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Campbell et al.

[11] **3,750,598**

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[54] **IMPACT ABSORBING CORNER STRUCTURE**

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[21] Appl. No.: **127,606**

[52] **U.S. Cl.** ..... **108/51**, 248/345.1, 16/86 A

[51] **Int. Cl.** **B65d 19/00**

[58] **Field of Search** ..... 16/51–58, 86 A; 52/573; 101/41, 44, 109, 113, 68; 248/345.1; 94/18.2, 18; 220/85 K, 66, 21; 49/9, 34

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[57] **ABSTRACT**

A self-reforming impact absorbing corner structure for pallets having a corner of lattice section with portions of outer walls designed to buckle inwardly under impact and thereby prevent bulging outside the normal pallet dimensions, the pallet being formed of a thermoplastic material having sufficient memory to be substantially self-reforming.

10 Claims, 6 Drawing Figures

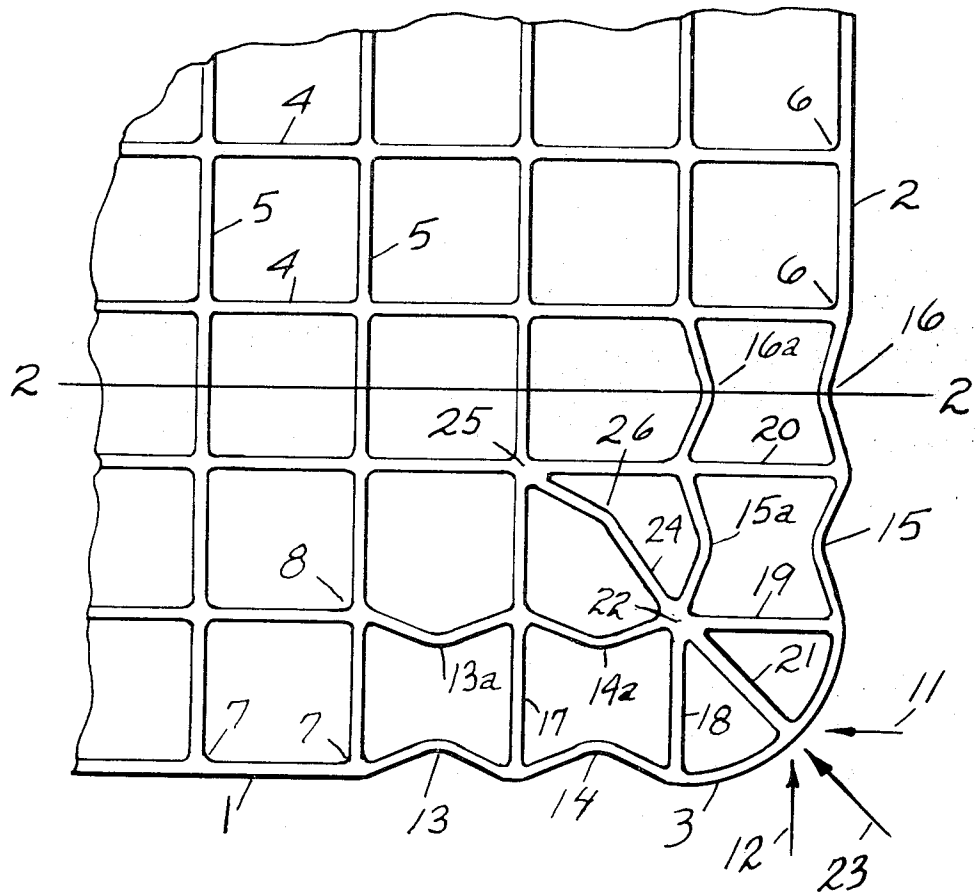


FIG. 1

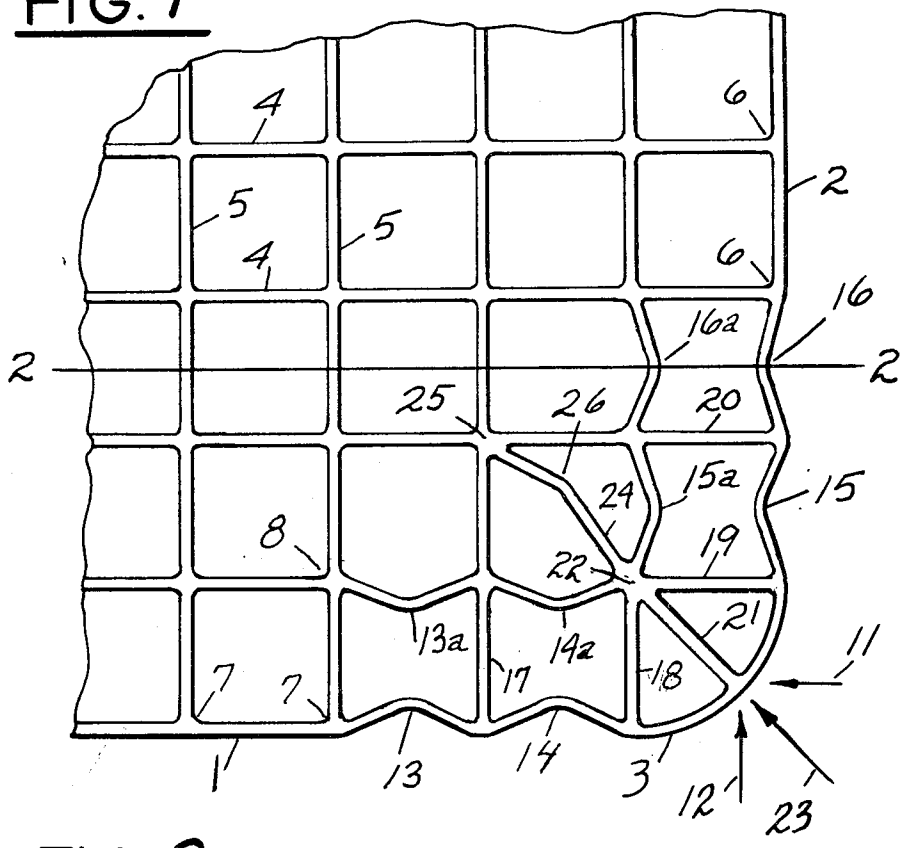
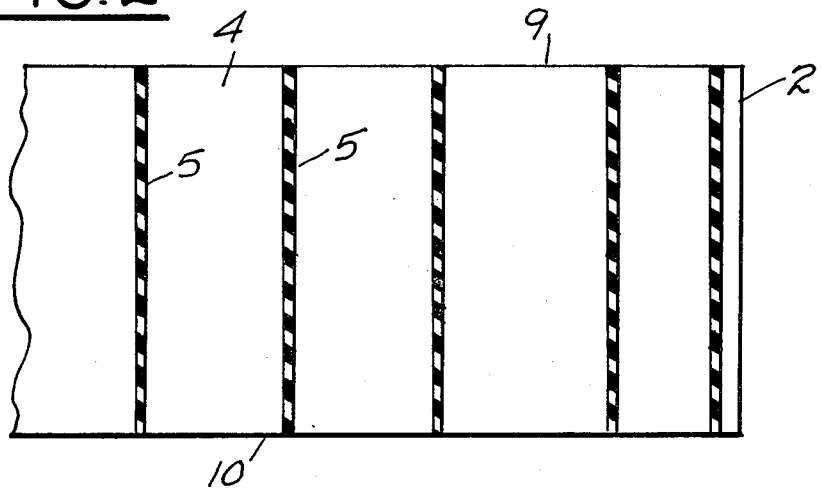


FIG. 2



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FIG. 6

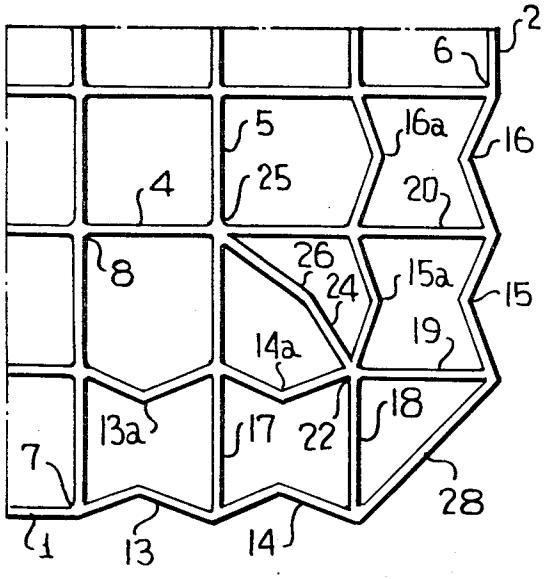


FIG. 5

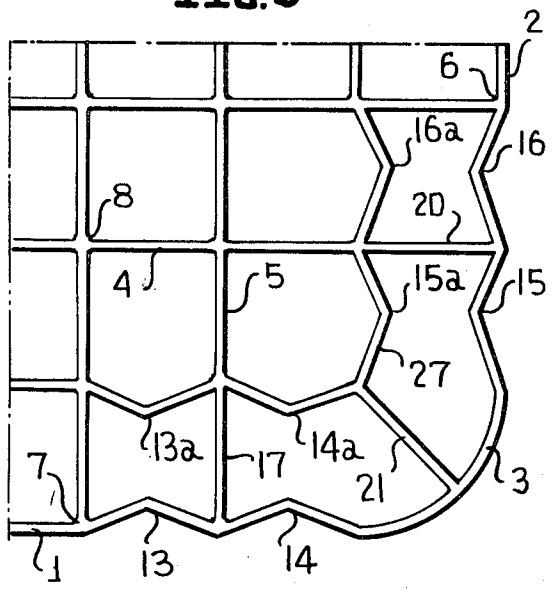


FIG. 4

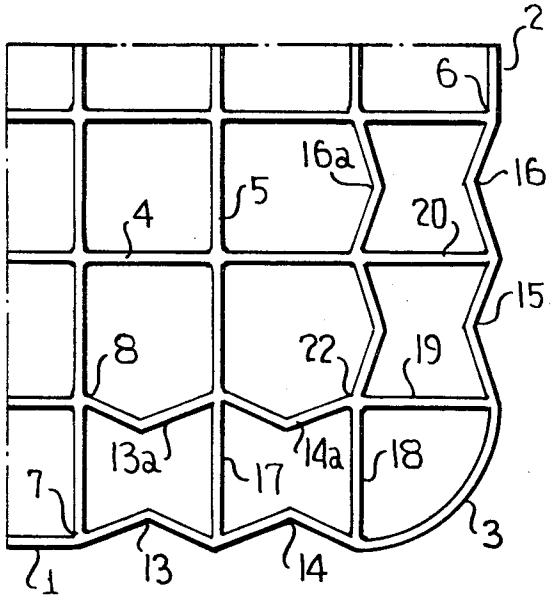
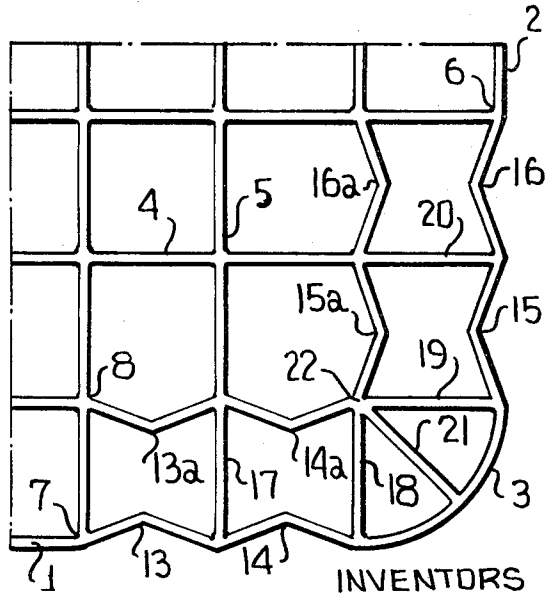


FIG. 3



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IMPACT ABSORBING CORNER STRUCTURE

This invention relates in general to new and useful improvements in pallet construction, and more particularly to a pallet corner structure which is of a configuration to hold the corner dimensions of a pallet within standard limits by an impact absorbing design in which walls forming the corner buckle inwardly rather than outwardly under impact.

BACKGROUND OF THE INVENTION

The invention relates in general to a pallet of the construction illustrated in U.S. Pat. No. 3,307,504. As described in detail in that patent, the upper and lower corners are vertical lattice walls form the load receiving elements of the pallet.

In use, the pallets are subject to frequent impact, particularly at the corners thereof. In pallets having straight or planar walls at the corners, such impacts, if large enough to cause buckling of the walls, cause the walls to buckle or distort inwardly at the immediate point of impact, and outwardly adjacent to the point of impact, thereby increasing the width or length of the pallet and interfering with the use thereof. For example, when a pallet is of a standardized dimension equipment designed for use in cooperation therewith have dimensions to closely receive such a pallet. If the pallet is of an increased dimension due to corner buckling, the pallet will not fit within the allotted space.

SUMMARY OF THE INVENTION

In accordance with this invention, it is proposed to provide an impact shock absorbing corner for pallets wherein the pallet may be of a conventional lattice wall construction and wherein when there is sufficient impact on the corner of the pallet to cause inward buckling of the corner, in lieu of adjacent portions of the outer walls of the pallet distorting or buckling outwardly, the outer walls are designed to collapse inwardly whereby all of the distortion or buckling of the pallet corner is inwardly notwithstanding the usual tendency to outward buckling, with the result that the collapsing of the pallet corner in no way increases the over-all dimensions of the pallet.

Another feature of this invention is the formation of the pallet of a thermoplastic material whereby due to the memory of the thermoplastic material, after buckling does occur due to impact, in due course the corner construction will substantially return to its original configuration to form the necessary supporting function.

With the above, and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

IN THE DRAWINGS:

FIG. **1** is a fragmentary plan view of a pallet having a corner structure formed in accordance with this invention.

FIG. **2** is a fragmentary vertical sectional view taken along the line **2—2** of FIG. **1.**

FIGS. **3, 4, 5** and **6** are fragmentary plan views showing the details of other pallet corner structure configurations.

With reference to FIG. **1,** it will be seen that there is illustrated a pallet having outer walls **1** and **2** which are arranged at right angles to each other and converge toward an arcuate corner wall **3** which joins the outer walls **1** and **2** and forms a rounded external corner. That portion of the pallet within the included angle between the outer walls **1** and **2** is occupied by a lattice of intersecting inner walls **4** and **5.** It is to be noted that there are a plurality of the inner walls **4** each extending at right angles to the outer wall **2** and having its end joined to the outer wall **2** as at **6.** There are also a plurality of inner walls **5** extending at right angles to the outer wall **1** and having their ends joined to the outer wall **1** as at **7.** The inner walls **4** and **5** intersect each other in intersections **8,** thereby providing a rigid structure.

With particular reference to FIG. **2,** it will be seen that both the upper and lower edges **9, 10** of the aforementioned walls lie in a common plane and serve as load receiving surfaces.

In use, the corners of the pallet are subject to impacts in a variety of directions which can be resolved or broken down into the forces indicated by arrows **11** and **12,** respectively, acting lengthwise of the outer walls **1** and **2.** It is to be understood that if the corner structure of the pallet were of a conventional construction with the outer walls **1** and **2** being straight or in a common plane adjacent the corners, large forces in the directions of the arrows **11** and **12** would cause sections of the outer walls **1** and **2** in the regions designated by the numerals **13, 14, 15** and **16** to buckle outwardly, thereby increasing the outer dimensions of the pallet and interfering with or preventing automatic stacking of the pallet with other pallets as well as the placement of the pallet within a confined space.

For example, with a conventional pallet corner construction, a force in the direction of the arrow **11** would cause such conventional pallet corner to move to the left, with reference to FIG. **1,** and would cause portions of the outer wall **1** in the region indicated by the numerals **13** and **14** to buckle outwardly. The movement of the corner to the left would not interfere with automatic stacking of the pallet, but the outward buckling of the outer wall **1** in the regions **13** and **14** outside of its normal envelope would interfere with the stacking. A similar analysis may be made for the forces in the direction of the arrow **12.**

At this time it is acknowledged that if the pallet is formed of a suitable thermoplastic material, the memory of the plastic material will cause it to slowly return to its original position. However, this memory is in most instances too slow to overcome the problem of stacking of the deformed pallet or the utilization thereof in a confined space for which the pallet is designed.

To solve the aforementioned problem, the outer walls **1** and **2** of the pallet formed in accordance with this invention are provided with re-entrant portions in the regions previously designated by the numerals **13, 14, 15** and **16.** These re-entrant angular sections cause the walls to buckle inwardly under forces in the directions of the arrows **11** and **12.** With this construction, forces in the direction of the arrow **11** causes the re-entrant sections **13, 14** to buckle inwardly when the corner **3** is moved to the left, as viewed in FIG. **1,** and forces in the direction or arrow **12** cause the re-entrant sections **15, 16** to buckle inwardly as the corner **3** is moved generally in the direction of the arrow **12.**

Impacts on the corner **3** in any direction, accordingly, cause the walls **1** and **2** of the pallet corner to move inward and to decrease the outside dimensions of

the pallet in the area of the corner. This decrease in dimensions occurs only in the first few inches adjacent each corner and does not affect the other dimensions of the pallet so that the over-all dimensional integrity of the pallet is maintained even through there is distortion at a corner.

The action of the re-entrant sections **13–16** is improved by having oppositely directed angulated sections **13***a*, **14***a*, **15***a* and **16***a* in the outermost of the inner walls **4** and **5**. Under forces in the direction of the arrow **11**, which causes the re-entrant sections **13** and **14** to buckle inwardly, the sections **13***a* and **14***a* will buckle outwardly. The buckling of these sections **13***a* and **14***a* maintain sections **15** and **18** of the inner walls **5** more nearly parallel to each other under motion in the direction of the arrow **11**. The buckling of sections **13***a* and **14***a* also absorb the impact in the region of the corner without causing distortion in adjoining sections of the pallet more remote from the corner.

It is to be understood that similarly, the buckling of sections **15***a* and **16***a* outwardly at the time of buckling of sections **15** and **16** causes the sections **19** and **20** of the outer walls **4** to remain more nearly parallel to each other under motions in the direction of the arrow **12**. Thus, in a like manner, forces in the direction of the arrow **12** may be absorbed within the pallet corner construction without the distortion of adjoining sections of the pallet.

In order to increase the rigidity of the corner **3**, in the preferred embodiment of the invention illustrated in FIG. **1**, a diagonal wall **21** is provided between the outermost part of the corner and a junction **22** between the outermost ones of the inner walls **4** and **5**. The bracing effect of the diagonal wall **21** in conjunction with the sections **18** and **19** causes the corner **3** to maintain its shape under impact and to transfer the impact forces to the adjoining sections of the pallet corner. Because of the bracing effect, diagonal forces in the direction of arrow **23** are transferred directly to the junction **22** and causes substantially equal amounts of buckling in the sections **13** through **16** and **13***a* through **16***a*.

A diagonal wall section **24** extends diagonally inwardly from the junction **22** to a junction **25** between the next inner ones of the inner walls **4** and **5**. The diagonal wall section **24** is generally in alignment with the diagonal wall section **21**, but has a mid-portion thereof offset out of straight line relation between junctions **22** and **25** as at **26** so that under forces in the direction of the arrow **23**, buckling will take place in the direction of the offset. It is to be noted that the direction of the offset **26** is not material. Its purpose is to absorb energy received in the direction of the arrow **23** and prevent distortion of the sections of the pallet more remote from the corner.

Reference is now made to FIG. **3** wherein a modified form of pallet corner structure is illustrated. It is to be noted that the corner structure illustrated in FIG. **3** is identical with that illustrated in FIG. **1** with the exception that the diagonal wall section **24** is omitted. It is to be understood that the collapsing of the corner structure of FIG. **3** will be identical to that of FIG. **1** with the exception that it will not have the benefit of the reinforcement of the diagonal wall section **26** of the corner section of FIG. **1**. On the other hand, it is to be understood that the omission of the diagonal wall section **24** will not materially detract from the strength of the corner.

Reference is now made to FIG. **4** wherein still another form of pallet corner structure is illustrated. It is to be noted that all of the illustrated components of the corner structure are those found in FIGS. **1** and **3**. However, in addition to omitting the diagonal wall section **24** as shown in the modified form of the invention of FIG. **3**, the modified pallet corner structure of FIG. **4** also omits the diagonal wall section **21**. The omission of the diagonal wall section **21** results in a slight weakening of the corner structure. However, this primarily means that in lieu of the curved corner element **3** being reinforced at its mid-section by a diagonal wall section, it is free to deflect inwardly from any force directed thereon. However, the inward deflection of the corner wall element **3** does not materially detract from the shock absorbing features of the corner structure and the bending or folding of the outer wall sections which will occur upon impact will be substantially that of the corner structure of FIG. **1**.

In FIG. **5** there is illustrated still another modified pallet corner structure. With reference to FIGS. **1** and **3**, it will be seen that the walls of the corner structure of FIG. **5** are all found in the corner structures of FIGS. **1** and **3**. However, with particular reference to FIG. **3**, it will be seen that in addition of the omission of the diagonal wall section **24** in FIG. **3**, the wall sections **18** and **19** of the inner walls **4** and **5** have also been omitted. As a result, the corner structure of FIG. **5** includes an outer corner **3** and an inner corner **27** defined by the wall sections **14***a* and **15***a*.

It will be seen that the corners **3** and **27** are disposed generally in nested relation and the corners are connected together by the diagonal wall section **21**. The diagonal wall section **21** extends between the mid-secctions of the corners **3** and **22** and is connected to the corner **27** at the intersection between the wall sections **14***a* and **15***a*.

It will be readily apparent from FIG. **5** that the corner **27** serves to reinforce the corner **3** and while the corner **27** may collapse outwardly towards one or both of the outer walls **1** and **2**, the bulging of the corner **27** will be within the original outline of the pallet.

Reference is now made to the embodiment of pallet corner structure illustrated in FIG. **6**. It is to be noted that the corner structure is very similar to that illustrated in FIG. **1**. However, in lieu of the rounded corner, the corner structure of FIG. **6** includes a diagonal corner wall member **28** which extends between the adjacent ends of the outer walls **1** and **2**. The corner wall member **28** extends generally from the intersection of the wall section **18** with the outer wall **1** to the intersection of the wall section **19** with the outer wall **2**. Because of the rigid triangular truss arrangement of the wall sections **18** and **19** and the corner wall member **28**, the necessity for a diagonal wall section corresponding to the wall section **21** is eliminated and thus no diagonal wall section engages the mid-section of the corner wall member **28**.

Although a wall section corresponding to the wall section **21** is not found in the corner structure of FIG. **6**, it has been desirable to provide the wall section **24**. It is to be noted that the wall section **24** reinforces the inner lattice work and the corner structure of FIG. **6** in the same manner as it does in the corner structure of FIG. **1**.

It is to be understood that while the several corner structures specifically illustrated and disclosed herein

may be formed from various materials, it is preferable that they be formed of thermoplastic materials having a memory. By utilizing such materials, it will be understood that even though the corner structures will not reform in a very short time, the corner structures will reform within a sufficiently reasonable time whereby the pallets will not be permanently distorted or damaged to a noticeable extent.

Although only several preferred embodiments of the pallet corner structures have been specifically illustrated and described herein, it is to be understood that minor variations may be made in the pallet corner structures without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A pallet having an upwardly presented load carrying surface integral with the upper edges of a lattice of a plurality of inner walls individually presented edgewise to said surface and intersecting each other at a plurality of intersections, said inner walls being united to each other at the intersections and forming openings between the intersections normal to said surface, peripheral support means for the lattice comprising a rectangular frame of outer walls joined integrally with the periphery of the lattice and having spaced fork entry passageways for receiving the forks of a lift truck, outer walls of said frame being joined to form a corner and portions of inner walls of said lattice bridging the space within the corner with ends of adjacent inner walls being spaced from each other along and joined to an outer wall, and portions of said outer walls in the space between said portions of inner walls along said corner having re-entrant portions and the outermost of said inner walls opposite said re-entrant portions having oppositely directed angulated sections to compel the inward buckling only of said outer wall portions and said corner in response to a blow on said corner large enough to cause buckling of the walls of said corner.

2. The pallet of claim **1** wherein said portions of inner and outer walls of said corner are formed of a deformable plastic material having a memory property sufficient to effect the return of said corner walls to substantially the original configuration thereof after being buckled.

3. The pallet of claim **1** wherein said portions of inner and outer walls of said corner are formed of a bendable material wherein buckling of said corner walls may occur without rupture of said inner and outer walls and the junctures therebetween.

4. The pallet of claim **1** in which the lattice comprises two sets of inner walls, the walls of each set being generally parallel to a different one of the outer walls and generally perpendicular to the other outer wall.

5. The pallet of claim **3** wherein a diagonal wall extends from the apex of the corner to an intersection of said portions of inner walls.

6. The pallet of claim **1** in which said outer walls are joined by a curved wall forming the apex of the corner and a diagonal wall extends from the apex of the corner to an intersection of said portions of inner walls.

7. The pallet of claim **6** wherein another diagonal wall extends from said intersection of said portions of inner walls to a diagonally adjacent another one of said inner wall intersections generally in alignment with the first mentioned diagonal wall, said another diagonal wall having a mid-section thereof offset out of straight line relation.

8. The pallet of claim **1** in which another wall extends diagonally between intersections of said portions of inner walls with the mid-section of said another wall out of straight line relation between said intersections.

9. The pallet of claim **4** in which said outer walls are joined by a diagonal outer wall defining said corner, said diagonal outer wall being joined to said outer walls at adjacent intersections thereof with said portions of inner walls.

10. The pallet of claim **9** in which another wall extends diagonally between intersections of said portions of inner walls with the mid-section of said another wall offset out of straight line relation between said intersections.

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