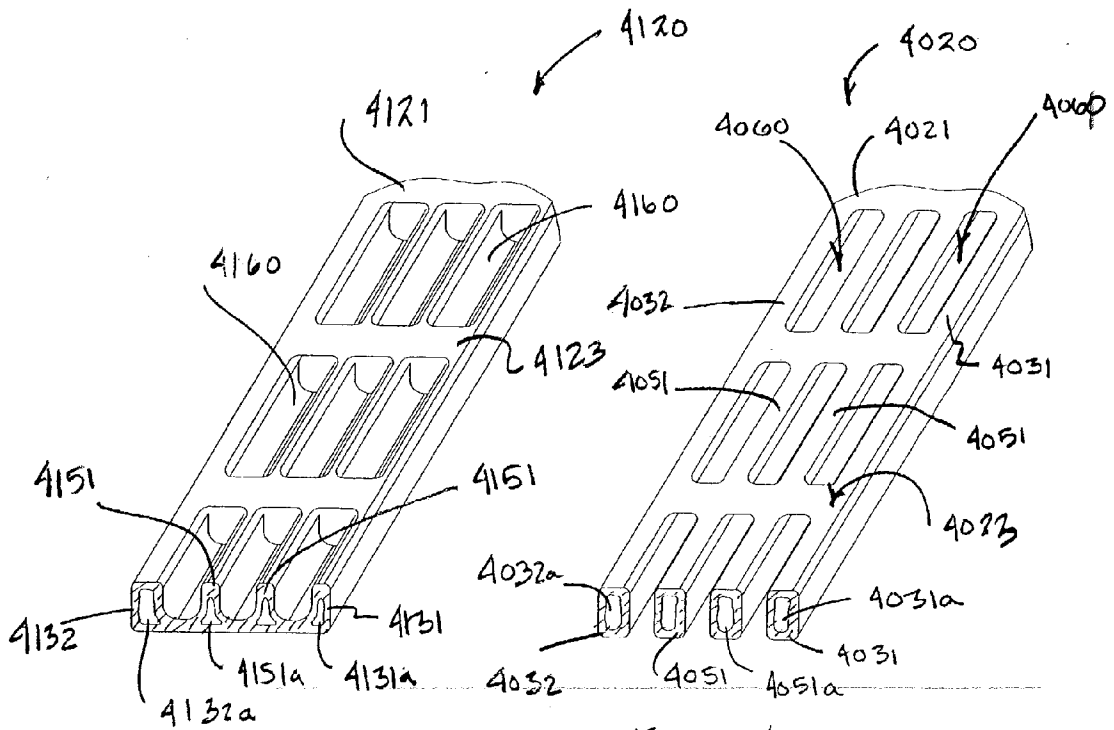


FIGURE 42

FIGURE 41



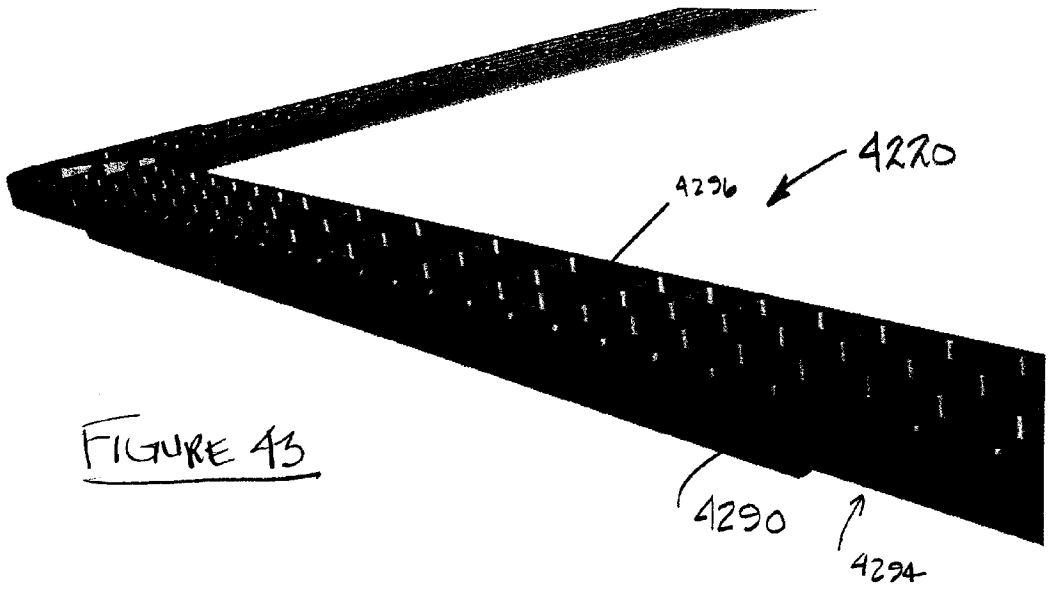


FIGURE 43

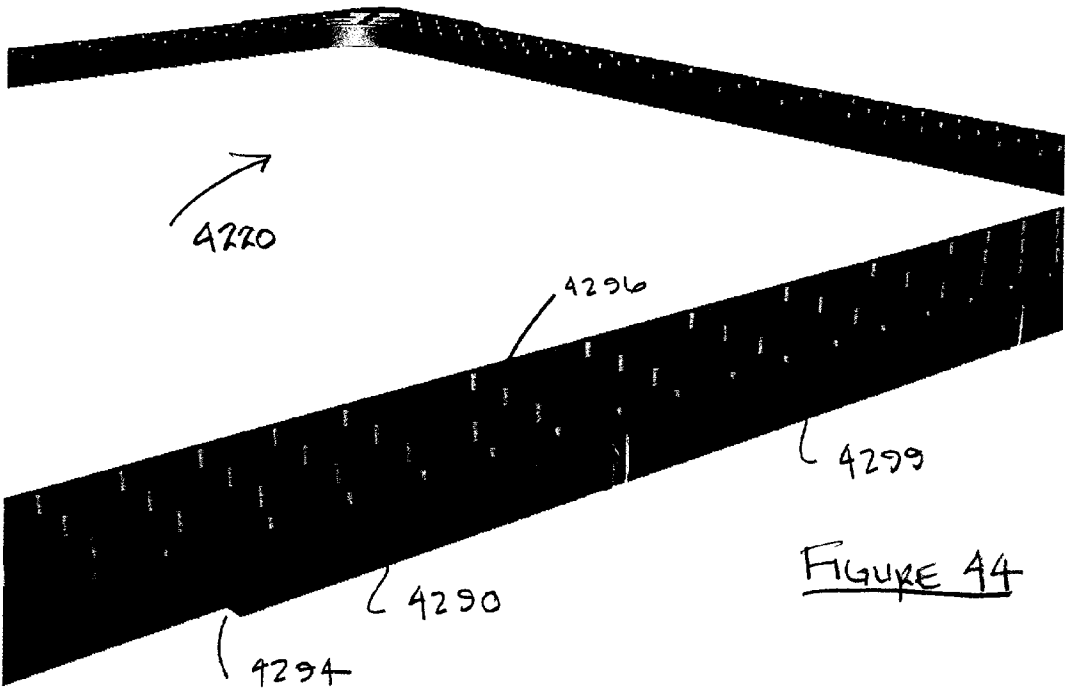
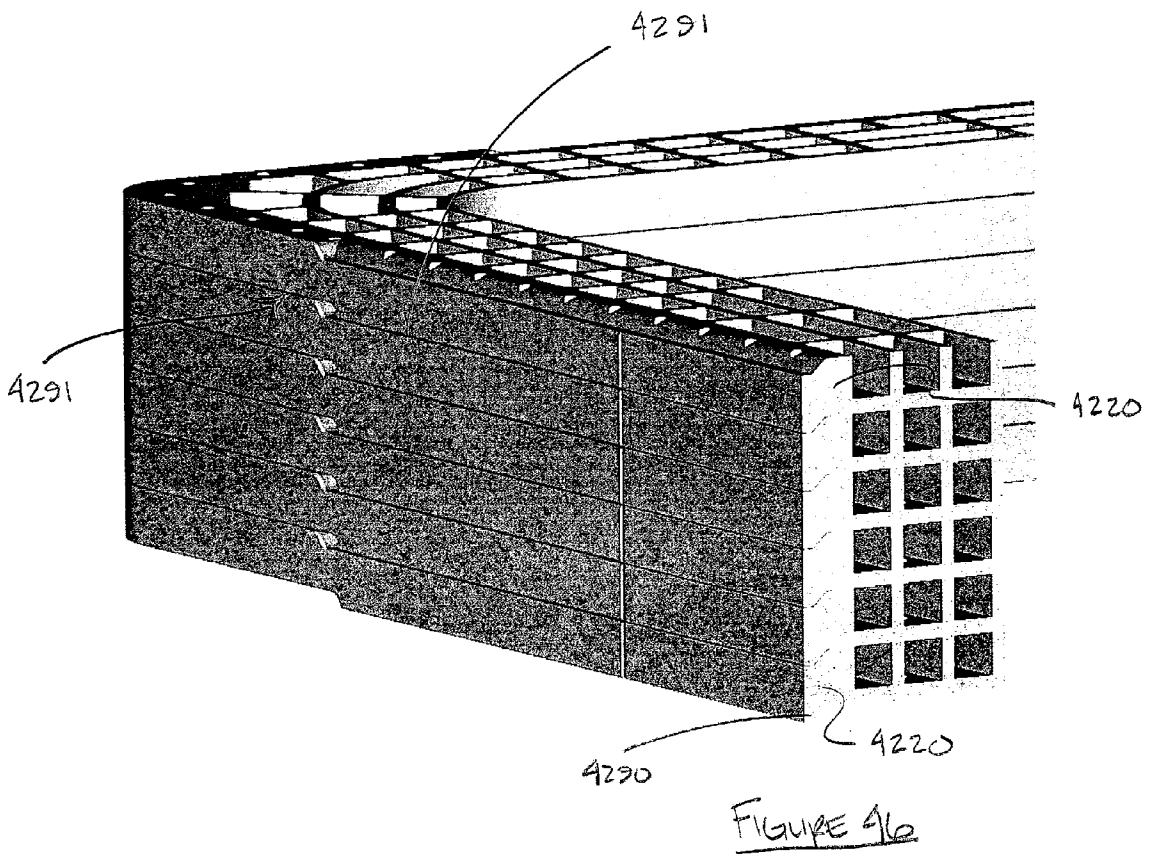
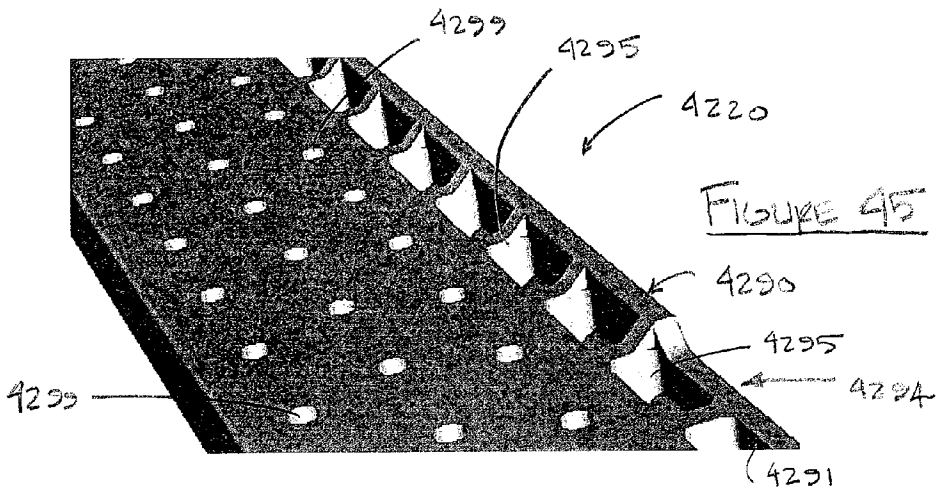


FIGURE 44



## TOP FRAME

### RELATED APPLICATIONS

[0001] This Application is a nonprovisional application of copending U.S. Provisional Patent Application No. 60/378,750, filed May 8, 2002, upon which a claim of priority is based.

### TECHNICAL FIELD

[0002] The present invention relates to frames used in conjunction with pallets, and more particularly, to a top frame strapped in a position on top of goods resting on the pallet, namely palletized goods. Goods being stored or transported can thus be secured between the pallet and the top frame.

### BACKGROUND OF THE INVENTION

[0003] It is customary to transport and store goods on pallets. Standard pallets are particularly useful in materials handling because forklift equipment can maneuver the pallets by inserting their forklift tines into openings provided by the pallet. Plastic pallets are more durable than wooden pallets. Plastic pallets light in weight, durable, capable of supporting heavy loads, easy to manufacture and have interchangeable parts are disclosed in: PLASTIC PALLET, U.S. Pat. No. 4,843,976, issued Jul. 4, 1989; PLASTIC PALLET, U.S. Pat. No. DES328,175, issued Jul. 21, 1992; PLASTIC PALLET WITH DECK ASSEMBLY, U.S. Pat. No. 5,197,395, issued Mar. 30, 1993; PLASTIC PALLET ASSEMBLY, U.S. Pat. No. 5,343,814, issued Sep. 6, 1994; TWO-PART INTERLOCKING PLASTIC PALLET, U.S. Pat. No. DES346,681, issued May 3, 1994; TWO PART INTERLOCKING PLASTIC PALLET ASSEMBLY, U.S. Pat. No. DES347,511, May 31, 1994; CONNECTOR FOR A PALLET ASSEMBLY, U.S. Pat. No. DES378,458, issued Mar. 11, 1997; CONNECTOR FOR A PALLET ASSEMBLY, U.S. Pat. No. DES354,606, issued Jan. 17, 1995; PLASTIC PALLET ASSEMBLY, U.S. Pat. No. DES364,030, issued Nov. 7, 1995; PLASTIC PALLET ASSEMBLY, U.S. Pat. No. 5,579,686, issued Dec. 3, 1996; CONNECTOR FOR A PALLET ASSEMBLY, U.S. Pat. No. DES378,458, issued Mar. 11, 1997; CONNECTOR FOR A PALLET ASSEMBLY, U.S. Pat. No. DES354,606, issued Jan. 17, 1995; PLASTIC PALLET ASSEMBLY, U.S. Pat. No. DES364,030, issued Nov. 7, 1995; PLASTIC PALLET ASSEMBLY, U.S. Pat. No. 5,579,686, issued Dec. 3, 1996; CONNECTOR FOR A PALLET ASSEMBLY, U.S. Pat. No. DES398,731, issued Sep. 22, 1998; CONNECTOR FOR A PALLET ASSEMBLY, U.S. Pat. No. DES412,047, issued Jul. 13, 1999; and, CONNECTOR ATTACHMENT FOR A PALLET ASSEMBLY, U.S. Pat. No. DES398,732, issued Sep. 22, 1998.

[0004] The pallets and connectors disclosed in these patents are owned by NUCON CORPORATION of Deerfield, Ill. USA and are highly successful.

[0005] While the goods are being moved (especially goods in bulk such as bottles), they can slip or slide on the pallet and either move to a different location on the pallet deck or fall off the pallet. Such occurrences can cause damage not only to the palletized goods but also to the pallets, to the surrounding goods, to the surrounding equipment, such as the forklift truck and surrounding pallets, and to the housing

facilities. Moreover, these occurrences can injure, even fatally, personnel in the immediate area.

[0006] While one solution is strapping the goods to the pallet, straps can slip because the goods are often irregularly shaped or are loose on the pallet, or the straps are not properly secured. Moreover, straps contacting the goods are usually narrow which can not hold all of the goods or they can cause deformation to the goods. Another solution is wrapping or banding the goods with a tight plastic sheet. This can be expensive and wasteful as the plastic sheet has to be cut and discarded. For these reasons, top frames are, at times, employed in conjunction with the pallet and the goods. The goods are placed on the pallet and a top frame is placed on the goods. The entire assembly is strapped together by encircling straps.

[0007] A highly successful top frame is shown and claimed in U.S. Pat. No. 5,160,029, titled UNITARY TOP FRAME, assigned to Nucon Corporation, the disclosure therein being incorporated herein by reference. The present invention is an improvement upon this patented top frame.

[0008] One previously attempted improvement is disclosed in U.S. Pat. No. 6,283,044 to Apps and assigned to Rehrig Pacific Company. In this patent, the inventor merely takes two of the top frames disclosed in U.S. Pat. No. 5,160,029 and welds them together. The resulting top frame in U.S. Pat. No. 6,283,044 is a single frame having an internal grid-type rib pattern of the original top frame of U.S. Pat. No. 5,160,029. Any increase in the top frame's strength appears overshadowed by the increase in its manufacturing cost.

[0009] There is a continual need for strong and efficient, feature-rich top frames that can be easily mass produced.

### SUMMARY OF THE INVENTION

[0010] According to an aspect of the present invention, a frame is composed of two identical members. Specifically, the frame comprises two generally rectangular frame members attached to each other with each one having a generally planar outer surface and an inner surface, the inner surface including a pair of generally parallel inwardly projecting rims. The two rims run along an edge of the member. In addition, there are a plurality of inwardly projecting transverse ribs disposed between the rims such that when the frame members are attached to one another, the rims and the transverse ribs confront one another. Further, each transverse rib extends from one rim towards the other rim and terminates at a distal end spaced apart from the other rim.

[0011] Preferably, the two rims are an outer perimeter rim and an inner perimeter and each rim is continuous.

[0012] According to another aspect of the present invention, the top frame includes at least one center rib between and substantially parallel to the two rims. As a result, each transverse rib extends from one rim towards the center rib and terminating at a distal end spaced apart from the center rib.

[0013] According to a further aspect of the present invention, the top frame includes an inner surface having a pair of generally parallel inwardly projecting rims, with each of the rims running along an edge of the member, and a plurality of inwardly projecting transverse ribs disposed between the

rims such that when the members are attached, the transverse ribs and rims contact the first frame member. Each transverse rib extends from one rim towards the other rim and terminates at a distal end that is spaced apart from the other rim. The perimeter rims (outer and inner) are continuous. In constructing the top frame, the frame members are attached to one another by either bonding (e.g., adhesive) or welding (heat or sonics) such that the inner most surfaces of the rims are joined to the confronting rims. In addition, the confronting ribs may also be similarly bonded to one another.

[0014] The just noted rims project from the inner surface of the member a first height and the transverse ribs project from the inner surface of the member a second height. In one embodiment, the first rim height is different (higher) than the second rib height. In another embodiment, the rib and rim heights are the same.

[0015] The internal ribbing takes on different forms. For example, the length of each transverse rib is the same length or alternate so that the distal ends of the transverse ribs appear to undulate.

[0016] For some applications, the top frame can also include an outermost peripheral edge and a lip projecting outwardly and downwardly therefrom. This lip may be either open or closed.

[0017] In addition, both continuous and non-continuous or depending perimeter lips may be employed. Non-continuous lips have specific advantages when separation sheets or divider sheets are employed.

[0018] According to a further aspect of the present invention, the outer surface of the top frame has anti-skid feature on at least one of the outer surfaces thereof. This anti-skid feature is formed by a soft material, specifically a thermoplastic elastomer applied to the outer surface of the frame. In addition, the anti-skid feature may include male protuberances and female cavities at the corners of the frame.

[0019] In addition to the structures above, a top frame can also be constructed including one or more center ribs between the two rims. This one or more center ribs are substantially parallel to the rims. In one design, the transverse ribs extend from one rim towards the center rib and terminate at a distal end spaced apart from the center rib(s).

[0020] According to yet another aspect of the present invention, a first mating segment is etched, molded or otherwise constructed into an outer surface of the frame member. A second mating segment, located at a position other than the position of the first mating segment, is etched, molded or otherwise constructed into the outer surface of the frame member. The two mating segments are constructed and located such that when a second frame is stacked upon a first frame, the male segment of the first frame aligns with and mates with the female segment of the second frame and the female segment of the first frame aligns with and mates with the male segment of the second frame. This reduces the likelihood of stacked frames from slipping or sliding relative to one another.

[0021] As to details, the first mating segment includes a plurality of male segments on the outer surface of the frame and the second mating segment includes a plurality of female segments on the outer surface of the frame. Each

male and female segment aligns and mates with a corresponding female and male segment of a frame stacked thereon. In a preferred embodiment, the segments are located adjacent the corners of the frame. Specifically, the male segments are diagonal one another and the female segments are diagonal one another. The male segments are a plurality of upwardly tapering protuberances protruding from outer surface of the frame and the female segments are a plurality of downwardly tapering cavities carved into the outer surface.

[0022] According to a further aspect of the present invention, the top frame comprises to different molded members joined together. A first generally rectangular frame member has a footprint and a generally planar outer surface. It also has an inner surface having a pair of generally parallel inwardly projecting rims, with each of the rims running along an edge of the member, and a plurality of inwardly projecting transverse ribs disposed between the rims. A second generally rectangular frame member has a generally planar outer surface and an inner surface attached to the first frame member. Each transverse rib extends from one rim towards the other rim and terminates at a distal end spaced apart from the other rim. In addition, an outer perimeter rim and an inner perimeter and each rim is continuous. The second embodiment, the second generally rectangular frame member also has a generally planar outer surface, but also an inner surface with a rim running along an edge of the member. The second frame member is attached first frame member. Both frame members have an outer perimeter rim and an inner perimeter and each rim is continuous.

[0023] According to a still further aspect of the present invention, a "Flow-Thru" top frame is disclosed. This frame includes a generally rectangular frame member with opposed sides and generally planar outer surfaces with a plurality of openings therein such that no pockets or crevices are formed therein to minimize the possibly of collecting liquid or debris. The frame member has at least two parallel longitudinal rims and a plurality of transverse ribs constructed therein and the openings are formed between the ribs and rims and by walls of those ribs and rims. All of the walls of the ribs and rim are substantially perpendicular to the outer surfaces of the frame member. The frame member is molded and the ribs and rims are solid. Or, the thicker sections of the frame can have hollows or voids. Such molding can be accomplished with gas assist technology, well known to those in the art, so that many of the ribs and rims are hollowed.

[0024] These and other aspects of the present invention will become apparent upon reading the following description of the drawings and detailed description of the invention.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0025] In the accompanying drawings forming part of the specification, and in which like numerals are employed to designate like parts throughout the same,

[0026] **FIG. 1** is the same as FIG. 1 in U.S. Pat. No. 5,160,029 and is a perspective view of a pallet, supporting goods with a top frame thereon;

[0027] **FIG. 1A** is a perspective exploded view of a top frame comprised of two confronting top frames of U.S. Pat. No. 5,160,029 married to one another;

- [0028] FIG. 2 is a perspective view of a top frame made in accordance with the teachings of the present invention;
- [0029] FIG. 3 is an exploded perspective view of the two members used to make the top frame of FIG. 2;
- [0030] FIG. 4 is perspective view of one of the members used to make the top frame of FIG. 2;
- [0031] FIG. 5 is a partial enlarged detail of the member shown in FIG. 4;
- [0032] FIG. 6 is a top plan view of the member shown in FIG. 4;
- [0033] FIG. 6A is a top plan view of an undulating rib pattern;
- [0034] FIG. 7 is a top plan view of a member having alternative ribbing to the member in FIG. 4;
- [0035] FIG. 8 is a top plan view of a member having further alternative ribbing to the members shown in FIGS. 6 and 7;
- [0036] FIG. 9 is a top plan view of a member having still further alternative ribbing to the members shown in FIGS. 6-8;
- [0037] FIG. 10 is a top plan view of a member having yet further alternative ribbing to the members shown in FIGS. 6-9;
- [0038] FIG. 11 is a top plan view of an alternative member to the one shown in FIG. 7;
- [0039] FIG. 12 is a top plan view of another alternative member to the ones shown in FIGS. 7 and 11;
- [0040] FIG. 13 is a top plan view of a further alternative member to the ones shown in FIGS. 7, 11 and 12;
- [0041] FIG. 14 is a top plan view of a further alternative member to the ones shown in FIGS. 7, and 11-13;
- [0042] FIG. 15 is a top plan view of a further alternative member to the ones shown in FIGS. 7 and 11-14;
- [0043] FIG. 16 is a top plan view of a further alternative member to the ones shown in FIGS. 7 and 11-15;
- [0044] FIG. 17 is a schematic top plan view of a top frame showing the placement and arrangement of the interlocking features;
- [0045] FIG. 18 is a perspective enlarged view of two mating interlocking features;
- [0046] FIG. 19 is another embodiment of the two mating interlocking feature shown in FIG. 18;
- [0047] FIG. 20 is a perspective view of another embodiment of a top frame made with two members;
- [0048] FIG. 21 is a cross-section view of a segment of a top frame of another embodiment constructed of two members;
- [0049] FIG. 22 shows a cross-section view of the joined members of the top frame of FIG. 21;
- [0050] FIG. 23 is a partial perspective segment view of a further embodiment of the present invention showing the addition of a depending perimeter lip;
- [0051] FIG. 24 is an cross-section view of the top frame of FIG. 23 with the frame members separated;
- [0052] FIG. 25 is a cross-section view of the top frame of FIG. 23 with the frame members bonded together;
- [0053] FIG. 26 is a cross-section of a few top frames of FIG. 23 stacked upon one another;
- [0054] FIG. 27 is a partial perspective segment view of an additional embodiment of the present invention showing the addition of another depending perimeter lip;
- [0055] FIG. 28 is an cross-section view of the top frame of FIG. 27 with the frame members separated;
- [0056] FIG. 29 is a cross-section view of the top frame of FIG. 27 with the frame members bonded together;
- [0057] FIG. 30 is a cross-section view of a few top frames of FIG. 27 stacked upon one another;
- [0058] FIG. 31 is a perspective top view of a flow-thru top frame;
- [0059] FIG. 32 is an enlarged perspective view of a corner of the top frame of FIG. 31;
- [0060] FIG. 33 is a perspective view, cut-away, at the corner of a top frame having a solid profile;
- [0061] FIG. 34 is a perspective view, cut-away, at the corner of a top frame having a profile with a combination fluted section and solid section;
- [0062] FIG. 35 is a perspective view, cut-away, at the corner of a top frame having a solid profile composed of foamed plastic;
- [0063] FIG. 36 is a perspective view, cut-away, at the corner of a top frame having a profile with a combination fluted section and foamed plastic section;
- [0064] FIG. 37 shows the top frame of FIG. 33 with an anti-skid feature added to the outer surfaces thereof;
- [0065] FIG. 38 shows the top frame of FIG. 35 with an anti-skid feature added to the outer surfaces thereof;
- [0066] FIG. 39 shows a fluted extruded top frame with a corner plate bonded thereto;
- [0067] FIG. 40 shows a fluted extruded top frame with a corner member interposed between the two profiles having a rounds at the corners;
- [0068] FIG. 41 shows a portion of a further top frame made by injection molding and with gas assist technology; and,
- [0069] FIG. 42 shows a segment of a variant to the top frame of FIG. 41 made by injection molding with gas assist technology;
- [0070] FIG. 43 shows a perspective top view of a top frame with a non-continuous depending perimeter lip;
- [0071] FIG. 44 shows another perspective top view of the non-continuous lip;
- [0072] FIG. 45 shows a close-up view of the underside of the top frame with the non-continuous lip; and,
- [0073] FIG. 46 shows the top frame of FIGS. 43-44 stacked upon one another.

## DETAILED DESCRIPTION

[0074] While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail preferred embodiments of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the broad aspect of the invention to embodiments illustrated.

[0075] As shown in FIG. 1 of the figures, typically a top frame, designated generally by the reference numeral 10, is used in conjunction with a pallet P and a plurality of straps S for holding a block of goods G. Often, palletized goods G are stacked in groups having a set number of rows with separation sheets SS between the rows. Suitable and highly successful pallets for supporting the goods are available from the Assignee and owner of the present invention, Nucon Corporation, Deerfield, Ill.

[0076] The frame 10 has both a first, top surface 11 (shown here as the surface facing away from the goods) and a second, bottom surface (not shown) (shown here as the surface facing towards the goods) and includes a pair of substantially parallel side members 13 and a pair of substantially parallel end members 14. These end members 14 are substantially perpendicular to the side members 13 so as to form a generally rectangular structure. An internal structure having two cross members, a first cross member 15 and a second cross member 16, integral with and disposed inside the rectangular structure may also be included. In particular, a first cross member 15 may be disposed between and connected to both of the end members 14 and a second cross member 16 may be disposed between and connected to both of the side members 13.

#### A. Identical Molded Members Joined Together to Form Top Frames

[0077] One of the top frames of the present invention 20 comprises two members 21. To facilitate construction and reduce manufacturing costs, the top frame members 21 may be identical and produced from the same mold. Each frame member 21 has an outer surface 22, that acts as the outside surface for the constructed frame, and an inner surface 23, that confronts the other frame member's 21 inner surface 23. Each frame has a pair of substantially parallel side members or stringers 24 and a pair of substantially parallel end stringers or members 25. These end members 25 are substantially perpendicular to the side members 24 so as to form a generally rectangular structure with a central opening therein. While the frame of FIGS. 2-6 does not include the two cross members shown in the frame 10 of FIG. 1 integral with and disposed inside the rectangular frame structure, such cross members may be included if desired for additional strength and support.

[0078] The outer surface 22 is generally planar. It is preferably flat with rounded edges. Contrarily, the inner surface 23 has a plurality of ribs and rims projecting outwardly therefrom. In particular, as shown in the detail of FIG. 5, the inner surface 23 includes a first rim 31 and a second rim 32, generally parallel to one another, projecting from the inner surface 23. These rims 31,32 project outwardly from the inner surface 23, which when the frame 20 is constructed, face inwardly (towards each other and the center of the constructed frame) from the inner surface. The

first rim 31 runs along or forms the outermost peripheral edge 26 of the member 21 and is preferably continuous. The second rim 32 runs along or forms the innermost peripheral edge 27 of the member 21 and is also preferably continuous. The rims 31,32 are constructed so as to have a sufficient height to mate with the opposing rims 31,32 when confronting frame members 21 are mated to form the top frame 20. Attaching the members 21 together, discussed below, seals the inside of the top frame from the environment and prevents moisture and contaminants from entering the inside of the top frame.

[0079] Though not shown in all the figures or discussed further in detail, it is recognized that the outermost peripheral edge 26 of the member 21 may not be straight but will have a slight indentation (reference letter I in FIG. 5) to accommodate straps. Specifically, to prevent the encircled straps S typically used to bind the palletized goods, from sliding or breaking as a result of their added thickness, i.e., rubbing against other frames, strap slots/indentations I are provided in the frame 20.

[0080] Each member 21 further has a plurality of projecting transverse ribs 41,42 between the edge rims 31,32. One transverse rib 41 extends from the outer perimeter rim 31 (the first rim 31, the one running along the outermost peripheral edge 26) towards the inner perimeter rim 32 and terminates at a distal end 41a that is spaced apart from the inner rim. The other transverse rib 42 extends from the inner perimeter rim 32 (the second rim 32, the one running along the innermost peripheral edge 27) towards the outer perimeter rim 31 and also terminates at a distal end 42a that is spaced apart from the outer perimeter rim. Consequently, there is a gap formed between the distal ends 41a,42a of the transverse ribs 41,42 and their respective opposed rims 32,31.

[0081] For strength and rigidity, as shown in FIG. 5, the transverse ribs 41,42 are substantially parallel to one another and perpendicular to the rims 31,32. As such, the ribs support and added strength to the edges of the frame and minimize contorting, twisting or bending of the frame's side members 24 and end members 25.

[0082] Each frame member 21 may further include a center rib 51 that runs between and substantially parallel to the outer and inner perimeter rims 31,32. This center rib 51, like the perimeter rims 31,32, is preferably continuous. A plurality of center transverse ribs 52,53 spoke out from and extend from the center rib 51 towards either the outer perimeter rim 31 or the inner perimeter rim 32. In particular, one center transverse rib segment 52 extends from the center rib 51 towards the outer perimeter rim 31 and terminates at a distal end 52a that is spaced apart from the outer rim. The other center transverse rib segment 53 extends towards the inner perimeter rim 32 and also terminates at a distal end 53a that is spaced apart from the outer inner perimeter rim. Consequently, there is again a gap formed between the distal ends 52a,53a of the center transverse ribs 52,53 and the opposed rims 32,31. With the center rib 51 utilized, one transverse rib 41 extends from the outer perimeter rim 31 towards the inner perimeter rim 32 and center rib 51 and terminates at a distal end 41a that is spaced apart from the center rib; and, the other transverse rib 42 extends from the inner perimeter rim 32 towards the outer perimeter rim 31 and center rib 51 and terminates at a distal end 42a that is

spaced apart from the center rib. There is thus a gap formed between the distal ends **41a,42a** of the transverse ribs **41,42** and the center rib **51**.

[0083] As shown in **FIG. 5**, each “pair” of opposed center transverse rib segments (e.g., reference numbers **52b,53b**) may be collinear so as to form a continuous transverse rib intersecting the center rib **51** or each center transverse rib segment (e.g., reference numbers **52c,53c**) may be staggered or alternating (not collinear).

[0084] The entire pattern, or configuration, of the ribs shown in **FIG. 5** can be seen in the top view of **FIG. 6**. The structure may aptly be described as a “facing combs” pattern in that the transverse ribs, like teeth of a comb, extend parallel to one another outwardly. Here one set of transverse ribs **41** face a first set of opposed center transverse ribs **52** and another set of transverse ribs **42** face a second set of opposed center transverse ribs **53**, all without touching, intersecting or crossing one another. The ribs do overlap in that, though not touching, they pass beyond each other. For example, there is an area between opposed ribs distal ends wherein the ribs lie next to each other, a zone of overlapping. In the illustrated embodiment, the ribs of the one set alternate with the first set of ribs (rib **41-rib 52-rib 41-rib 52**, etc.) and the ribs of the another set alternate with the second set of ribs (rib **42-rib 53-rib 42-rib 53**, etc.). As a result, an alternating pattern of ribs is presented. In addition, the transverse ribs **41,42** do not touch intersect or cross the center rib **51** and the transverse center ribs **52,53** do not touch, intersect or cross the rims **31,32**.

[0085] As noted, the distal end of ribs from two combs extends past the other distal end of the facing rib creating a zone of overlapping. This is contrary to conventional grid patterns for internal ribs, as demonstrated in the prior art. The solid and continuous outer surface **22** is another contributing factor to the strength of the design.

[0086] While the ribs may be evenly spaced from one another, for added strength and/or rigidity, there may provided areas or zones of increased density, such as the areas marked **A** in **FIG. 6**. In such high density areas, the distance between ribs is less than in other areas. Such zones of higher density include those portions of the top frame contacting the straps encircling the pallet, goods and frame. These areas are adjacent the strap indentations **I** and thus have more pressure and force applied to them.

[0087] The length of each transverse rib is the distance the transverse rib extends from the one rim towards the center rib and the length of each transverse center rib is the distance the transverse center rib extends from the center rib towards the edge rim. In **FIG. 6**, the transverse ribs **41,42** are approximately the same length. Similarly, the transverse center ribs **52,53** are the same length.

[0088] **FIG. 6A** shows an alternative embodiment of undulating ribs. Specifically, the lengths of the transverse ribs decrease (**L1-L2-L3**) and then increase (**L3-L2-L1**) in a repeating pattern. In this manner, the transverse ribs (actually their distal ends) will appear to be undulating. In addition, the lengths of the transverse center ribs can decrease (**M1-M2-M3**) and then increase (**M3-M2-M1**) in a repeating pattern so that they too (actually their distal ends also) will appear to be undulating. Using this undulating ribs can further reduce the cost of manufacturing the top frame and reduce the weight.

[0089] In the preferred embodiment, the ribs and rims of the member **21** have the same height, that being distance the ribs/rims project from the inner surface **23**. In this manner, the outermost (or innermost) surface of the ribs and rims is complainer, facilitating the welding thereof to corresponding ribs and rims on a confronting, second member **21** to form a frame **20**.

[0090] Thicker, longer or larger transverse ribs **41b** are employed in the corners of the top frame member **21** to absorb the larger impacts typically received in the corners of the top frame. Similarly, for added strength, corner fillets **55** are molded in the corners of the innermost peripheral edge **27** adjacent the inner perimeter rim **32**.

[0091] To complete the construction of a finished top frame **20**, two members **21** are brought together, with the inner surfaces **23** facing each other, aligned and bonded together. A preferred bonding method is hot plate welding wherein a heated metal platen is inserted between the two confronting members **21** and each member is then brought into contact with the heating platen disposed therebetween for a preselected length of time. The innermost plastic surface(s) of the inner surface **23** (specifically, the plastic surface(s) closest to the confronting member and the surface projecting furthest from the inner surface of each frame member—here the rims and ribs) is heated to at least its melting temperature, resulting in its softening and melting. Once the heated surfaces are softened or melted, the heating platen is withdrawn from its position between the members. The two frame members are next brought into contact with one another and the innermost surface(s) **23** (ribs and rims) are pressed together under pressure. The molten plastic is then cooled down, resulting in a strong bond between the two members joined together.

[0092] Other methods of bonding include, but not limited to, adhesive bonding, friction welding, ultrasonic welding and mechanical fastening.

[0093] Preferably, the ribs and rims are at the same height. Therefore, the heating platen will contact all the outer surfaces of the ribs and the rims and melt them for bonding. This succeeds in maximizing the bonding surface area between the two frame members.

[0094] Alternative designs having different rib configurations are shown in **FIGS. 7-10**. Alternative top frame structures or constructions are shown in **FIGS. 11-14**. In these figures, like components and elements are like numbered but in different series (such as 100 series, 200 series, etc.)

[0095] In **FIG. 7**, the center rib **151** of the frame member **121** is not continuous in the corners. Rather, the center wall **151** is interrupted and divided into two parallel center walls **151a**, each with a flange, or transverse center rib **151b**, extending therefrom.

[0096] In **FIG. 8**, the center rib of the frame member **221** is modified to have two parallel center ribs **251**. These parallel ribs **251** are also not continuous in the corners. Rather, each center wall **251** is interrupted and divided. Each **251** terminates in either two angled flanges **151a,151b** or a single flange **151c**. The center ribs **251** each have transverse center ribs **252,253** extending therefrom so as to form T-shaped intersections. The center ribs **251** can also be continuous as well.

[0097] In FIG. 9, the center rib of the frame member 321 is modified to have two parallel center ribs 351. Each center rib 351 has transverse center ribs 352,353 extending therefrom. This accentuates the comb configuration noted previously. The center ribs 351 and the transverse center ribs 252,253 extending therefrom form X-shaped intersections.

[0098] In FIG. 10, the center rib 451 of the frame member 421 is modified to have angular transverse center ribs 452,453. Instead of all the transverse center ribs being normal or perpendicular to the center rib 451, some 452,453 intersect at other angles, such as 45 degrees. Though not shown, curved ribs are also possible. The important aspect is that if a single mold is used to make a frame, the ribs need to be arranged as mirror images of so that when the members are brought to face one another and together to make the frame, the ribs face one another for bonding.

[0099] In FIG. 11, the top frame 521 includes pronounced corner braces 528, with an inner rim 533 along the edge or perimeter and a series of parallel ribs 556. Corner bracing aids in transmitting horizontal strapping forces that are put on the top frame in a perpendicular directions. When the frame is strapped in two directions, a standard practice, the corner bracings transmit the perpendicular forces against each other. This helps to reduce any deflection of the top frame. Existing molded top frames usually have small radii in the inner/inside corners, typically in the range of less than 2"; existing extruded or wooden top frames usually have perpendicular inside/inner corners.

[0100] FIGS. 12-15 show numerous variants of top frames and top frame members 821. Each member 821 includes opposed side stringers 824 and opposed end stringers 825. The variations include adding a single center cross member or stringer 826 (FIG. 12), two intersecting cross members 826,827 (FIG. 13), two parallel cross members 828 (FIG. 14), two parallel cross members 828 with bridging stringers 829 (FIG. 15) and corner stringers or braces 830 (FIG. 16). In each of these variants, the rim and rib configuration (patterned after the one shown in FIGS. 5 and 6) are shown. Conventional grid pattern ribs, or other patterns, can be used as well.

[0101] As shown in FIG. 16, the corner stringers 830 intersect the rectangular side and end stringers 824,825 behind the strap indentations I. The corner stringer 830 thus add extra support to the areas of the frame most subjected to strap tension (I). Similarly, the bridging stringers 829 and cross members 828 in FIG. 15 are located behind the strap indentation area I as well.

[0102] While the frame of the present invention has been described alone and in conjunction with a pallet, it is important to note that by the present design, it is easily transportable with other similar frames on return trips or during storage. It can be easily stacked. In addition, the frame of the present invention is preferably made of plastic and injection molded.

#### B. Interlocking Features of Top Frames

[0103] An interlocking feature is utilized to assist in stacking the frames one upon another. This feature is shown in FIGS. 17 and 18. FIG. 17 shows schematically the placement on the outer surface 22 of the frame member 21 placement of male interconnection segments 61 and female

interconnection segments 71. The segments 61,71 are portions of the outer surface 22 molded so as to have a particular, contoured profile, as opposed to being flat or plainer. The male segments 61 mate with the female segments 71, discussed below. The two male segments 61 are diagonal from one another and the two female segments 71 are diagonal from one another across the top frame. As such, after two frame members are joined together to form a completed top frame, a male segment on the top of the completed frame will have a corresponding female segment on the bottom of the same frame at the underneath, that being the same location below the male segment. The corollary is also true in that in a completed frame, a female segment on the top will have a male segment directly below it.

[0104] One pair of diagonal corners (diagonal to one another) of a top frame has a male segment on each of the corner's top outer surface with a female segment underneath on the corner's bottom outer surface. The other pair of diagonal corners (diagonal to one another) of the top frame has a female segment on each of the corner's top outer surface with a male segment underneath on the corner's bottom outer surface. In short, each outer surface (top and bottom) has two male segments and two female segments. The male segments are diagonal one another and the female segments are diagonal one another. Under each top surface male segment is a female segment on the bottom surface. Similarly, under each top surface female segment is a male segment on the bottom surface. With this arrangement, one top frame will always interlock with another top frame, no matter which one is turned 180 degrees or upside down.

[0105] FIG. 18 shows the male and female segments more particularly. The male segment 61 comprises a plurality of protuberances 62 protruding from outer surface 22 of the top frame member 21. These protuberances can be conical or other shapes. In the embodiment illustrated they are pyramidal having four sides 63 and a peak 64. Corresponding to the male protuberances, the female segments 71 have pyramidal cavities 72 having four side walls 73 and a basal 74. Thus, when the outer surfaces 22 of adjoining frames are abutting one another, the plurality of protuberances 62 align with the plurality of cavities 72 to reduce slippage between the frames.

[0106] FIG. 19 shows an alternative arrangement of the interlocking feature. The top frame 920 has frame members 921 with the male segment being a single male protuberance 961 and the female segment being a single female cavity 971 constructed (molded) in the outer surface 922 of the at the corners. The male protuberance 971 aligns and mates with the female cavity 961 of an adjacent top frame 920 when they abut one another. It is understood that the number, size and configuration of the male protuberances and female cavities can vary from those shown in FIGS. 18 and 19.

#### C. Different Molded Members Joined Together to Form Top Frames

[0107] FIG. 20 shows a perspective view of another embodiment of the top frame formed by two-pieces attached to one another. Specifically, the top frame 1020 has a first top frame member 1021 like the one 21 shown in FIG. 1A and U.S. Pat. No. 5,160,029. The second, mating top frame member 1021a is a flat sheet having a footprint identical to



the first top frame member **1021**. The first and second top frame members **1021,1021a** are joined together to form a single top frame **1020**.

[0108] FIG. 21 shows a further variant of the top frame **1020** of FIG. 20. Instead of a flat sheet acting as the second top frame member, the second top frame member **1021b** has rims **1031b,1032b** along the edges thereof to mate with the rims **1031,1032** of the first member **1021**. However, unlike the first member **1021**, the second member **1021b** does not have ribs therein. It is understood that the center ribs **1051** can be of any pattern.

[0109] FIG. 22 shows the frame of FIG. 21 joined together.

#### D. Top Frames With a Closed Lip

[0110] FIGS. 23-26 show a further embodiment of the present invention. As shown in the partial perspective segment view of FIG. 23, the frame **1120** is also a two-piece top construction formed of a top frame member **1121a** and a bottom frame member **1121b** welded together as discussed above. The frame **1120** includes a downwardly projecting lip **190**. This lip **190** projects downwardly along and from the entire perimeter of the frame **1120** and is formed by the joining, or welding, of downwardly projecting portions **191,192** from the frame members. Specifically, the lip **190** projects outwardly and downwardly from the outermost peripheral edge (**1126**) of the top frame. FIGS. 23-26 show generally the construction and configuration of each projecting portion **191,192** combined to make the lip **190**. The lip of FIGS. 23-27 is "closed" in that when it is formed by joining the frame members together, it is sealed, or closed off, from the outside. In short, the interior of the lip **190** is sealed off from the outside.

[0111] Thus, when bulk products, such as bottles, are stacked in multiple layers on top of a pallet, the top layer of product has a tendency to fall from the stack first. This can happen even though a top frame is used and straps are applied over the top frame. A cause of this is the localized strap tensions applied to the bottles since the strap tension may loosen over time due to the expansion or loosening of the straps or the deformation of the top frame. The lip **190** aids with preventing such bulk products on the top layer of a stack of goods from falling out. The lip also increases the rigidity of the top frame. The area above the lip **190** is recessed, forming a shoulder **193**, to allow for the nesting of the top frames when they are stacked together.

#### E. Top Frames With an Open Lip

[0112] In contrast to the embodiment of FIGS. 23-26, FIGS. 27-30 show another embodiment **1220** of the present invention wherein the lip **290** is "open." The frame **1220** is also a two-piece top construction, formed of a top frame member **1221a** and a bottom frame member **1221b** welded together. The lip **290** projects downwardly along and from the entire perimeter of the frame **1220**; it **290** is formed by the joining of perimeter edge or rim **291** of the top member **1221a** with downwardly projecting portion **292** of the bottom frame member **1221b**. Specifically, the lip **290** projects outwardly and downwardly from the outermost peripheral edge **1226** of the bottom member **1221b** of the top frame **1220**. The outer rim **291** of the top member **1221a** remains unchanged. FIGS. 23-26 show generally the construction

and configuration of each projecting portion **291,292** combined to make the lip **290**. The lip is "open" in that when it is formed by joining the frame members together, it's underside **294** is exposed to the outside. Gussets or webs **295** are formed within the lip.

[0113] As before, the area above the lip **290** is recessed, forming a shoulder **293**, to allow for nesting of the top frames **1220** when they are stacked together.

#### F. Top Frames With Non-Continuous Lip

[0114] FIGS. 43-46 show a top frame **4220** with a non-continuous depending perimeter lip **4290**. Specifically, downwardly projecting perimeter lips **4290** are typically continuous around the entire outer edge of the top frame **4220**. When bulk products are stacked on a pallet, divider sheets (separation sheets **SS** (FIG. 1)) are used to separate each layer or row of goods. A divider sheet is also placed on the top of the top layer or row of goods to cover the products up just below the top frame. When a top frame with a continuous lip is used, the top frame needs to be slightly larger than the sheets so that the depending perimeter lip does not interfere, damage or destroy the uppermost sheet.

[0115] By employing non-continuous depending lips **4290**, the top frame can be the same size as the divider sheets and pallet supporting the goods. The depending lips (one or more along each side) of the frame cause the divider sheet to curl or bend downwardly along the sheet's outer edge. Specifically, the inner surface **4291** of the lip **4290** abuts the outer margins of the divider sheet causing the edge of the divider sheet to deform or bend downwardly also. Because the lip does not extend to the corner of the frame (recesses **4294**), the corners of the divider sheets relax and extend, without forming folds or folding crests.

[0116] Another advantage of non-continuous lips is the recesses **4294** between the lips (the non-continuous gap portion) permit better, more secure stacking of the top frames (FIG. 46). The lips **4290** and the recesses **4294** interlock stacked frames **4220**. This is particularly advantageous during shipping.

[0117] The lips, whether continuous or discontinuous, are supported by internal gussets **4295** or other means. These gussets **4295** are inclined or rounded to facilitate the curling of the divider sheets abutting the lip **4220**. Drainage holes **4299** may also be provided in pockets for permitting fluids (wash water, snow, rain, etc.) to drain from the frame. U-channels **4296** are provided along the perimeter of the frame. These can, if desired, be reversed (upwardly facing). Most, if not all, of the frames disclosed in this specification can employ a non-continuous perimeter lip.

#### G. Flow-Thru Top Frames

[0118] The above descriptions focus upon two-piece welded top frames. This, of course, is not necessary. As set forth above, single piece top frames, e.g., U.S. Pat. No. 5,160,029, have been quite successful. To this end, attention is directed to FIGS. 31 and 32, wherein a flow-thru top frame **2020** is shown. Traditional top frames have solid outer surfaces (e.g., surface **22** in FIG. 3). If the ribs are exposed, they can catch and hold debris over time. After washing, they can also collect water. An improvement to this construction may be achieved by removing the solid outer surfaces so as to form cells that are open, or with continuous channels or holes.

[0119] The flow-thru top frames of the present invention (FIGS. 31, 32, and 41-42) are preferably constructed of one piece and not two pieces as discussed above. The top frame members are thus preferably not joined together.

[0120] With this flow-thru construction, the frame member 2021 has opposed outer surfaces 2022 constructed of a pair of parallel rims 2031 and 2032, with a plurality of transverse ribs 2041 disposed therebetween and longitudinal center ribs 2051 parallel the rims (2031,2032) and intersecting the ribs (2041), all forming channels 2060 therethrough.

[0121] FIG. 32 is an enlarged view of a corner area of the flow-through top frame of FIG. 31. There are, like those shown in FIG. 19, designed in pairs, comprising a single male protuberance 2061 and single female cavity 2071 for interlocking. The construction of these segments 2061,2071 is the same as those discussed above.

#### H. Extruded Top Frames

[0122] Extruded top frames are usually made of hollowed profiles joined together. Typically, four equal sized profiles are joined together at the corners, much like a picture frame, to form the entire top frame. Each corner is mitered at 45 degrees to be joined with another corner mitered at 45 degrees. Such frames are well known in the industry.

[0123] Hollowed profiles are pieces with an outer skin and a void therein. Hollowed profiles are typically made with thin and uniform wall thicknesses to ensure lightweight and rapid extrusions. For an extruded top frame, cut and welded at the corners, one shortcoming is that the corner forms is a 90-degree apex, or bend, on the outside edge; this configuration affects the handling of the frame. However, one cannot cut this sharp outer corner edge off because to do so would open a hole, exposing the hollowed interior of the frame and degrading its strength.

[0124] FIG. 33 shows a corner segment of a top frame 3020 made with extruded solid (3022) profile 3021. There are four such corners associated with the top frame 3020. The corner is cut (miter cut of 45 degrees), joined (at seam 3023) and rounded 3024. Because the profile is solid, the hollow interior typically associated with such a cut after rounding does not occur.

[0125] FIG. 34 shows the corner of a frame 3120 with an interior comprised of a combination of fluted sections 3125 (e.g., closed channels, passageways, etc.) and at least one solid section 3126. Typical profiles with fluted sections are shown in FIGS. 39 and 40. (In FIG. 39, the top frame 3420 has profiles or pieces made with equal sized flutes, boxes or channels 3425). The width WZ of the solid section 3126 is determined by the radius RZ of the outer corner 3124. Thus, the portion cut away to round the corner (a radius RZ) will be solid and will not extend into a flute or channel. As noted above, if there is no solid portion 3126 and the outer surface of the corner is rounded, the interior flutes will be uncovered, exposing the inside of the frame to the outer elements and greatly reducing the strength of the frame. Thus, when the width WZ of a solid section 3126 is greater than a critical width determined by RZ, the solid section will cover the fluted section 3125 after the corner 3124 is cut.

[0126] This design has the benefits of the fluted profile, that being reduced weight, and the advantages of the solid profile, that being the ability to round the corners.

[0127] FIG. 35 shows a corner segment of a top frame 3220 made with extruded foamed 3222 profiles 3221. Foamed plastic 3222 has closed cellular cores and a solid outer skins. Because the cells are closed, water cannot penetrate to the interior of the profile 3221 even when the corner is cut and the core of the profile is exposed.

[0128] FIG. 36 shows a top frame 3320 having a combination of fluted sections 3325 (e.g., closed channels, passageways, etc.) and a foamed section 3326. The width WY of the foamed section 3326 is, as before, determined by the outer radius RY of the corner 3324. When the width WY of a foamed section 3326 is greater than a critical width determined by RY, the foamed section will cover the fluted section 3325 after the corner 3324 is cut. The benefit of this combination is reduced weight.

#### Anti-Skid Features Added to Top Frames

[0129] FIGS. 37 and 38 show an anti-skid feature being used with two top frames 3020,3220 discussed above. The anti-skid feature is one or more collinear beads or lines 3030,3230 applied to the one or both outer surfaces of the top frame. The anti-skid material is a thermoplastic elastomer and may be either applied to the outer surfaces of the top frame (e.g, while still in the liquid state) or co-extruded with the outer surface of the top frame. In the embodiments shown, the thermoplastic elastomer is applied as two parallel lines on the outer top surface and outer bottom surface of the frame. It is appreciated that several other configurations can be employed to reach satisfactory results of minimizing undesired movement relative to the top frame of items abutting the top frame. This anti-skid feature can be used in the other types of extruded top frames disclosed herein.

[0130] FIG. 39 shows a further improvement, that being the employment of corner plates. Specifically, the top frame 3420 is composed of a plurality of identical fluted 3425 profiles 3421. The profiles 3421 are mitered and jointed (3423) at the corners 3424 as before. Instead of rounding the outer edge of the corner, the outer edge of the corners are cross-cut (3424a) (perpendicular to the miter cuts 3423). This cross-cut 3424a exposes the interior flutes 3425. A corner plate 3431 is attached to the opening created by the cross-cut to seal off any exposed flutes. As a result, the corner plate 3431 acts as the outer edge of the frame 3420. The corner plate 3431 can be bonded to the profiles 3421 by adhesives or by welding.

[0131] FIG. 40 shows yet another improvement to the top frames by constructing a top frame 3520 made with extruded fluted profiles 3521. A separate corner member 3533 is interposed and connected (by welding or adhesives) between the profiles 3521. As such, the profiles are not mitered at 45 degrees and joined; rather, they are cut perpendicular to their edges and joined to the corner member 3533. The profiles 3521 thus form the sides of the top frame 3520 while the corner members 3533 form the corners of the top frame. Each corner member 3533 may have a rounded outer edge 3533a and rounded inner edge 3533b. Corner members 3533 can be made by injection molding processes and can be bonded to the profiles to cover the exposed interior after the corner is cut.

#### I. Gas-Assisted Molded Flow-Thru Top Frames

[0132] The top frame 4020 of FIG. 41 is constructed much like the top frame 2020 of FIGS. 31 and 32; it is also a

flow-thru type design. As such, the components of the frame **4020** are referenced like the frame **2020** of **FIGS. 31 and 32**. The frame member **4021** has opposed outer surfaces **4022** constructed of a pair of parallel rims **4031** and **4032**, with a plurality of transverse ribs **4041** disposed therebetween and longitudinal center ribs **4051** parallel the rims (**4031,4032**) and intersecting the ribs (**4041**), all forming channels **4060** therethrough.

[**0133**] The top frame **4020** is made by injection molding and with gas assistance (“gas assist”) technology. This technology, well known to those skilled in the industry, forces material, while liquid, to the outer surfaces of the mold, leaving voids or hollows within the various molded elements (e.g., see the voids **4031a,4031b,4051** in rims **4031,4032** and center ribs **4051**) when the liquid element solidifies. This technique of molding, wherein the thick sections have hollows or voids, can significantly reduce weight of the molded articles. As such, the rigidity to weight ratios improve for the top frame’s construction.

[**0134**] **FIG. 42** shows a segment of a top frame **4120** that is a variant to the top frame **4020** of **FIG. 41** made by injection molding with gas assist technology. Specifically, the top frame **4120** of **FIG. 42** has troughs **4160** formed in the place of the flow-thru channels **4060** of the top frame **4020** of **FIG. 41**.

[**0135**] While specific embodiment have been illustrated and described, numerous combinations and modifications come to mind without significantly departing from the spirit of the invention and the scope of protection is only limited by the scope of the accompanying claims. For example, the interlocking features, center stringers, corner stringers or bracings, anti-skid features mentioned may be combined with the each of the top frames described above.

I claim:

1. A top frame comprising:
  - two identical generally rectangular frame members attached to each other with each having
    - a generally planar outer surface and an inner surface having a pair of generally parallel inwardly projecting rims,
    - with each of the rims running along an edge of the member, and a plurality of inwardly projecting transverse ribs
    - disposed between the rims such that when the members are attached, the rims and the transverse ribs confront one another, each transverse rib extending from one rim towards the other rim and terminating at a distal end spaced apart from the other rim.
2. The top frame of claim 1 wherein there is an outer perimeter rim and an inner perimeter and each rim is continuous.
3. The top frame of claim 1 wherein the rims project from the inner surface of the member a first height and the transverse ribs project from the inner surface of the member a second height, the first height being different than the second height.
4. The top frame of claim 1 wherein the rims project from the inner surface of the member a first height and the transverse ribs project from the inner surface of the member a second height, the first height being substantially the same as the second height.
5. The top frame of claim 1 wherein the length of each transverse rib is the distance the transverse rib extends from the one rim towards the other rim and wherein the transverse ribs either have the same length or alternate so that the distal ends of the transverse ribs appear to undulate.
6. The top frame of claim 1 wherein the frame members are attached to one another by one of bonding or welding such that the inner most surfaces of the ribs and rims are joined to the confronting ribs and rims.
7. The top frame of claim 1 further including an outermost peripheral edge and a lip projecting outwardly and downwardly therefrom.
8. The top frame of claim 7 wherein the lip is closed.
9. The top frame of claim 7 wherein the lip is open.
10. The top frame of claim 1 wherein the outer surface of the top frame has anti-skid feature on at least one of the outer surfaces thereof.
11. The top frame of claim 10 wherein the anti-skid feature is formed by a soft material.
12. The top frame of claim 11 wherein the soft material is a thermoplastic elastomer applied to at least one outer surface of the top frame.
13. The top frame of claim 10 wherein the anti-skid feature has at least one male protuberance and one female cavity at least one corner of the top frame.
14. The top frame of claim 1 further including at least one center rib between and substantially parallel to the one rim and the other rim, each transverse rib extending from one rim towards the center rib and terminating at a distal end spaced apart from the center rib.
15. The top frame of claim 14 wherein there is an outer perimeter rim and an inner perimeter and each rim and the center rib is continuous.
16. The top frame of claim 14 wherein the rims project from the inner surface of the member a first height and the transverse ribs project from the inner surface of the member a second height, the first height being different than the second height.
17. The top frame of claim 14 wherein the rims project from the inner surface of the member a first height and the transverse ribs project from the inner surface of the member a second height, the first height being substantially the same as the second height.
18. The top frame of claim 14 wherein the length of each transverse rib is the distance the transverse rib extends from the one rim towards the other rim and wherein the transverse ribs either have the same length or alternate so that the distal ends of the transverse ribs appear to undulate.
19. The top frame of claim 14 further including a plurality of center transverse ribs, each transverse rib extending from the center rib to either the one rim or the other rim and terminating at a distal end spaced apart from the rim, the center transverse ribs being spaced apart from the transverse ribs.
20. The top frame of claim 19 wherein a transverse rib is disposed between each center transverse rib so as to present an alternating pattern.
21. The top frame of claim 19 wherein each center transverse rib extending from the center rib to the one rim is collinear with each center transverse rib extending from the

center rib to the other rim, the center transverse ribs being spaced apart from the transverse ribs.

22. The top frame of claim 19 wherein a transverse rib is disposed between each center transverse rib so as to present an alternating pattern.

23. The top frame of claim 14 wherein the frame members are attached to one another by one of bonding or welding such that the inner most surfaces of the ribs and rims are joined to the confronting ribs and rims.

24. The top frame of claim 14 further including an outermost peripheral edge and a lip projecting outwardly and downwardly therefrom.

25. The top frame of claim 24 wherein the lip is closed.

26. The top frame of claim 24 wherein the lip is open.

27. The top frame of claim 14 wherein the outer surface of the top frame has anti-skid feature on at least one of the outer surfaces thereof.

28. The top frame of claim 27 wherein the anti-skid feature is formed by a soft material.

29. The top frame of claim 28 wherein the soft material is a thermoplastic elastomer applied to at least one outer surface of the top frame.

30. The top frame of claim 27 wherein the anti-skid feature has at least one male protuberance and one female cavity at least one corner of the top frame.

31. A top frame comprising:

a substantially flat rectangular first frame member; and,

a second frame member attached to the first frame member having

a generally planar outer surface and

an inner surface having a pair of generally parallel inwardly projecting rims, with each of the rims running along an edge of the member, and a plurality of inwardly projecting transverse ribs disposed between the rims such that when the members are attached, the transverse ribs and rims contact the first frame member, each transverse rib extending from one rim towards the other rim and terminating at a distal end spaced apart from the other rim.

32. The top frame of claim 31 wherein there is an outer perimeter rim and an inner perimeter and each rim is continuous.

33. The top frame of claim 31 wherein the rims project from the inner surface of the member a first height and the transverse ribs project from the inner surface of the member a second height, the first height being different than the second height.

34. The top frame of claim 31 wherein the rims project from the inner surface of the member a first height and the transverse ribs project from the inner surface of the member a second height, the first height being substantially the same as the second height.

35. The top frame of claim 31 wherein the length of each transverse rib is the distance the transverse rib extends from the one rim towards the other rim and wherein the transverse ribs either have the same length or alternate so that the distal ends of the transverse ribs appear to undulate.

36. The top frame of claim 31 wherein the frame members are attached to one another by one of bonding or welding such that the inner most surfaces of the ribs and rims are joined to the confronting ribs and rims.

37. The top frame of claim 31 further including an outermost peripheral edge and a lip projecting outwardly and downwardly therefrom.

38. The top frame of claim 37 wherein the lip is closed.

39. The top frame of claim 37 wherein the lip is open.

40. The top frame of claim 31 wherein the outer surface of the top frame has anti-skid feature on at least one of the outer surfaces thereof.

41. The top frame of claim 40 wherein the anti-skid feature is formed by a soft material.

42. The top frame of claim 41 wherein the soft material is a thermoplastic elastomer applied to at least one outer surface of the top frame.

43. The top frame of claim 40 wherein the anti-skid feature has at least one male protuberance and one female cavity at least one corner of the top frame.

44. The top frame of claim 31 further including at least one center rib between and substantially parallel to the one rim and the other rim, each transverse rib extending from one rim towards the center rib and terminating at a distal end spaced apart from the center rib.

45. The top frame of claim 44 wherein there is an outer perimeter rim and an inner perimeter and each rim and the center rib is continuous.

46. The top frame of claim 44 wherein the rims project from the inner surface of the member a first height and the transverse ribs project from the inner surface of the member a second height, the first height being different than the second height.

47. The top frame of claim 44 wherein the rims project from the inner surface of the member a first height and the transverse ribs project from the inner surface of the member a second height, the first height being substantially the same as the second height.

48. The top frame of claim 44 wherein the length of each transverse rib is the distance the transverse rib extends from the one rim towards the other rim and wherein the transverse ribs either have the same length or alternate so that the distal ends of the transverse ribs appear to undulate.

49. The top frame of claim 44 further including a plurality of center transverse ribs, each transverse rib extending from the center rib to either the one rim or the other rim and terminating at a distal end spaced apart from the rim, the center transverse ribs being spaced apart from the transverse ribs.

50. The top frame of claim 49 wherein a transverse rib is disposed between each center transverse rib so as to present an alternating pattern.

51. The top frame of claim 49 wherein each center transverse rib extending from the center rib to the one rim is collinear with each center transverse rib extending from the center rib to the other rim, the center transverse ribs being spaced apart from the transverse ribs.

52. The top frame of claim 49 wherein a transverse rib is disposed between each center transverse rib so as to present an alternating pattern.

53. The top frame of claim 44 wherein the frame members are attached to one another by one of bonding or welding such that the inner most surfaces of the ribs and rims are joined to the confronting ribs and rims.

54. The top frame of claim 44 further including an outermost peripheral edge and a lip projecting outwardly and downwardly therefrom.

55. The top frame of claim 54 wherein the lip is closed.

- 56.** The top frame of claim 54 wherein the lip is open.
- 57.** The top frame of claim 44 wherein the outer surface of the top frame has anti-skid feature on at least one of the outer surfaces thereof.
- 58.** The top frame of claim 57 wherein the anti-skid feature is formed by a soft material.
- 59.** The top frame of claim 58 wherein the soft material is a thermoplastic elastomer applied to at least one outer surface of the top frame.
- 60.** The top frame of claim 57 wherein the anti-skid feature has at least one male protuberance and one female cavity at least one corner of the top frame.
- 61.** A top frame having an outer surface comprising:
- a first mating segment on a portion of the outer surface; and,
  - a second mating segment on a separate portion of the outer surface, such that when a second frame is stacked upon a first frame the male segment of the first frame align with and mate with the female segment of the second frame and the female segment of the first frame aligns with and mates with the male segment of the second frame.
- 62.** The top frame of claim 61 wherein the outer surface has a plurality of male segments on the outer surface of the frame and a plurality of female segments on the outer surface of the frame, each male and female segment aligning and mating with a corresponding female and male segment of a frame stacked thereon.
- 63.** The top frame of claim 62 wherein the segments are interconnecting segments located adjacent the corners of the frame.
- 64.** The top frame of claim 62 wherein the segments are located at the corners of the frame and the male segments are diagonal one another and the female segments are diagonal one another.
- 65.** The top frame of claim 64 wherein the male segment are a plurality of upwardly tapering protuberances protruding from outer surface of the frame and the female segments are plurality of downwardly tapering cavities carved into the outer surface.
- 66.** A top frame comprising:
- a first generally rectangular frame member having
    - a footprint and
    - a generally planar outer surface and
    - an inner surface having
      - a pair of generally parallel inwardly projecting rims, with each of the rims running along an edge of the member, and
      - a plurality of inwardly projecting transverse ribs disposed between the rims; and,
  - a second generally rectangular frame member having
    - a generally planar outer surface and
    - an inner surface with a rim running along an edge of the member,
    - the second frame member being attached to the first frame member.
- 67.** The top frame of claim 66 wherein each transverse rib extends from one rim towards the other rim and terminates at a distal end spaced apart from the other rim.
- 68.** The top frame of claim 66 wherein there is an outer perimeter rim and an inner perimeter and each rim is continuous.
- 69.** A top frame comprising:
- a first generally rectangular frame member having
    - a footprint and
    - a generally planar outer surface and
    - an inner surface having
      - a pair of generally parallel inwardly projecting rims, with each of the rims running along an edge of the member, and
      - a plurality of inwardly projecting transverse ribs disposed between the rims; and,
  - a second generally rectangular frame member having
    - a generally planar outer surface and
    - an inner surface with a rim running along an edge of the member,
    - the second frame member being attached to the first frame member.
- 70.** The top frame of claim 69 wherein each frame member has an outer perimeter rim and an inner perimeter and each rim is continuous.
- 71.** A top frame comprising:
- a generally rectangular frame member having
    - opposed sides with a generally planar outer surfaces with a plurality of openings therein such that no pockets or crevices are formed therein to minimize the possibly of collecting liquid or debris.
- 72.** The top frame of claim 71 wherein the frame member has at least two parallel longitudinal rims and a plurality of transverse ribs constructed therein and the openings are formed between the ribs and rims and by walls of those ribs and rims.
- 73.** The top frame of claim 72 wherein all of the walls of the ribs and rim are substantially perpendicular to the outer surfaces of the frame member.
- 74.** The top frame of claim 71 wherein the frame member is molded and the ribs and rims are solid.
- 75.** The top frame of claim 71 wherein the frame member is molded with gas assist technology and many of the ribs and rims are hollowed.

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