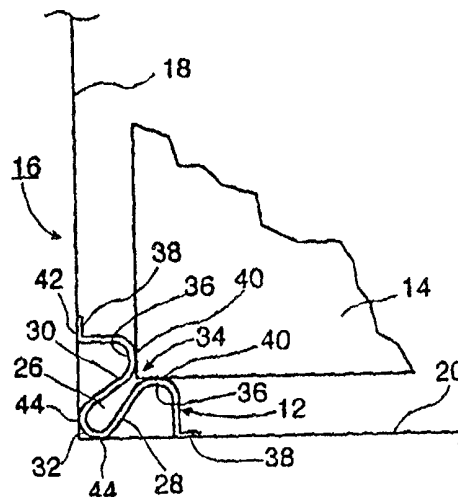




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<b>(54) Title:</b> MOLDED PRODUCT CUSHIONING DEVICE		
<b>(57) Abstract</b>		
<p>A unitary product cushioning device (12, 50, 80, 90, 110, 150) is provided for supporting a shock sensitive product (14) in an outer packaging container (16), and is formed of a moldable resilient plastics material. The device comprises a post structure (26, 26a, 34, 110, 152), with a first closed end (32, 32a, 154) and a second open end (38, 38a, 56, 160), with the open end having a curved ridge formed at at least a first side of the post structure, and terminating in a container contacting flange at the end of the curved ridge remote from the open end. A portion of the curved ridge presents a product supporting surface (40, 40a, 44, 44a, 162); and a further portion of the curved ridge is curved in a direction outwardly and away from the post structure. There may be a container contacting surface near the closed end of the post structure.</p>		



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## MOLDED PRODUCT CUSHIONING DEVICE

This invention relates to product cushioning devices for use in packaging shock sensitive products. In particular, the invention relates to re-usable or recyclable product cushioning devices which are made from plastics material, and which may have several different embodiments including corner pieces, edge pieces, and end caps.

5 Each of the embodiments of the present invention comprises a unitary structure which may be molded from a plastics material using a variety of molding techniques.

GOBAN United States patent No. 3,294,223 teaches a molded plastic corner piece having the configuration of a triangular polyhedron which is either rounded or flattened at its apex. The purpose of the corner support is to entrap air between the  
10 molded plastic corner piece and the corner of the carton into which it is placed.

FOOS *et al.* United States patent No. 5,226,543 teaches a packaging structure which includes both a platform portion and a sidewall portion, wherein the sidewall portion forms an enclosure around the platform portion. Essentially, this product is an end cap or platform. The sidewall has both inner and outer walls which are joined  
15 by a bridge section, and the inboard wall is relatively shorter than the outboard wall such that the platform portion holds the fragile article at a specific distance above the lower edge of the outboard wall. Shock absorbing formations - typically, notches - are formed in the bridge portion of the sidewall. These notches have a degree of elasticity such that, when the packaging structure is loaded and then unloaded, or shocked and  
20 then unloaded, the notch will return to its original shape and can absorb multiple loads without deteriorating. However, in order for the elasticity to exist, a material with a high degree of stiffness must be used - typically, that material is high density polyethylene. The patent requires that the inboard wall is shorter than the outboard wall.

25 Another patent issued to Foos *et al.* is United States patent No. 5,385,232. This patent also teaches a sidewall structure which forms an enclosure around a platform

portion. However, the teachings of this patent also address the issue of light shock loads that may not deform or compress the shock load formations - the notches that are discussed in the previous Foos *et al.* patent. Here, the concept of openings which provide for collapsibility and allow for the release of compressed air beneath the package when the package is subject to shock loading, is introduced. These collapsible openings may be located in the platform at various locations, and may have a variety of shapes. Still, like the other Foos *et al.* patent, the teaching is directed to the use of inboard and outboard walls as well as the use of the shock formations (the notches) that have an elastic characteristic.

10 MOREN *et al.* United States patent No. 5,515,976 teaches a structure which has side flanges that are adapted to contact all sides of an end portion of a fragile article, and is thus configured as an end cap. There are a number of protrusions disposed throughout the sidewalls to support the article. There is also a notch provided in the side wall as a means to absorb shock loads. The end cap of this patent is also  
15 provided with at least one crush button for absorbing shocks applied along the longitudinal length of the fragile article.

Finally, AZELTON *et al.* United States patent No. 5,799,796 teaches a unitary spring system end cap packaging unit. Here, the structure includes an inner wall, an outer wall, and a spring system disposed between them. The spring system includes  
20 at least one flexible harmonic bellows which forms a flexible ridge that has an arcuate shape along the length of the sidewall structure. A cushioning space exists between the edge of the inner sidewall and the edge of the outer sidewall. Dimples may be provided on the inner surfaces of the sidewall to allow a friction fit of the end cap to the product over which it will be placed. The arcuate harmonic bellows form flexible  
25 ridges that are elastic in nature; and each bellows of the spring system operates independently when a shock load is applied.

In its broadest sense, and as a common feature of any of the embodiments of the present invention - corner piece, edge piece, or end cap - the present invention provides a product cushioning device which, in all events, is intended for supporting  
30 a shock sensitive product in an outer packaging container. The present invention is

applicable for use in any container which has at least parallel and planar top and bottom surfaces and at least three planar sides surfaces, each of which is perpendicular to the planar top and bottom surfaces. As will be discussed hereafter, in several embodiments of the present invention, the post structure may have several configurations, such that it may or may not contact one or more of the planar surfaces of the container. In any event, and in its broadest sense, the unitary product cushioning device of the present invention is formed of a moldable resilient plastics material and comprises:

10 A post structure having a first closed end and a second open end. The open end of the post structure has a first curved ridge formed at at least a first side of the post structure, and that ridge terminates in a first container contacting flange at the end thereof which is remote from the open end of the post structure.

A portion of at least the first curved ridge at the first side of the post structure presents a product supporting surface.

15 A further portion of at least the first curved ridge at the first side of the post structure is curved in a direction outwardly and away from the post structure.

When the unitary product cushioning device is placed in a container so that the post structure extends towards a corner defined by at least two surfaces of the container, the first container contacting flange will contact one of the planar surfaces of the container. The product supporting surface will be parallel to that contacted surface.

20 When a shock load is applied to the unitary product cushioning device in a direction towards the one of the planar surfaces which has been contacted by the container contacting flanges, the curve of the curved ridge will at least temporarily be further curved in a direction away from the post structure. Moreover, the product supporting surface will also at least temporarily move closer to that surface.

In one embodiment of the present invention, the post structure may be curved away from the second open end thereof. In a further, more general, embodiment of the present invention, the post structure has a pair of sidewalls which extend away from

the second open end of the post structure, where the sidewalls will terminate in the closed end of the post structure.

In a particular embodiment of the present invention, at least one of the pair of sidewalls of the post structure has a container contacting surface near the closed end.

5 Thus, when the unitary product cushioning device is placed in an outer packaging container, the container contacting surface will contact one of the corner defining planar surfaces of the container.

In another embodiment of the present invention, the unitary product cushioning device is intended for use in an outer packaging container which has a rectilinear configuration. However, as otherwise expressed above, the unitary product cushioning device comprises a post structure with a first closed end and a second open end, and with the open end having a first curved ridge formed at at least a first side of the post structure. The first curved ridge terminates at a first container contacting flange at the end thereof remote from the open end of the post structure.

15 The unitary product cushioning device of the present invention may be designed so as to be specifically non-symmetrical. Such a non-symmetrical unitary product cushioning device will find its usefulness in association with some products which may have a more pronounced shock sensitivity in one direction than in another, generally perpendicular, direction.

20 If the unitary product cushioning device is to be utilized as an edge piece, then the device may be formed of an extruded plastics material. In that case, the device will have first and second ends, each of which is open.

However, if the unitary product cushioning device of the present invention is to be formed as an end cap, it may be molded by drape molding, vacuum molding, blow molding, or injection molding. In that case, the end cap will have a predetermined length, and will have first and second ends which are closed. Also, the post structure will have first and second ends which are closed.

25 Typically, the unitary product cushioning device, when configured as an end cap, will be such that the length of the post structure is less than the length of the end

cap. Moreover, the end cap will further comprise a pair of extension wings, one at each of the first and second closed ends thereof.

When the unitary product cushioning device of the present invention is configured as a corner piece, the post structure is formed having an isosceles triangular cross-section, having a base portion and two side portions. The post structure is truncated.

When the unitary product cushioning device which is conformed as a corner piece is fitted into a corner of a rectilinear container, one of the three intersecting surfaces of the rectilinear container will be contacted by the container contacting flange at the base portion side of the post structure.

In a particular embodiment of corner piece in keeping with the present invention, the post structure has an equilateral triangular cross-section. In this embodiment, a curved ridge is formed at each of the three sides of the post structure, and each of the curved ridges terminates in a container contacting flange at the respective end thereof which is remote from the open end of the post structure.

Typical materials from which any unitary product cushioning device of the present invention may be formed include low density polyethylene, high density polyethylene, polyvinyl chloride, PET (polyethyleneterephthalate), polystyrene, nylon, polypropylene, and appropriate mixtures and co-polymers thereof.

The novel features which are believed to be characteristic of the present invention, as to its structure, organization, use and method of operation, together with further objectives and advantages thereof, will be better understood from the following drawings in which a presently preferred embodiment of the invention will now be illustrated by way of example. It is expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the invention. Embodiments of this invention will now be described by way of example in association with the accompanying drawings in which:

Figure 1 is a side elevation view of a unitary product cushioning device in keeping with the present invention, together with a product and a container package;

Figure 2 illustrates the use of edge pieces in keeping with the present invention;

Figure 3 is an elevation of a corner piece in keeping with the present invention;

Figure 4 is an end view of a corner piece in keeping with the present invention;

Figure 5 illustrates the use of a corner piece in keeping with the present invention;

5 Figure 6 is a side elevation of an end cap in keeping with the present invention;

Figure 7 is an end elevation of an end cap in keeping with the present invention;

Figure 8 illustrates the use of an end cap in keeping with the present invention;

10 Figure 9 is an end elevation of a further embodiment of end cap in keeping with the present invention;

Figure 10 is an end view of a still further embodiment of end cap in keeping with the present invention;

Figure 11 is a partial view of the embodiment of Figure 11 when folded into its operative configuration; and

15 Figure 12 is a view similar to Figure 1, but showing a post structure which extends towards but does not contact a corner defining surface of the container in which the unitary product cushioning device is found.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:**

20 Turning first to Figure 12, some fundamental configuration principals are discussed. In particular, it will be understood that some issues surrounding the configuration of a unitary product cushioning device will be found in all embodiments of unitary product cushioning devices in keeping with the present invention. Thus, while the following discussion is particularly directed to the embodiment of Figure 12, 25 the particular principals which are discussed will be found in all embodiments.

The unitary product cushioning device 150, in this case, is one which is formed of a moldable resilient plastic material. It comprises a post structure 152, which has a first closed end 154, and a second open end 156. In the most general sense, the unitary product cushioning device 150 includes a first curved ridge 158 which is 30 formed at a first side - in this case, the lower or right side, as seen in Figure 12 - of the



unitary product cushioning device 150. The first curved ridge 158 terminates at a first container contacting flange 160, which is at the end of the first curved ridge 158 which is remote from the open end 156 of the post structure 152. A portion 162 of the first curved ridge 158 presents a product supporting surface. A further portion of the first curved ridge 158 - being that portion thereof which extends between the product supporting surface 162 and the container contacting flange 160 - is curved in a direction outwardly and away from the post structure 152.

Two planar surfaces of a container are shown in Figure 12, at 164 and 166. As noted above, it will be understood that any unitary product cushioning device of the present invention is intended to be employed in a container which, in the broadest sense, is defined as having parallel and planar top and bottom surfaces, and at least three planar side surfaces. In the orientation of the surfaces 164 and 166 as they are shown in Figure 12, surface 166 can be considered to be a planar bottom surface.

As will be discussed hereafter, a container having a rectilinear configuration is the most common configuration of container which may be found, being one which has parallel and planar top and bottom surfaces as well as a pair of parallel and planar end surfaces and a pair of parallel and planar side surfaces. However, the unitary product cushioning device of the present invention may be employed with other configurations of containers, such as those described above.

In the configuration shown in Figure 12, a corner is shown which is defined by the intersection of surfaces 164 and 166. It will be noted that the container contacting flange 160 is in contact with the surface 166; and, if the configuration shown in Figure 12 were to be turned over, surface 166 would be a planar top surface. In any event, it is seen that the product supporting surface 162 is parallel to the planar surface 166.

If a shock load is applied to the unitary product cushioning device 150, in a direction towards the surface 166, then that portion of the curved ridge 158 which is between the product supporting surface 162 and the container contacting flange 160 will at least temporarily be further curved in a direction outwardly and away from the post structure 152 - that is, in the configuration shown in Figure 12, to the right.

Moreover, the product supporting surface 162 will at least temporarily move closer to the planar surface 166.

From Figure 12, it can be seen that the post structure 152 may be configured so as to be curved away from the open end 156. Indeed, the post structure may  
5 essentially adopt a partial cylinder configuration.

On the other hand, the post structure 152 will be seen in other figures, such as Figure 1, where a post structure 26 is shown to comprise a pair of sidewalls 28 and 30, each of which extends away from the open end 34, and is such that the post structure 26 terminates in a closed end 32. This is discussed in greater detail hereafter.

10 It will be noted that the post structure 152 in Figure 12 does not touch either surfaces 164 or 166, whereas the post structure 26 shown in Figure 1 touches at least one of the surfaces 18 and 20, and may contact both surfaces.

Thus, having regard to the embodiment of Figure 1, there may be a container contacting surface 44 at one side of the unitary product cushioning device, but not  
15 necessarily at the other side. Moreover, there may be an axis of symmetry which bisects the post structure; and, as particularly seen in Figures 12 and 1, an axis of symmetry is such that there are curved ridges 158 and 36 which are formed at both sides of the respective post structure 152 or 26. Each of the curved ridges terminates at respective first and second container contacting flanges 160 in Figure 12 and 38 in  
20 Figure 1.

Reference will now be made to Figures 1 and 2, where a particular fundamental embodiment of a unitary product cushioning device in keeping with the present invention is illustrated. In this case, there is shown a unitary product cushioning device 12 which, especially as shown in Figure 2, is being put to use as an edge piece.  
25 As discussed hereafter, Figure 1 may also be considered to be a cross-section of an end cap unitary product cushioning device in keeping with the present invention.

Moreover, Figures 1 and 2 may be utilized to illustrate certain fundamental characteristics of any unitary product cushioning device in keeping with the present invention, whether it be an edge piece, end cap, or corner piece. Principally, any  
30 unitary product cushioning device in keeping with the present invention is intended for

supporting a shock sensitive product, shown generally at 14, and the shock sensitive product is intended to be supported in an outer packaging container having a rectilinear configuration. The outer packaging container is shown generally at 16; and, in the views of the rectilinear outer packaging container shown in Figures 1 and 2, the container comprises six planar surfaces, including surfaces 18, 20, and 22.

In each unitary product cushioning device in keeping with the present invention, there is a post structure 26, which has a pair of sidewalls 28 and 30. Each post 26 has a first closed end 32, and a second open end 34.

The open end 34 has a curved ridge formed at at least a first side of the post structure. In the embodiment of Figures 1 and 2, there is a pair of curved ridges 36. Each ridge terminates in a container contacting flange 38, each of which is located at the end of the curved ridge 36 which is remote from the open end 34. The intersection between curved ridge 36 and the respective container contacting flange 38 is shown at 42. A portion of the curved ridge 36 presents a product supporting surface, shown at 40. Obviously, in the specific embodiment shown in Figures 1 and 2, there are two product supporting surfaces 40, but only one functions as a product supporting surface; the other functions as a limiting surface, precluding movement of the product 14 further towards the container surface 18. In another orientation, of course, the container may be placed on its side, so that the roles of the respective product supporting surfaces 40 are reversed.

A further portion of the ridge 36 is curved in a direction outwardly and away from the post structure 26.

There is also a container contacting surface formed in the post structure 34, and shown at 44.

When the unitary product cushioning device 12 is placed in a rectangular container so that the post structure 26 extends into a corner defined by the intersection of the surfaces 18 and 20, the container contacting surfaces 44 at the at least one side of the post structure 26 - for purposes of the present discussion, consider the container contacting surface 44 which contacts the container surface 20 - and the container contacting flange 38, will indeed contact at least one of the two surfaces 18 and 20.

The embodiment shown in Figures 1 and 2 has both surfaces 18 and 20 being contacted by the respective container contacting flanges 38 and container contacting surfaces 44.

It is also obvious that the product supporting surface 40 will be parallel to the container surface 20.

When a shock load is applied to the unitary product cushioning device 12 in a direction toward the container surface 20, such as when a container 16 having the product 14 inside it is dropped, the curved ridge 36 will at least temporarily extend further away from the post structure 26 and become more acute. Moreover, the product supporting surface 40 will at least temporarily move closer to the container surface 20. Thus, it will be seen that the product 14 is cushioned, and shock which might be experienced by the shock sensitive product 14 is at least reduced.

It is evident from Figures 1 and 2 that the embodiment of the unitary product cushioning device shown in those figures has an axis of symmetry which bisects the post structure 26. Thus, as already described, there is a curved ridge 36 at each side of the structure, and so on. The importance of the discussion concerning an axis of symmetry through the post structure so that a container contacting flange 38, a container contacting surface 44, and a product supporting surface 40 is disposed at each side of the axis of symmetry, becomes more clear when it is considered that such characteristics are true of an end cap but not of a corner piece, as described hereafter.

The edge piece configuration of the unitary product cushioning device of the present invention may be formed from an extruded plastic. If so, it then has first and second ends, of which an end 46 is shown, the other end of each device 12 shown in Figure 2 having been removed for the sake of illustration of the device. When an edge piece is used, there will in fact be four devices utilized in a rectilinear container 16. Two devices will be used at opposed ends or sides at the bottom of the container 16, the other two devices will be used on the other sides or ends of the container at the top thereof. One such device is shown at the bottom and one end of the container 16 in Figure 2; and another device is shown at the top and along one side of the container

16 in Figure 2, it being understood that another device will be on the other side and also at the top of the container.

As noted above, Figure 1 may also be considered to be a cross-section of an end cap, such as that which is shown in Figures 6, 7, and 8.

5       Turning now to Figures 6, 7, and 8, an end cap is shown, which end cap may be formed from a plastics material which has been molded by drape molding, vacuum molding, blow molding, or injection molding. It is evident that an end cap may not be extruded since it has closed ends, as discussed hereafter.

Each end cap has a predetermined length, and has first and second ends 60 and 10 62 which are closed. The post structure 26 also has first and second ends 64 and 66, which are also closed.

Figure 8 shows the application of an end cap, where two unitary product cushioning devices 50 are placed, at each end of a product 14, within a container 16.

As noted in Figure 6, the length of the post structure 26 is less than the length 15 of the end cap 50. It will be noted that the end cap 50 further comprises a pair of extension wings 52, one at each of the first and second ends 60 and 62. Each extension wing 52 comprises a curved ridge 54 which is curved away from the post structure 26, and which terminates in a container contacting flange 56.

It will be evident, particularly from Figures 6 and 8, that each of the container 20 contacting flanges 56 of the extension wings 52 is disposed in a pair of planes which may be substantially parallel to each other, so as to contact the bottom and top surfaces of the container 16 when in place. Thus, each of the further planes in which the container contacting flanges 56 are located may be substantially perpendicular to each of the first and second planes by which the other container contacting flanges 38 25 and the container contacting surfaces 44 of the post structure 26 are defined. It will also be evident from an examination of Figures 6 and 8 that the predetermined length of the end cap 50 is measured between the container contacting flanges 56 of the extension wings 52.

However, it must be noted that the planes in which the container contacting 30 flanges 56 of the extension wings 52 are disposed may have approximate parallelism.

Indeed, the planes in which the container contacting flanges 56 are disposed may have parallelism plus or minus zero degrees to 40° or more with respect to each other - that is, if the planes of the respective container contacting flanges 56 were extended and were such that they would intersect with each other, there would be up to 80° or more out of parallelism of each plane with respect to the other. However, as noted above, it is usual that the planes of the container contacting flanges 56 may be as much as 10° off parallel with respect to each other in a practical unitary product cushioning device.

In general, an end cap unitary product cushioning device of the present invention is formed with the post structure 26 having a predetermined length and a predetermined width at its open end, as can be noted from an examination of Figures 6 and 7. Moreover, the sidewalls of the post structure are sloped towards each other, as shown in Figure 7, in a direction from the open end towards the closed end thereof. The first and second ends 64 and 66 of the post structure 26 are also sloped towards each other in a direction from the open towards the closed end.

A further inspection of Figures 6, 7, 9, 10, and 11 will show a pair of rectilinear depressions 70 which is formed, one at each end of the post structure 26. Each rectilinear depression 70 has a substantially planar end wall 72, and a pair of sidewalls 74 and 76, which are perpendicularly disposed to each other. The sidewalls 74 and 76 intersect at a vertex 78, which is disposed along the axis of symmetry of the end cap structure.

It is shown particularly in Figure 9 that a pair of similarly configured unitary product cushioning devices 80 may be employed at opposite sides of a rectilinear container (not shown), so as to cushion a rectilinear product received therein. Obviously the rectilinear product, in this case, will be received and retained by the rectilinear depressions 70.

Indeed, Figure 9 shows that a unitary product cushioning device of the present invention may be formed as a pair of similarly configured unitary product cushioning devices 80 which are joined together at a respective one of the container contacting flanges 38 which are at a respective first or second side of the respective post structure 26 of each unitary product cushioning device 80.

Referring to Figures 10 and 11, a pair of similarly configured unitary product cushioning devices 90 may be formed together as a unitary structure, having a further extension structure 92 interposed between a respective one of the container contacting flanges 38 at a respective first or second side of the respective post structure 26 of each structure 90. This will accommodate a wider product 14, as will be particularly  
5 inferred from an examination of Figure 11, where it is evident that the pair of product cushioning device structures 90 may be folded up to present a structure for receiving a rectilinear product.

Moreover, from Figures 10 and 11, it can be seen that the further extension  
10 structure 92 may be formed flat, but more particularly it will be formed with a centrally located ridge 94 which is parallel to the container contacting flanges 38 of each of the structures 90. The extension structure 92 further has a pair of rims 96 which are located one at each side of the centrally located ridge 94. Each of the rims 96 includes an upstanding wing portion 98. Each of the curved ridges 36 of the  
15 structures 90 includes an opening (not shown) formed therein.

Thus, when the respective container contacting flanges 38 and the rims 96 are oriented towards each other by a flexible hinge 100 formed between them being bent, then the wing portions 98 are received in the respective openings so that the structures are locked together with each structure 90 being locked to the interposed ridge  
20 structure 92.

Referring now to Figures 3, 4, and 5, a unitary product cushioning device of the present invention is shown as being formed in the configuration of a corner piece 110. Here, the corner piece is intended to be fitted into a corner of a rectilinear container 116, which corner is defined by three intersecting surfaces such as surfaces  
25 18, 20, and 22 shown in each of Figures 2 and 5. Each of the surfaces 18, 20, and 22 are mutually perpendicular one to another.

Similar structural features retain the same reference numeral, but are differentiated by the additional suffix "a". Thus, each corner piece 110 as shown in Figures 3, 4, and 5 has a post structure 26a, with container contacting surfaces 44a.  
30 There are curved ridges 36a, terminating in container contacting flanges 38a.

It should be particularly noted that each post structure 26a may be formed having the cross-section of an isosceles triangle. Of course, it is understood that an equilateral triangle is a special case of an isosceles triangle, with the two sides being each the same length as the base portion. Thus, the two sides which are subtended by  
5 the base portion may be either shorter or longer than the base portion of such a post structure 26a.

As seen particularly in Figures 4 and 5, each post structure 26a may be formed having an equilateral triangular cross-section, so that there are three sides to the post structure 26a. The post structure 26a is truncated as at 112, at the closed end 32a of  
10 the post structure 26a. It is also evident that there are three axes of symmetry, each being perpendicular to one of the three sides of the post structure 26a.

The open end of the post structure 26a has a curved ridge 36a formed at least at the base portion side thereof, or at each of the three sides thereof, with each ridge terminating in a container contacting flange 38a.

15 Obviously, each of the curved ridges 36a presents a product supporting surface 40a. Moreover, as is seen particularly from Figure 3, a further portion of each of the curved ridges 36 is curved in a direction outwardly and away from the post structure 26a.

When the corner piece 110 is fitted into a corner of a rectilinear container, only  
20 one of the three intersecting surfaces of the rectilinear container will be contacted by one of the container contacting surfaces 38a. As shown in Figure 5, that surface, in that illustration, is surface 20. Likewise, only one of the container contacting surfaces 44a at the closed end 32a of the post structure 26a will contact the surface 20.

It will be obvious from Figure 5 that the respective product supporting surface  
25 40a which is oriented so as to, in fact, support a product 14 when placed thereon, is parallel to the surface 20.

Thus, as before, when a shock load is applied to the unitary product cushioning device, configured in this case as a corner post 110, in a direction towards the contacted container surface 20, the respective curved ridge 36 will at least temporarily  
30 extend further away from the post structure and become more acute, and the respective



product supporting surface 40a will at least temporarily move closer to the contacted container surface 20.

A protuberance or "button" may be formed in any of the product supporting surfaces 40 or 40a to extend upwardly therefrom. The protuberance or "button" is shown at 120 in Figures 2, 4, and 6. Further, a protuberance may be formed in each of the planar end walls 72 of the rectilinear depressions 70, and is shown as 122 in Figures 7 and 9.

The purpose of the protuberances 120 and 122 is to provide an additional means to urge the supported product 14 towards the centre of the container 16. Additionally, the protuberances 120 and 122 provide an initial structure which may collapse and thereby absorb shock force before the rims 36 begin to collapse under shock loading.

When a corner piece or end piece is employed, it will be seen that shock loading from the side of the container will also be absorbed. In all instances, and in any event, it will be seen that shock loading forces will be transferred from the container 16 to the unitary product cushioning device through the container contacting flanges 38 or 38a and the container contacting surfaces 44 or 44a formed on the post structures 26 or 26a. Moreover, due to the elasticity of the plastics materials from which the unitary product cushioning devices of the present invention are manufactured, there is no permanent deformation of the unitary product cushioning devices when they have been put to the task of absorbing shock loading so as to protect the shock sensitive product that is cushioned in them.

To that end, drop tests on a variety of embodiments of unitary product cushioning devices in keeping with the present invention, having differing sizes and being intended for different purposes, have indicated, in each instance, the ability of the unitary product cushioning devices of the present invention to meet all drop test standards. Those standards vary from case to case, depending on the product to be protected, the size and nature of the product cushioning device, and so on. In general, a unitary product cushioning device in keeping with the present invention will reduce

the impact forces imparted to the product being cushioned, to a level below 100 g's - typically, to a level of 50 g's to 60 g's for a drop of about one metre.

It has been noted that the embodiment of the unitary product cushioning device of the present invention which is employed as an edge piece may be extruded.

5 Otherwise, the molding technique which may be employed can be drape molding, vacuum molding, blow molding, or injection molding. Any such molding technique which is employed is well known to those skilled in the plastics molding arts, and requires no further discussion herein.

10 Generally, and especially when drape molding or vacuum molding techniques are employed, the unitary product cushioning device of the present invention is molded at an angle which is less than 90 degrees to the product supporting surface. This may give added integrity to the unitary product cushioning device of the present invention, and provides for easier removal from the mold in which or over which the unitary product cushioning device of the present invention has been molded.

15 Likewise, the materials from which the unitary product cushioning devices of the present invention may be molded include low density polyethylene, high density polyethylene, polyvinyl chloride, PET, polystyrene, nylon, polypropylene, and appropriate mixtures and co-polymers thereof. However, it will be understood that the above list of materials is intended to be illustrative but not exhaustive.

**WHAT IS CLAIMED IS:**

1           A unitary product cushioning device (12, 50, 80, 90, 100, 150) for supporting a shock sensitive product (14) in an outer packaging container (16), said unitary product cushioning device being formed of a moldable resilient plastics material, and being **c h a r a c t e r i z e d** by:

          a post structure (26, 26a, 34, 110, 152) having a first closed end (32, 32a, 154) and a second open end (34, 156); and

          a first curved ridge (36, 158) formed at at least a first side of said post structure, said first curved ridge terminating at a first container contacting flange (38, 38a, 56, 160) at the end thereof remote from said open end of said post structure;

          wherein a portion of at least said first curved ridge at said first side of said post structure presents a product supporting surface (40, 40a, 44, 44a, 162);

          wherein a further portion of at least said first curved ridge at said first side of said post structure is curved in a direction outwardly and away from said post structure;

          wherein, when said unitary product cushioning device is placed in an outer packaging container having parallel and planar top and bottom surfaces and at least three planar side surfaces (18, 20, 22, 164, 166), each of which is perpendicular to said planar top and bottom surfaces, so that said post structure extends towards a corner defined by at least two of said planar surfaces, said first container contacting flange will contact one of said planar surfaces, and said first product supporting surface will be parallel to said one of said planar surfaces; and

          wherein, when a shock load is applied to said unitary product cushioning device in a direction towards said one of said planar surfaces, said further portion of said first curved ridge at said first side of said post structure will at least temporarily be further curved in a direction outwardly and away from said post structure, and said product supporting surface will at least temporarily move closer to said one of said planar surfaces.

2           A unitary product cushioning device (12, 50, 80, 90, 110, 150) for supporting a shock sensitive product (14) in an outer packaging container (16) having a rectilinear configuration, said unitary product cushioning device being formed of a moldable resilient plastics material, and being **c h a r a c t e r i z e d** by:

          a post structure (26, 26a, 34, 110, 152) having first closed end (32, 32a, 154) and a second open end (34, 156);

          said open end having a first curved ridge formed at at least a first side of said post structure, said first curved ridge terminating at a first container contacting flange (38, 38a, 56, 160) at the end thereof remote from said open end;

          wherein a portion of at least said first curved ridge at said first side of said post structure presents a product supporting surface (40, 40a, 44, 44a, 162);

          wherein a further portion of at least said first curved ridge at said first side of said post structure is curved in a direction outwardly and away from said post structure;

          wherein, when said unitary product cushioning device is placed in a rectilinear container so that said post structure extends towards a corner defined by at least two surfaces (18, 20, 22, 164, 166) of said rectilinear container, said container contacting flange will contact one of said at least two container surfaces, and said product supporting surface will be parallel to said one of said at least two container surfaces; and

          wherein, when a shock load is applied to said unitary product cushioning device in a direction towards said one of said at least two container surfaces, said further portion of said first curved ridge will at least temporarily be further curved in a direction outwardly and away from said post structure, and said product supporting surface will at least temporarily move closer to said one of said at least two container surfaces.

3           The unitary product cushioning device of claim 1, wherein said post structure is curved away from said second open end thereof.

4           The unitary product cushioning device of claim 1, wherein said post structure has a pair of side walls which extend away from said second open end thereof, and said side walls terminate in said closed end of said post structure.

5           The unitary product cushioning device of claim 4, wherein at least one of said pair of side walls of said post structure has a container contacting surface near said closed end;

              whereby, when said unitary product cushioning device is placed in an outer packaging container, said container contacting surface will contact one of said corner defining planar surfaces.

6           The unitary product cushioning device of claim 5, wherein said container contacting surface is on the side wall which is at said first side of said post structure;

              whereby said container contacting surface will contact said one of said planar surfaces.

7           The unitary product cushioning device of claim 1, wherein said post structure may be placed in a container so that said post structure extends towards a corner defined by at least one of said planar side surfaces and one of said planar top and bottom surfaces.

8           The unitary product cushioning device of claim 7, wherein there is an axis of symmetry which bisects said post structure;

              whereby first and second curved ridges are formed at first and second sides of said post structure, and each of said first and second curved ridges terminates at a respective first and second container contacting flange.

9               The unitary product cushioning device of claim 8, wherein said post structure has a pair of said walls which extend away from said second open end thereof, and said side walls terminate in said closed end of said post structure; and  
                  wherein each of said pair of side walls of said post structure has a container contacting surface near said closed end.

10             The unitary product cushioning device of claim 1 or 2, wherein said device is formed of an extruded plastics material so as to have first and second ends, each of which is open.

11             The unitary product cushioning device of claim 1 or 2, wherein said device is formed of a plastics material which has been molded by one of the molding processes chosen from the group consisting of drape molding, vacuum molding, blow molding, and injection molding.

12             The unitary product cushioning device of claim 7, wherein said device is formed of a plastics material which has been molded by one of the molding processes chosen from the group consisting of drape molding, vacuum molding, blow molding, and injection molding;  
                  wherein said device is formed as an end cap having a predetermined length, wherein said end cap has first and second ends which are closed; and  
                  wherein said post structure has first and second ends which are closed.

13             The unitary product cushioning device of claim 2, wherein the length of said post structure is less than the length of said end cap, and wherein said end cap further comprises a pair of extension wings, one at each of said first and second closed ends thereof;  
                  wherein each of said extension wings comprises a curved ridge which is curved away from said post structure and terminates in a container contacting flange;  
and

wherein said predetermined length of said end cap is measured between said container contacting flanges of said extension wings.

14 The unitary product cushioning device of claim 12 or 13, wherein the length of said post structure is less than the length of said end cap, and wherein said end cap further comprises a pair of extension wings (52), one at each of said first and second closed ends thereof;

wherein each of said extension wings comprises a curved ridge (54) which is curved away from said post structure and terminates in a container contacting flange; and

wherein said predetermined length of said end cap is measured between said container contacting flanges of said extension wings.

15 The unitary product cushioning device of claim 12 or 13, wherein the length of said post structure is less than the length of said end cap, and wherein said end cap further comprises a pair of extension wings (52), one at each of said first and second closed ends thereof;

wherein each of said extension wings comprises a curved ridge (54) which is curved away from said post structure and terminates in a container contacting flange; and

wherein said predetermined length of said end cap is measured between said container contacting flanges of said extension wings; and

wherein said container contacting flanges of said extension wings are disposed in a pair of planes have parallelism plus or minus zero degrees to 10° with respect to each other.

16 The unitary product cushioning device of claim 12 or 13, wherein the length of said post structure is less than the length of said end cap, and wherein said end cap further comprises a pair of extension wings (52), one at each of said first and second closed ends thereof;

wherein each of said extension wings comprises a curved ridge (54) which is curved away from said post structure and terminates in a container contacting flange; and

wherein said predetermined length of said end cap is measured between said container contacting flanges of said extension wings; and

wherein said container contacting flanges of said extension wings are disposed in a pair of planes have parallelism plus or minus zero degrees to 10° with respect to each other; and

said unitary product cushioning device further comprising a pair of rectilinear depressions (70) formed one at each end of said post structure, each of said rectilinear depressions having a substantially planar end wall (72) and a pair of side walls (74, 76) perpendicularly disposed to each other and intersecting at a vertex (78) which is disposed along said axis of symmetry;

whereby a pair of similarly configured unitary product cushioning devices may be employed at opposed sides of a rectilinear container so as to cushion a rectilinear product therein.

17           The unitary product cushioning device of claim 12 or 13, wherein the length of said post structure is less than the length of said end cap, and wherein said end cap further comprises a pair of extension wings (52), one at each of said first and second closed ends thereof;

wherein each of said extension wings comprises a curved ridge (54) which is curved away from said post structure and terminates in a container contacting flange; and

wherein said predetermined length of said end cap is measured between said container contacting flanges of said extension wings; and

wherein said container contacting flanges of said extension wings are disposed in a pair of planes have parallelism plus or minus zero degrees to 10° with respect to each other; and



said unitary product cushioning device further comprising a pair of rectilinear depressions (70) formed one at each end of said post structure, each of said rectilinear depressions having a substantially planar end wall (72) and a pair of side walls (74, 76) perpendicularly disposed to each other and intersecting at a vertex (78) which is disposed along said axis of symmetry;

whereby a pair of similarly configured unitary product cushioning devices may be employed at opposed sides of a rectilinear container so as to cushion a rectilinear product therein;

wherein said unitary product cushioning device is formed as a pair of similarly configured unitary product cushioning devices (90) joined together at a respective one of said container contacting flanges (38) at a respective first or second side of the respective post structure of each.

18           The unitary product cushioning device of claim 12 or 13, wherein the length of said post structure is less than the length of said end cap, and wherein said end cap further comprises a pair of extension wings (52), one at each of said first and second closed ends thereof;

wherein each of said extension wings comprises a curved ridge (54) which is curved away from said post structure and terminates in a container contacting flange; and

wherein said predetermined length of said end cap is measured between said container contacting flanges of said extension wings; and

wherein said container contacting flanges of said extension wings are disposed in a pair of planes have parallelism plus or minus zero degrees to 10° with respect to each other; and

said unitary product cushioning device further comprising a pair of rectilinear depressions (70) formed one at each end of said post structure, each of said rectilinear depressions having a substantially planar end wall (72) and a pair of side walls (74, 76) perpendicularly disposed to each other and intersecting at a vertex (78) which is disposed along said axis of symmetry;

whereby a pair of similarly configured unitary product cushioning devices may be employed at opposed sides of a rectilinear container so as to cushion a rectilinear product therein; and

wherein said unitary product cushioning device is formed as a pair of similarly configured unitary product cushioning devices (90), and having a further extension structure (92) interposed between a respective one of said container contacting flanges at a respective first or second side of the respective post structure of each.

19           The unitary product cushioning device of claim 12 or 13, wherein the length of said post structure is less than the length of said end cap, and wherein said end cap further comprises a pair of extension wings (52), one at each of said first and second closed ends thereof;

wherein each of said extension wings comprises a curved ridge (54) which is curved away from said post structure and terminates in a container contacting flange; and

wherein said predetermined length of said end cap is measured between said container contacting flanges of said extension wings; and

wherein said container contacting flanges of said extension wings are disposed in a pair of planes have parallelism plus or minus zero degrees to 10° with respect to each other; and

said unitary product cushioning device further comprising a pair of rectilinear depressions (70) formed one at each end of said post structure, each of said rectilinear depressions having a substantially planar end wall (72) and a pair of side walls (74, 76) perpendicularly disposed to each other and intersecting at a vertex (78) which is disposed along said axis of symmetry;

whereby a pair of similarly configured unitary product cushioning devices may be employed at opposed sides of a rectilinear container so as to cushion a rectilinear product therein; and

wherein said unitary product cushioning device is formed as a pair of similarly configured unitary product cushioning devices (90), and having a further extension structure (92) interposed between a respective one of said container contacting flanges at a respective first or second side of the respective post structure of each; and

wherein said unitary product cushioning device being further characterized in that said extension structure is formed with a centrally located ridge (94) parallel to said container contacting flanges of each of said pair of similarly configured unitary product cushioning devices, and a pair of rims (96) located one at each side of said centrally located ridge;

wherein a flexible hinge (100) is formed between each of said pair of rims and the respective container contacting flange; and

wherein an upstanding wing portion (98) is formed in one of each of said rims or said curved ridges which are adjacent said centrally located ridge, and a co-operating opening is formed in the other of each of said rims or said curved ridges;

whereby when said respective container contacting flanges and said rims are oriented towards each other by said flexible hinges having been bent, said upstanding wing portions are received in the respective openings so as to lock said pair of similarly configured unitary product cushioning devices and said interposed ridge structure in place; and

whereby said similarly configured unitary product cushioning devices may be placed at opposed sides of a container having a predetermined size so as to receive a rectilinear product having predetermined dimensions in said rectilinear depressions.

The unitary product cushioning device of claim 1 or 2, wherein a protuberance (120, 122) is formed in said product supporting surface, and extends upwardly therefrom.

21           The unitary product cushioning device of claim 1 or 2, when formed from a plastics material chosen from the group consisting of low density polyethylene, high density polyethylene, polyvinyl chloride, PET, polystyrene, nylon, polypropylene, and mixtures and co-polymers thereof.

22           The unitary product cushioning device of claim 2, wherein there is a container contacting surface near said closed end of said post structure at at least said first side thereof.

23           The unitary product cushioning device of claim 2, wherein there is an axis of symmetry which bisects said post structure;

                  whereby a curved ridge is formed on first and second sides of said axis of symmetry at first and second sides of said post structure, and having a container contacting flange at both sides of said post structure;

                  wherein said container contacting flanges are disposed in first and second planes which are substantially perpendicular one to the other;

                  wherein there is a product supporting surface and a container contacting surface on each side of said post structure, wherein each product supporting surface is near said open end of said post structure, and each said container contacting surface is near said closed end of said post structure, and wherein said container contacting surfaces at each side of said post structure are also each disposed in said first and second planes;

                  whereby, when said unitary product cushioning device is placed in a rectilinear container, said container contacting surfaces and said container contacting flanges will each contact a respective one of said at least two surfaces of said rectilinear container, and said product supporting surfaces will each be parallel to a respective one of said at least two surfaces.

24           The unitary product cushioning device of claim 1 or 2, wherein said device is formed of a plastics material which has been molded by one of the molding

processes chosen from the group consisting of drape molding, vacuum molding, blow molding, and injection molding; and

wherein said unitary product cushioning device is formed as a corner piece to be fitted into a corner of a rectilinear container, which corner is defined by three intersecting surfaces which are mutually perpendicular one to another.

25           The unitary product cushioning device of claim 1 or 2, wherein said device is formed of a plastics material which has been molded by one of the molding processes chosen from the group consisting of drape molding, vacuum molding, blow molding, and injection molding; and

wherein said unitary product cushioning device is formed as a corner piece to be fitted into a corner of a rectilinear container, which corner is defined by three intersecting surfaces which are mutually perpendicular one to another;

said unitary product cushioning device being further characterized in that said post structure is formed having an isosceles triangular cross-section having a base portion and two side portions, and is truncated;

wherein said open end of said post structure has at least a first curved ridge formed at said base portion side thereof, with said at least first curved ridge terminating in a container contacting flange at the end thereof remote from said open end of said post structure;

wherein a portion of said at least first curved ridge presents a first product supporting surface;

wherein a further portion of at least first said curved ridge is curved in a direction outwardly and away from said post structure;

wherein, when said unitary product cushioning device is fitted into a corner of a rectilinear container, one of said three intersecting surfaces of said rectilinear container will be contacted by said container contacting flange at said base portion side of said post structure;

wherein said first product supporting surface will be parallel to said one contacted container surface; and

wherein, when a shock load is applied to said unitary product cushioning device in a direction towards said one contacted container surface, said further portion of said first curved ridge will at least temporarily be further curved in a direction away from said post structure, and said first product supporting surface will at least temporarily move closer to said one contacted container surface.

26           The unitary product cushioning device of claim 1 or 2, wherein said post structure has an equilateral triangular cross-section; and

              wherein a curved ridge is formed at each of the three sides thereof, and each of said curved ridges terminates in a container contacting flange at the respective end thereof remote from said open end of said post structure.

27           The unitary product cushioning device of claim 1 or 2, wherein said post structure has a container contacting surface at at least said base portion side thereof, near said closed end.

28           The unitary product cushioning device of claim 1 or 2, wherein said post structure has a container contacting surface on all three sides thereof, near said closed end.

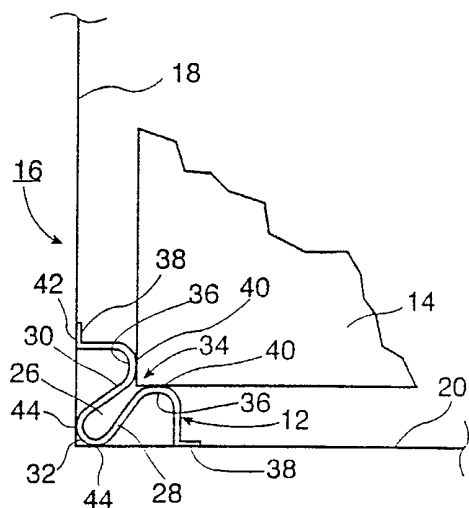


Fig. 1

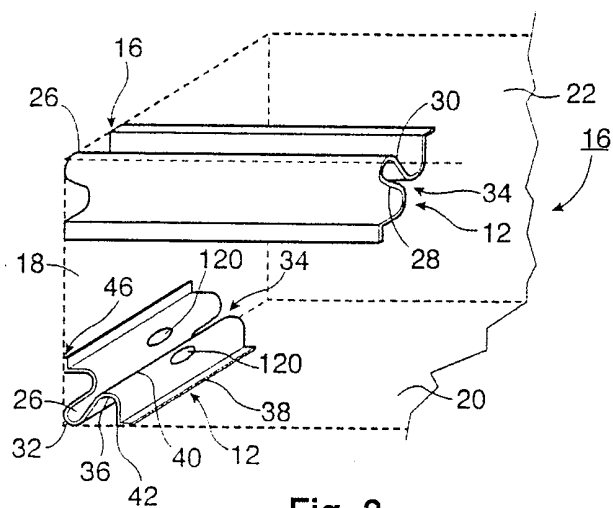


Fig. 2

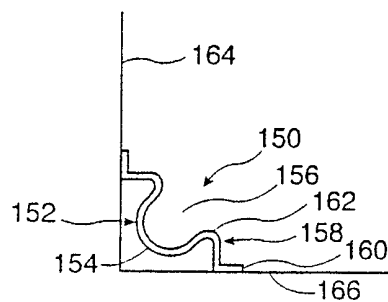


Fig. 12

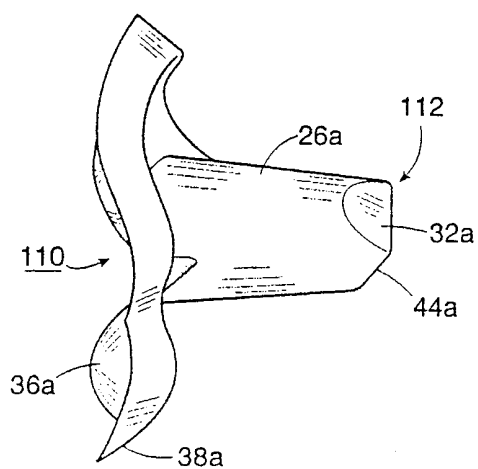


Fig. 3

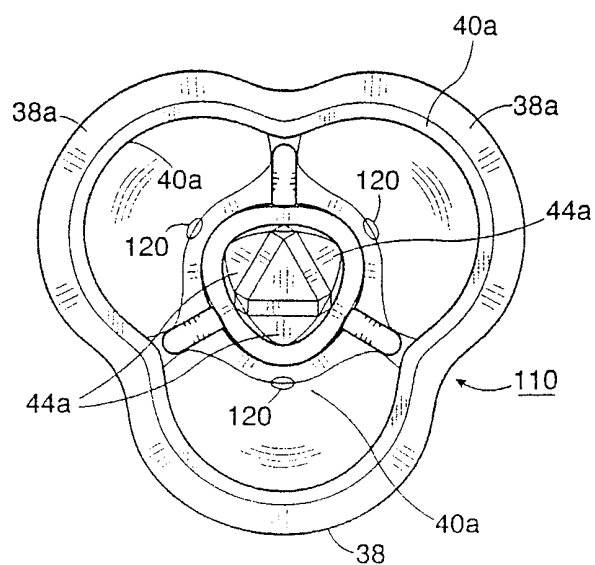


Fig. 4

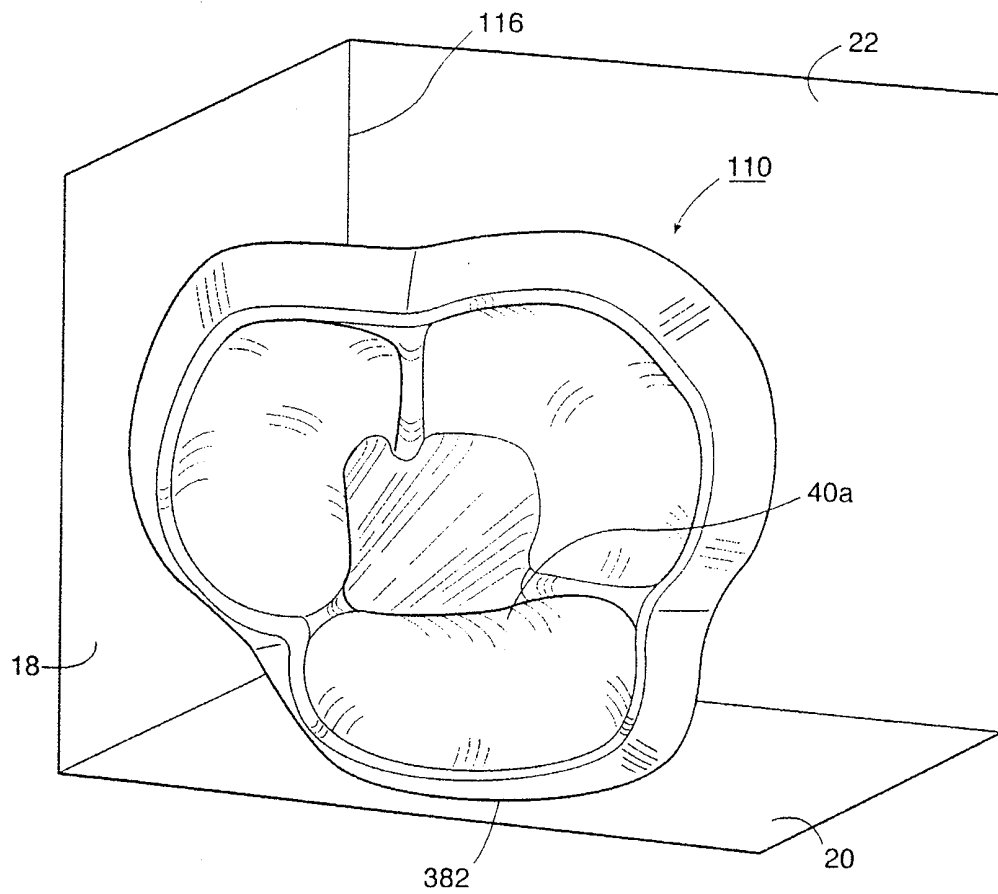


Fig. 5

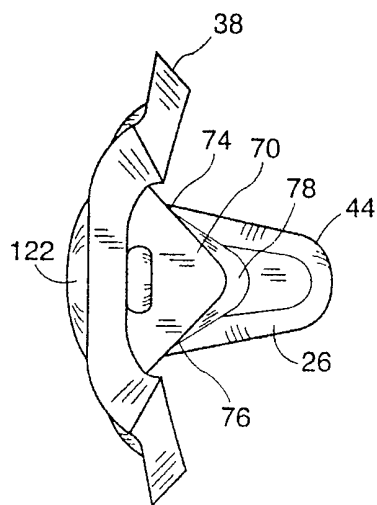


Fig. 7

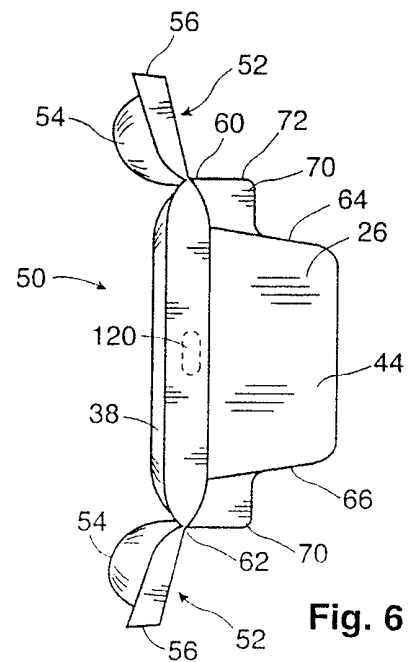


Fig. 6



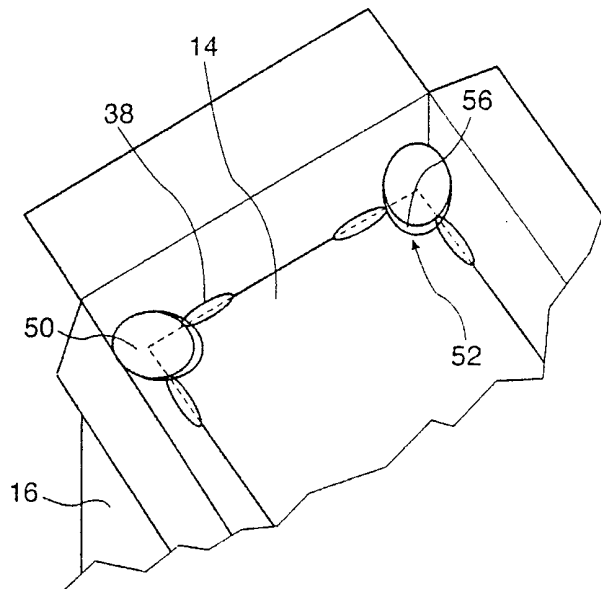


Fig. 8

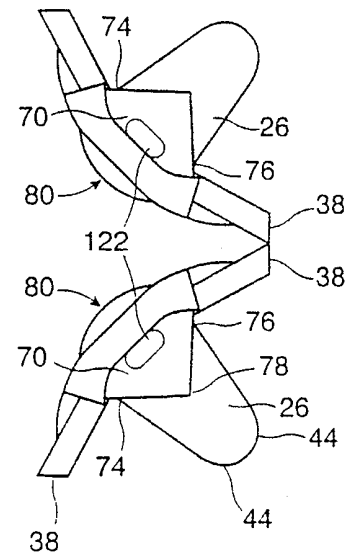


Fig. 9

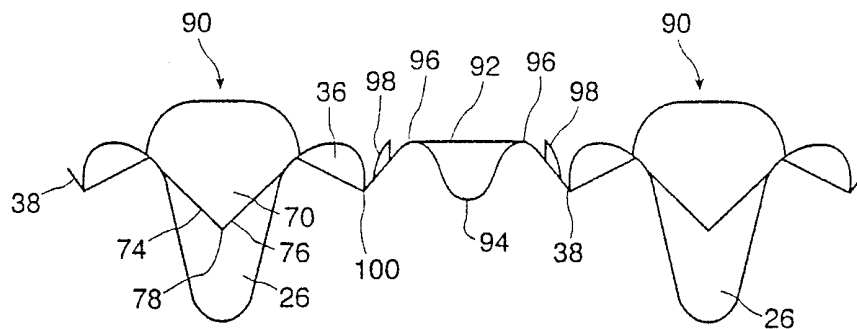


Fig. 10

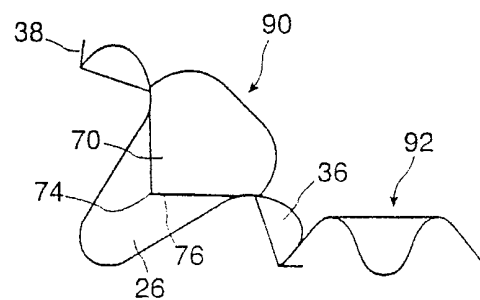


Fig. 11

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 00/00390

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B65D81/05

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 975 564 A (JONES) 17 August 1976 (1976-08-17)	1,2,4,7, 8,11, 21-26,28
A	the whole document	3,5,6,8, 10, 12-20,27
A	US 5 826 726 A (YANG) 27 October 1998 (1998-10-27) column 3, line 7 - line 28; figures 3A,3B	1
A	FR 2 381 685 A (BENDT) 22 September 1978 (1978-09-22) claims; figures	1
A	DE 70 27 767 U (FR. JARAND) 3 December 1970 (1970-12-03) claims; figures	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

15 June 2000

Date of mailing of the international search report

06/07/2000

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Authorized officer

Newell, P

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No  
PCT/CA 00/00390

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3975564 A	17-08-1976	NONE	
US 5826726 A	27-10-1998	FR 2751309 A JP 10029665 A	23-01-1998 03-02-1998
FR 2381685 A	22-09-1978	DK 80277 A AT 358985 B AT 136878 A BE 864239 A CA 1084858 A CH 626851 A DE 2805698 A FI 780574 A GB 1598411 A IE 46455 B IT 1094261 B JP 53106295 A LU 79118 A NL 7709052 A NO 780624 A SE 7801806 A US 4202449 A	25-08-1978 10-10-1980 15-02-1980 16-06-1978 02-09-1980 15-12-1981 31-08-1978 25-08-1978 23-09-1981 15-06-1983 26-07-1985 16-09-1978 27-06-1978 28-08-1978 25-08-1978 25-08-1978 13-05-1980
DE 7027767 U	03-12-1970	NONE	