United States Patent

Wood

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[45] **Oct. 3, 1972**

[54] **PACKAGE ASSEMBLY AND CUSHION THEREFOR**

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[21] Appl. No.: **70,414**

[52] **U.S. Cl.** .....**206/46 FC,** 217/53, 229/14 C

[51] **Int. Cl.** **B65d 81/04,** B65d 85/30

[58] **Field of Search** .....206/46 FC, 46 FR, 62 R; 217/53; 229/14 C; 220/9 F; 35/72

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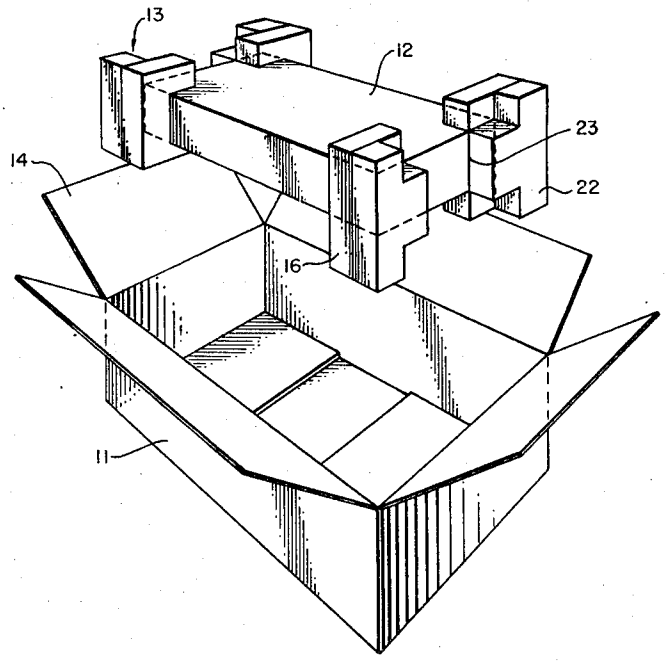
[57] **ABSTRACT**

A package assembly for commodities comprising an outer container and a plurality of spaced elongated corner cushions formed of resilient energy absorbing material each having first and second portions of resilient material, a recess intermediate the ends for accomodating and holding the commodity in the container in spaced relationship to the top, bottom an sides of the container, and means including a bonding layer cooperating between said first and second portions for distributing forces between the two portions whereby to accommodate forces exerted by the commodity during handling and shipping.

7 Claims, 9 Drawing Figures



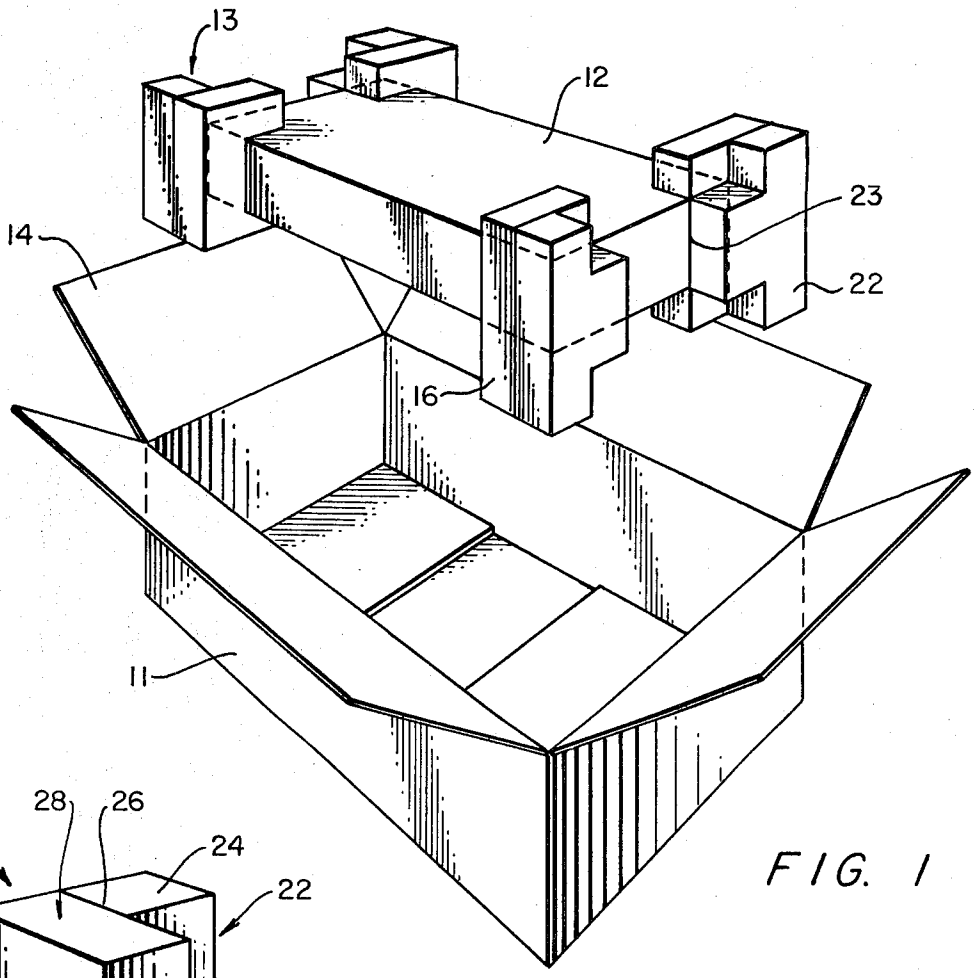


FIG. 1

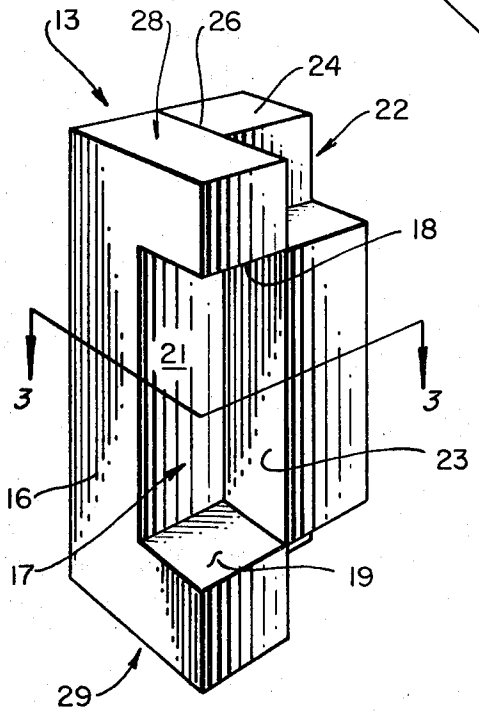


FIG. 2

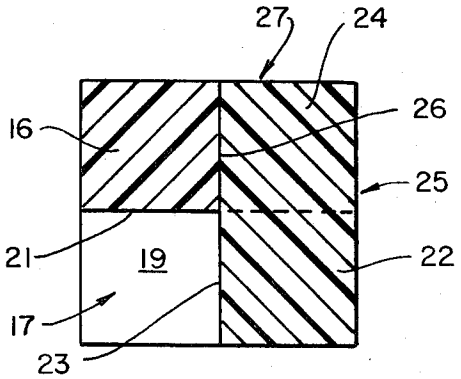


FIG. 3

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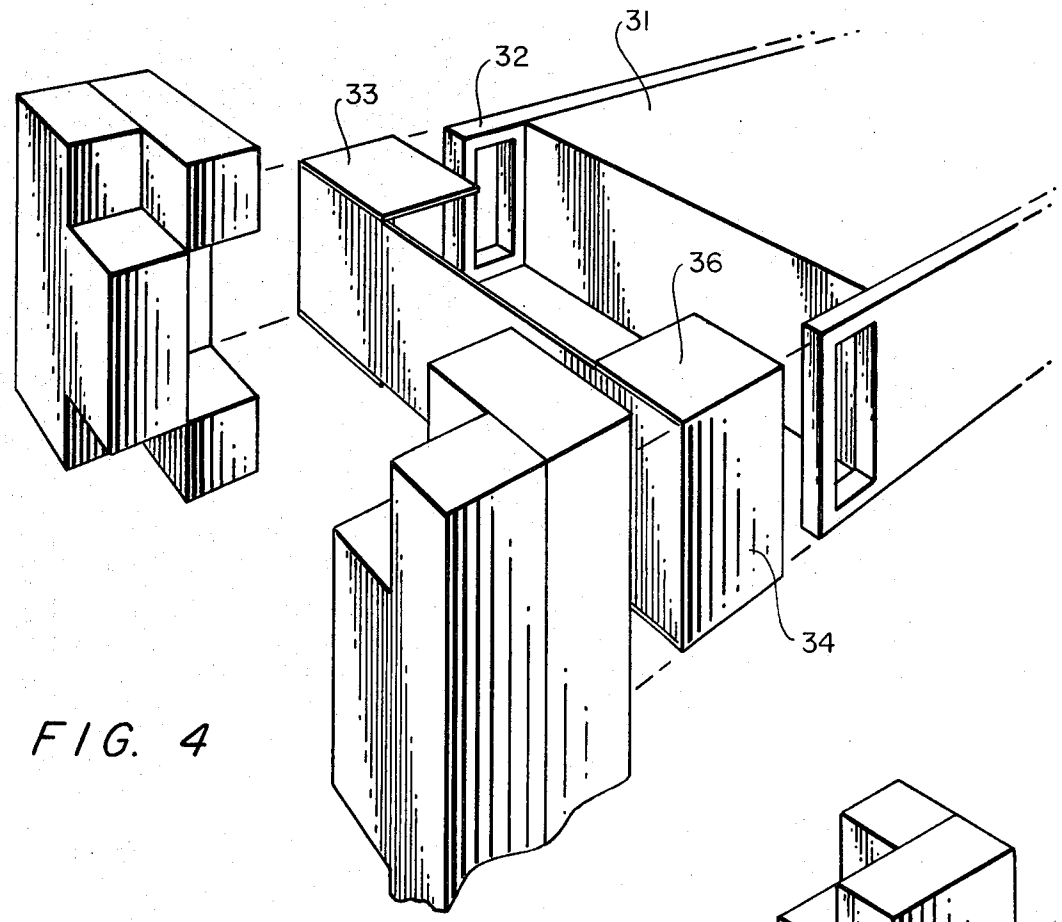

FIG. 4

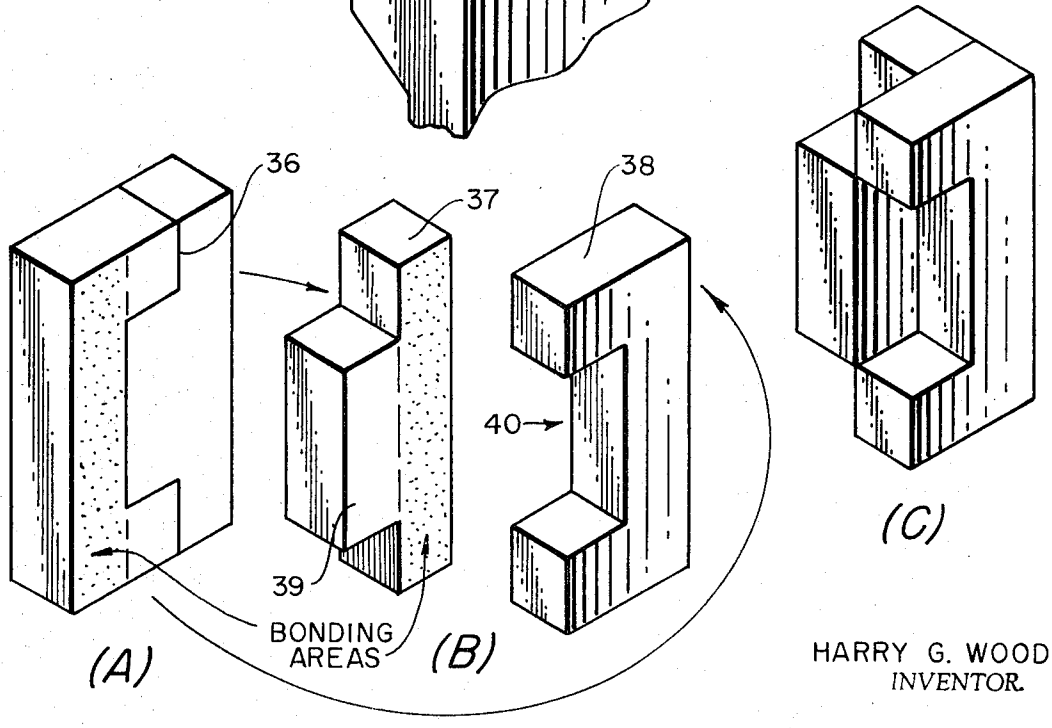

FIG. 5

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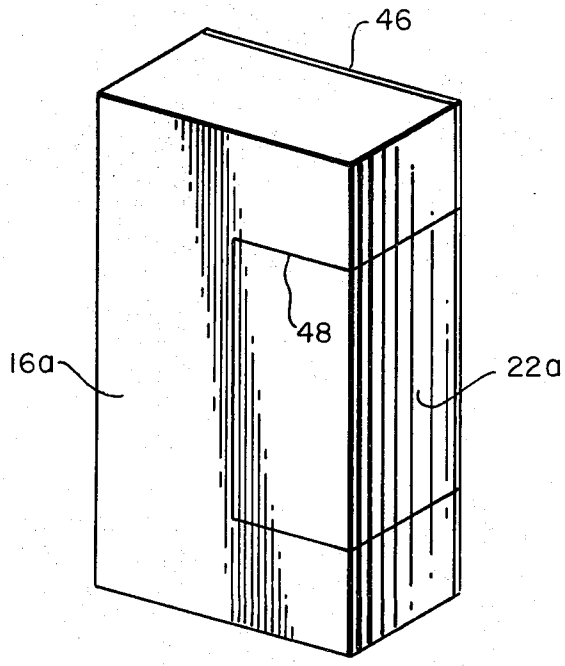

FIG. 6

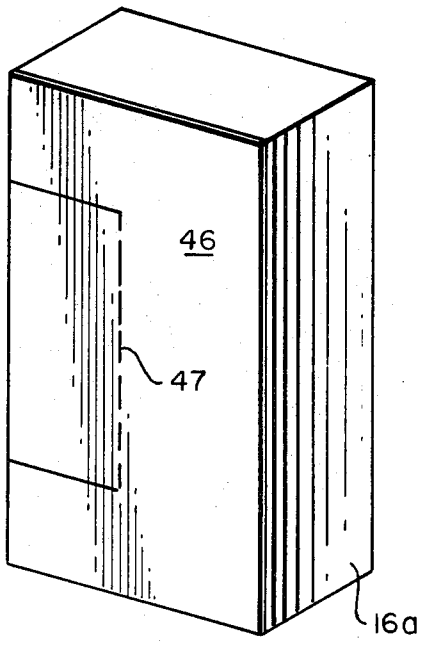

FIG. 7

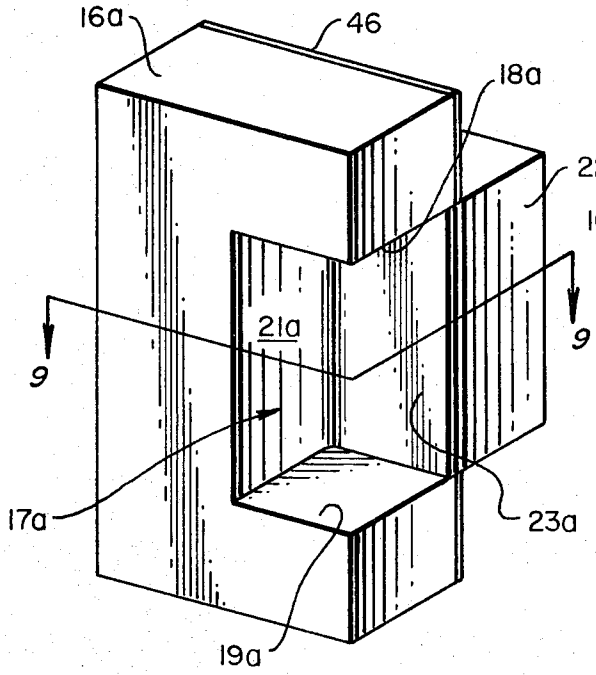

FIG. 8

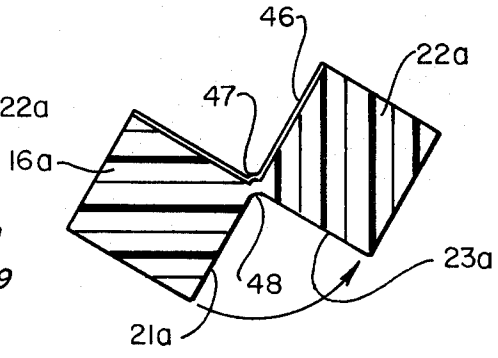

FIG. 9

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PACKAGE ASSEMBLY AND CUSHION THEREFOR

BACKGROUND OF THE INVENTION

This invention relates generally to a shock-damping package assembly and more specifically to an improved corner cushion for use therein. In particular, the invention relates to a package assembly suitable for protecting commodities such as electronic equipment, scientific measuring, testing and analytical devices, communication and navigational apparatus and similar electronic, scientific and measuring apparatus during world-wide shipping and distribution of the commodities.

Damage in shipment with conventional packages of commodities of the foregoing type within the United States is substantial. In my U.S. Pat. No. 3,221,872, there is described a package assembly which provides a high level of protection. The assembly combines low cost, minimal assembly labor, light weight and small cube.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the present invention to provide a package assembly and corner cushion with improved shock and vibration damping capability.

It is another object of the present invention to provide a package assembly which: allows the designer to specify load bearing areas of the corner cushion in precise pounds per square inch so as to obtain maximum performance; uses less cushioning material; requires significantly less labor to fabricate; is applicable to a wider variety of products; allows reduction in the size of shipping container; and improves the stacking capability of the package assembly.

It is a further object of the present invention to provide a package assembly in which the commodity is suspended in spaced relationship with respect to an outer box by resilient corner posts which include tensile means for distributing forces and which engage the corner surfaces of the outer container to resiliently suspend the commodity and absorb impact and vibrational energy.

The foregoing and other objects of the invention are achieved by a package assembly including an outer container and corner cushions for supporting the commodity in spaced relationship within the outer container, said corner cushions each comprising a first portion of resilient energy-absorbing material of predetermined thickness having a cut-out defining a recess having upper and lower support surfaces for engaging the top and bottom of said commodity and a rear surface for abutting one side of said commodity, a second portion adjacent said recess for engaging another side of said commodity and means including a bonding layer secured to said two portions for distributing forces between the two portions, said portions providing a predetermined thickness of resilient material between the commodity and the top, bottom and side ends of said container.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded view of a package assembly in accordance with the invention.

FIG. 2 is a perspective view of a corner cushion in accordance with the present invention.

FIG. 3 is a sectional view taken along the lines 3—3 of FIG. 2.

FIG. 4 shows a corner cushion in relation to a commodity with a corrugated front filler pad placed over an irregular portion of the commodity to distribute shock over a large bearing area of the corner cushion.

FIGS. 5A–C show the steps in forming a corner cushion in accordance with the present invention.

FIG. 6 is a front perspective view of a corner cushion in accordance with another embodiment of the invention.

FIG. 7 is a rear perspective view of a corner cushion of FIG. 6.

FIG. 8 is a perspective view of the corner cushion of FIGS. 6 and 7 opened to receive a product.

FIG. 9 is a sectional view taken along the line 9—9 of FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1 there is shown an outer container or box 11 which may be corrugated fiberboard, plastic, wood or other material and which is adapted to contain a commodity 12 such as electronic, scientific or other measuring apparatus. The commodity 12 may include an additional outer protective package or may be directly suspended within the outer container 11. In the embodiment of the invention shown in FIG. 1, four corner cushions 13 receive the four corners of the commodity. The commodity together with the corner posts is then placed in the outer container 11 and the upper flaps 14 folded over and secured to enclose the commodity in the outer container 11. The commodity is suspended in the container in spaced relationship to the side, top and bottom walls of the container.

The corner posts are identical and each includes a first portion 16 having a recess 17, FIGS. 2 and 3, which includes upper and lower support surfaces 18 and 19 and end support surface 21. The spacing between the support surfaces 18 and 19 is slightly less than the height of the commodity which is to be accommodated thereby accomplishing a snug fit of the cushion with the top and bottom surfaces of the commodity. The surface 21 bears against the corner sides of the commodity to offer lateral support in one direction. The corner cushion includes a second portion 22 of resilient material adjacent the recess and providing a second surface 23 which offers lateral support in the other direction. In the embodiment of FIG. 2 the second portion is integral with portion 24 which affords support both to the portion 22 and to the portion 16 through the connecting layer 26.

The outer surfaces 25 and 27, FIG. 3, of the corner cushions bear against the corner sides of the outer container 11 and the top and bottom surfaces 28 and 29 bear against the top and bottom of the container 11. The height of the corner cushions is slightly greater than the internal height of the outer container 11. The total width and length of the commodity plus the portions of the corner cushions between the commodity and container are also slightly greater than the length and width of the outer package 11. After the posts are placed on the corners of the commodity, the complete assembly is lowered into the box whereby the posts snugly fit against the adjacent faces of the four corners

of the box and are tightly under compression. The top of the box is then closed and sealed whereby to compress vertically the corner posts and provide a snug fit in the vertical direction. The instrument is suspended in the package with the top, bottom and sides spaced from the respective top, bottom and sides of the associated box and the corner posts are under compressive forces in all directions.

In certain instances, as in connection with instruments, the commodity may include handle portions. Referring to FIG. **4**, an instrument **31** is shown including outwardly extending handles **32**. In order to provide a larger bearing surface than that of the handles between the recess of the corner cushions and the commodity, a fiberboard, or other suitable material, cap **33** is fitted over the front of the instrument as shown in FIG. **4**. The cap **33** may comprise a single sheet of corrugated fiberboard material which is then folded at the ends to form the portions **34** and the tabs **36** are folded downwardly to provide a box-like structure which is accommodated within the recesses and distributes the impact supporting forces throughout the faces **18, 19, 21** and **23** and the connecting layer **26** which bonds the two portions of the cushion as will be described hereinafter. Separate caps or inserts may also be used in individual posts. Furthermore, if the instrument includes delicate knobs or extensions which must be protected, the cushion may include reliefs which serve to accommodate them. Referring again to FIG. **3**, cut-outs may, if desired, be incorporated into the front, side, top or bottom support areas of a corner post to accommodate projections of the commodity. In such instance, additional cushion thickness may be added to maintain adequate space for deflection under stress. Similarly, angle cuts, bevels, etc., may be made on portions of the corner post so as to avoid contact with fragile control knobs, fuse holders and similar projections.

The corner posts are made of a resilient material having a high damping coefficient with omnidirectional energy absorption properties. The resilient cushion preferably has a high degree of recovery after compression. Thus, any force due to dropping of the box or other external impacts compress the corner cushions in the direction opposite of the forces and absorb the impact shock or vibration energy. The resilient cushions then revert to their original configuration to again support the commodity in spaced relationship within the container. The material of the corner posts should limit reasonance and reduce high frequency motion. The drift loss under compression should be relatively small. Preferably, the material is light-weight, immune to water, non-abrasive, non-toxic, clean and resistant to fungus and the like. Furthermore, preferably the material should be easily molded or fabricated.

A suitable material is expanded polyethylene foam known by the trade name "ETHAFOAM." ETHAFOAM is a polyethylene expanded thirty times or more from the solid state into a cellular, extremely light-weight material in which each cell is closed off from its neighbor. The material further has good energy retention whereby to absorb a large amount of any compression forces to which it is exposed.

One method of forming corner posts of the type described is cutting them from a plank with a steel rule die in a stamping press. An elongated plank of ETHAFOAM material is pushed through a band or table saw to form a plank of given width. The plank is then placed in a stamping press wherein the material is cut whereby to form a rectangular block such as shown in FIG. **5A** with a cut **36**. The two portions are then separated, FIG. **5B**, to form a T-shaped portion **37** with a U-shaped portion **38**. The T-shaped portion includes a leg **39** and the U-shaped portion includes a cut-out **40**.

The two sections are then placed face-to-face with the leg **39** adjacent the cut-out **40** as shown in FIG. **5C**. Prior to placing the two sections **37** and **38** in face-to-face relationship, a suitable bonding adhesive is applied to the two surfaces. Thereafter, the two sections are forced together to bond the two pieces to form a unitary post such as shown in FIG. **2**. It is, of course, apparent that the T-shaped and U-shaped portions may be formed by other means of cutting, such as by use of a "hot-wire" common in the trade, with a knife, or with a band, jig or sabersaw. Furthermore, the polyethylene foam sections may be adhered to one another by heating the facing surfaces and then compressing the sections together and allowing them to cool to form the bond. Alternately, an applied adhesive may be used to join the foam sections.

The bond, made either by heat-sealing or by applied adhesive, fuses together the two pieces of material which are forced to supplement each other as cushions when subjected to dynamic stress as happens when the package assembly impacts the floor. For example, consider a packaged **40** pound instrument dropped by a freight handler flat onto its fragile front face. The areas of cushioning material directly under the commodity compress. However, the welded joint and the bonded second section combine to add a distinctively new element not available in the prior art corner posts. The weld limits the amount of compression and slows the downward deflection of the areas of cushioning under the front of the commodity. Here, then, is a mechanical assist, a damping of stress by forcing material to work in tension, a supplement to the primary load-bearing cushion by means of a securely-bonded adjacent material against which the primary cushion pulls and stretches using its elasticity and its tensile strength to resist displacement. Furthermore, the joint or weld imparts its own tensile strength to resist compression of the primary cushion area. Under severe stress, the cushioning material itself will tear before the weld gives way.

Another advantage of the two-piece corner post is its resistance to tearing and to puncture. Extensive testing has demonstrated that only minimal fractures of the plastic foam resulted when the packaged product was dropped onto four corners, five different flat surfaces and a bottom edge. Joints showed little effect of the impacts and in no case did puncturing of the foam nor bottoming-out of the product occur.

A corner post of twl welded or bonded sections as described provides significantly improved shock-damping capability, greater tensile strength and more resistance to fracturing and puncturing under dynamic stress than a similar post made from a single piece of the same kind of material and of greater thickness. The mechanical assist of the welded joint is effective in impacts of the package assembly on all eight corners, edges, and on front, back and side surfaces.

It is evident that the corner cushions may be fabricated from any thickness material, and that the length and widths of the impact-receiving top, bottom and sides may be made of any thickness or shape depending upon the protection requirements of the product being packaged. It is also evident that cushioning material other than polyethylene foam can be used and that a variety of materials other than corrugated fiberboard can be bonded to the foam and force it to act as a cushion in tension as well as in compression while also strengthening the foam.

Using two-piece corner posts of the type described, a set of four were cut and cemented together with 3–M Brand 4693 Adhesive. The overall height of the post was 9 inches, and the height of the cut-out in the U-shaped section was 4 ⅞ inches to snugly engage a 5 inch high commodity with a fiberboard cap between the commodity and the post. The first step in assembly of the package was to center the commodity on a stand having a flat surface approximately **6** inches narrower and shorter than the bottom of the product. This allowed all four corners of the commodity to extend well beyond the stand. The fiberboard front cap was then placed over the front handles of the instrument to extend over the projecting handles. While holding the cap with one hand, a corner post was pressed over one end thereby locking the end in position around the handle. The operation was repeated so as to anchor the other end onto the handle. Each rear corner post was placed by holding it at an angle to engage the bottom corner of the instrument in the cut-out, then shoving it tightly into position so as to grip the product. The undersized cut-out of all four post corners was sufficient to hold them in place as a friction fit. The commodity was then lifted, lowered into a fiberboard shipping container and thrust downwardly until the posts were firmly seated on the bottom of the container. The top flaps of the fiberboard box were brought together and secured with a 3 inch wide gum back tape of the water-activated type. The resulting package assembly provided a very tight fit of the product, the corner posts and box with foam under compression from front to back, side to side and top to bottom. The instrument weighed 39 pounds, and the entire package assembly and instrument combined were 44 pounds gross weight. The assembly was drop tested from a height of 30 inches on four different corners, on five different flat surfaces, and on the front bottom edge. "G" forces were measured by means of a Model 815A2 Kistler accelerometer, a power supply and an HP Model No.141*a* Oscilloscope. Average "G" readings were **16** G's on corner drops at 40 milliseconds duration and 40 G's at 27 milliseconds from the flat surface impacts. These results were excellent when compared to comparable measurements of cushioning performance of a number of other types of packaging. The reliability of the packaging assembly was established through a series of ten identical drop tests of ten drops each, all with closely comparable results.

Another embodiment of the invention is illustrated in FIGS. **6** through **9**. Referring in particular to FIG. **8**, the cushion includes a first section of resilient material **16***a* having recess **17***a* with upper and lower support surfaces **18***a* and **19***a* and an end support surface **21***a*. The spacing between the support surfaces **18***a* and **19***a* is slightly less than the height of the commodity which is to be accommodated thereby accomplishing a snug fit of the cushion with the top and bottom surfaces of the commodity. The surface **21***a* bears against the corner sides of the commodity to offer lateral support in one direction. The corner cushion includes a second portion **22***a* of resilient material adjacent the recess and providing a second surface **23***a* which offers lateral support in the other direction.

In the embodiment of the invention shown in FIG. **8**, a stiff support member **46** is suitably bonded to one face of the portion **16**a and to one face of portion **22***a*. The member **46** may be of corrugated fiberboard or other suitable material firmly bonded to the members **16***a* and **22***a* by an adhesive or the like. The supporting or reinforcing member is hinged at **47** to allow the support member **22***a* to be rotated outwardly to present surface **23***a* to the commodity and provide lateral support.

Referring to FIGS. **6** and **7**, the support member **22***a* is initially an integral portion of the overall cushion which is cut at **48** and then the cut-out portion is rotated to form the portion **22***a* serving to laterally support the commodity. Preferably, the cut at the fold **47** does not extend entirely through the resilient material whereby there is a small portion of the material at the fold **48**.

The combination of first and second cushioning portions with a support layer or portion adhered to the surface offering additional support provides a corner post which can be compressed in all directions to transmit the forces and which offers improved tensile strength and puncture resistance. This material improves the shock distribution in that stress in shear exerts a tensile pull on one portion of the cushion with support from the other. The strength of the welded or bonded joint and support member thereby supplements the resistance of the cushion. It is stronger and more effective than adding a considerably more cushioned thickness.

The arrangement of the post and instrument described has assumed that the assembled package includes the posts disposed at four corners of a box. It is apparent that the same cushioning would be obtained if the corner posts were located horizontally along the top and bottom of the box or on the sides or edge corners. In essence then, the posts should be disposed at opposed or spaced corners or edges or other areas whereby to support the commodity. If the container has only three corners for a three-cornered commodity, only three posts are required to stably suspend the commodity in spaced relationship with the walls of the box. This would result in economy of cushioning material in boxes of certain configurations. It is apparent that corner posts described, which receive and suspend the goods, may be used with many other configurations of containers. It is also evident that products of shapes other than rectangular may be packaged using the corner cushion. For example, a commodity of the shape of a disc could be suspended by four spaced cushions cut out to grasp the commodity firmly with each post located in the center of each of the four sides of the walls of the shipping container. It is, therefore, to be understood that the invention is not intended to be limited in this respect.

I claim:

1. A package assembly including cushions for supporting a commodity in spaced relationship with the other container, said cushions each comprising a first portion of resilient energy-absorbing material of predetermined thickness having a cut-out defining a recess with upper and lower support surfaces for engaging the top and bottom of an associated commodity and a rear surface for abutting one side of the commodity and providing lateral support in said direction, a second portion adjacent said recess for engaging the adjacent side of said commodity and providing lateral support in the other direction and means including a bonding layer between and secured to said two portions for securing one to the other and for distributing forces between the two portions, said first and second portions providing a predetermined thickness of material between the commodity and the top, bottom and side walls of the container.

2. A cushion for supporting commodities in spaced relationship within an outer container comprising a first portion of resilient energy-absorbing material of a predetermined thickness having a cut-out defining a recess with upper and lower support surfaces for engaging the top and bottom of an associated commodity and a rear surface for abutting one side of the commodity and providing lateral support in said direction, a second portion adjacent said recess for engaging an adjacent side of said commodity and providing lateral support in the other direction and means including a bonding layer between and secured to said two portions for securing one to the other and for distributing forces between the two portions, said first and second portions providing a predetermined thickness of material between the commodity and top, bottom and side walls of the container with which the cushion is associated.

3. A cushion as in claim 2 in which said first portion is a rectangular piece of resilient energy-absorbing material of predetermined thickness and said cut-out extends entirely through the thickness of said rectangular piece whereby said portions are U-shaped.

4. A cushion as in claim 2 wherein said first and second portions are cut from a piece of rectangular resilient energy-absorbing material of predetermined thickness in such a manner that the first potion is U-shaped and the second portion is the leg of a T-shaped section disposed adjacent the recess of the U-shaped portion, and bonding means joining the adjacent faces of the T-Shaped section and the U-shaped portion.

5. A cushion as in claim 2 in which said first and second portions are cut-out to form a rectangular section of energy-absorbing resilient material of predetermined thickness to form a U-shaped portion with a recess with the cut-out from the recess disposed adjacent said recess to provide lateral support, and means including a bonding layer cooperating between said two portions.

6. A cushion as in claim 5 in which said means cooperating between said two portions comprises a stiff support member bonded to one face of said U-shaped portion and to one face of said cut-out.

7. A corner cushion for supporting commodities in spaced relationship with an outer container comprising a first U-shaped portion of resilient energy-absorbing material defining a recess with upper and lower support surfaces for engaging the top and bottom of an associated commodity and a rear surface for abutting one side of the commodity and providing lateral support in said direction, a second rectangular member of predetermined thickness disposed adjacent said recess and presenting one face to said recess for engaging the adjacent side of said commodity and providing lateral support in the other direction, and a stiff member bonded to said U-shaped portion and to said rectangular portion to secure said portions one to the other and to provide support between said first and second portions of resilient material.

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