

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
29 July 2004 (29.07.2004)

PCT

(10) International Publication Number
WO 2004/063052 A1

(51) International Patent Classification⁷: **B65D 81/07**, 5/50

(21) International Application Number:

PCT/US2003/041565

(22) International Filing Date:

29 December 2003 (29.12.2003)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10/336,624

3 January 2003 (03.01.2003)

US

(71) Applicant: **ADE, INC.** [US/US]; 1430 East 130th Street,
Chicago, IL 60633 (US).

(72) Inventors: **LOFGREN, Lewis, C.**; 405 N. Wabash
#4309, Chicago, IL 60611 (US). **ADAMS-KRAUS, Car-**
men, Leigh; 953-4B Old Lincoln Highway, Schererville,
IN 46375 (US).

(74) Agent: **ZAYIA, Gregory, H.**; Brinks Hofer Gilson & Li-
one, P.O. Box 10087, Chicago, IL 60610 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR,
CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD,
GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR,
KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN,
MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU,
SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA,
UG, UZ, VC, VN, YU, ZA, ZM, ZW.

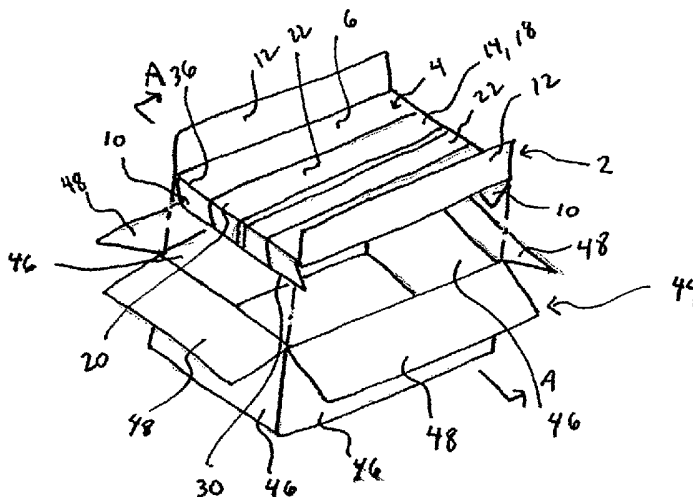
(84) Designated States (*regional*): ARIPO patent (BW, GH,
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE,
SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: SUSPENSION PACKAGES AND SYSTEMS, CUSHIONING PANELS, AND METHODS OF USING SAME



(57) Abstract: Suspension packages are described that include (a) a product-supporting platform (4) having first (6) and second (8) opposed faces; (b) two end panels, each pivotally connected to a respective end of the product-supporting platform; (c) two side panels, each pivotally connected to a respective side of the product-supporting platform; and (d) an elastomeric enclosure mounted between the two end panels and extending over the first face of the product-supporting platform. The two side panels are configured to pivot towards the first face of the product-supporting platform, such that the two side panels may be configured substantially perpendicular thereto. The two end panels are configured to pivot towards the second face of the product-supporting platform, thereby tensioning the elastomeric enclosure, such that acute angles may be formed between the second face of the product-supporting platform and each of the end panels. Suspension systems, cushioning panels, and methods of packaging products are also described.



WO 2004/063052 A1

SUSPENSION PACKAGES AND SYSTEMS, CUSHIONING PANELS, AND METHODS OF USING SAME

BACKGROUND

5 The present invention relates to suspension packages and, more particularly, to suspension packages for protecting products against shipping damage caused in transit.

10 Various designs of suspension packages have been proposed, including designs having a frame and a product-restraining hammock extending across a central opening in the frame. When the ends of the frame are folded to be perpendicular thereto in order to tension the hammock, a product may be suspended in the central opening. Such frame-containing suspension packages are described in United States Patent Nos. 5,894,932 and 5,975,307 to Harding et al., both of which are assigned to the assignee of the present invention.

15 While frame-containing suspension packages of the type described above are well suited for a variety of applications, certain applications require more effective protection against product damage caused by bottom drops. In addition, products suspended in the central opening of frame-containing structures may undergo undesirable twisting during certain types of drops, which may diminish the ability of the structures to immobilize and protect the products. Furthermore, frame-containing structures are susceptible to buckling, which may likewise diminish the ability of the structures to immobilize and protect the products.

SUMMARY

25 The scope of the present invention is defined solely by the appended claims, and is not affected to any degree by the statements within this summary.

30 By way of introduction, a first suspension package embodying features of the present invention includes (a) a product-supporting platform having first and second opposed faces; (b) two end panels, each pivotally connected to a respective end of the product-supporting platform; (c) two side panels, each

pivotally connected to a respective side of the product-supporting platform;
and (d) an elastomeric enclosure mounted between the two end panels and
extending over the first face of the product-supporting platform. The two side
panels are configured to pivot towards the first face of the product-supporting
platform, such that the two side panels may be configured substantially
perpendicular thereto. The two end panels are configured to pivot towards
the second face of the product-supporting platform, thereby tensioning the
elastomeric enclosure, such that acute angles may be formed between the
second face of the product-supporting platform and each of the end panels
and a biasing force acting to restore the end panels to ambient positions is
established.

A second suspension package embodying features of the present
invention includes (a) a product-supporting platform having first and second
opposed faces; (b) two end panels, each pivotally connected to a respective
end of the product-supporting platform; (c) two side panels, each pivotally
connected to a respective side of the product-supporting platform; and (d) an
elastomeric hammock comprising a polymeric film arranged in a C-fold,
mounted between the two end panels and extending over the first face of the
product-supporting platform. The product-supporting platform, the two end
panels, and the two side panels are formed from a single sheet of corrugated
paperboard. The two side panels are configured to pivot towards the first face
of the product-supporting platform, such that the two side panels may be
configured substantially perpendicular thereto. The two end panels are
configured to pivot towards the second face of the product-supporting
platform, thereby tensioning the elastomeric enclosure, such that acute angles
may be formed between the second face of the product-supporting platform
and each of the end panels.

A suspension system embodying features of the present invention
includes (a) a suspension package of a type described above, and (b) an
outer container for enclosing the suspension package.

A cushioning panel embodying features of the present invention
includes (a) a platform having first and second opposed faces; (b) two end

panels, each pivotally connected to a respective end of the platform; and (c) an elastomeric member mounted between the two end panels and extending over the first face of the platform. When the end panels are pivoted towards the second face of the platform, thereby tensioning the elastomeric member, acute angles may be formed between the second face of the platform and each of the end panels, such that a biasing force acting to restore the end panels to ambient positions is established.

A first method of packaging a product embodying features of the present invention includes (a) placing the product in a suspension package of a type described above; (b) tensioning the elastomeric enclosure of the suspension package, thereby substantially immobilizing the product; and (c) placing the suspension package in an outer container dimensioned such that the side panels of the suspension package are held in a configuration substantially perpendicular to the product-supporting platform.

A second method of packaging a product embodying features of the present invention includes (a) placing the product in a container having a plurality of walls; (b) tensioning a cushioning panel of a type described above; and (c) placing at least one tensioned cushioning panel between the product and at least one of the plurality of walls, such that the first face of the platform is adjacent to the product. The container is dimensioned such that the end panels of the cushioning panel are substantially prevented from returning to ambient positions.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a perspective view of a first suspension package embodying features of the present invention.

FIG. 2 shows a top view of the suspension package shown in FIG. 1.

FIG. 3 shows a bottom view of the suspension package shown in FIGS. 1 and 2.

FIG. 4 shows a side view of the suspension package shown in FIGS. 1-

3.

FIG. 5 shows a plan view from the top of the suspension package shown in FIGS. 1-4 under ambient conditions, wherein all elements of the suspension package are located in a single plane.

FIG. 6 shows a detailed view of the acute angle formed between the product-supporting platform and an end panel of the suspension package shown in FIGS. 1-5

FIG. 7 shows an exploded perspective view of a first suspension system embodying features of the present invention.

FIG. 8 shows a cross-sectional side view of the suspension system shown in FIG. 7 under activated conditions taken along the line A—A.

FIG. 9 shows a cross-sectional side view of the suspension system shown in FIG. 7 under bottom-out conditions.

FIG. 10 shows a perspective view of a second suspension package embodying features of the present invention.

FIG. 11 shows a top view of the suspension package shown in FIG. 10.

FIG. 12 shows a bottom view of the suspension package shown in FIGS. 10 and 11.

FIG. 13 shows a side view of the suspension package shown in FIGS. 10-12.

FIG. 14 shows a plan view from the top of the suspension package shown in FIGS. 10-13 under ambient conditions, wherein all elements of the suspension package are located in a single plane.

FIG. 15 shows a detailed view of the acute angle formed between the product-supporting platform and an end panel of the suspension package shown in FIGS. 10-14.

FIG. 16 shows a cross-sectional side view of a second suspension system embodying features of the present invention under activated conditions.

FIG. 17 a cross-sectional side view of the suspension system shown in FIG. 16 under bottom-out conditions.

FIG. 18 shows a perspective view of a cushioning panel embodying features of the present invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

It has been discovered that effective protection of products against damage caused by bottom drops, front drops, back drops, and end drops can be achieved with a suspension package that provides a spring-like cushioning effect analogous to that provided by a leaf spring. The cushioning effect is controlled by an elastomeric film that has stretchability and memory (i.e., the ability to return to an original shape after deformation), which is suspended across the end panels of the suspension package. When a product is loaded in the suspension package, the suspension package may be activated simply by folding back the end panels, thereby tensioning the elastomeric film and imparting springiness to the end panels. If the suspension package containing the product is subjected to bottom drop, energy imparted to and/or forces acting upon the package during the drop will be absorbed through the spring-like cushioning effect at the end panels. If the suspension package containing the product is subjected to other types of drops, the elastomeric film absorbs energy and/or forces imparted during the drop by accommodating side-to-side and/or upward vertical motion of the product.

It has further been discovered that cushioning panels, which rely on similar spring-cushioning principles as the above-described suspension packages, may be placed around a product within an outer container to absorb shocks and attenuate effects of potentially damaging external shocks.

Throughout this description and in the appended claims, the following definitions are to be understood:

The phrase "ambient" or "under ambient conditions" refers to an un-activated (i.e., un-tensioned) state of an empty (i.e., devoid of product) or loaded (i.e., product-containing) suspension package, including but not limited to the substantially flat configurations that may be used during storage or transportation of empty suspension packages (i.e., all elements of the suspension package lie in substantially the same plane, as shown in FIGS. 5 and 14).

The phrase "activated" or "under activated conditions" refers to a tensioned state of an empty or loaded suspension package, which is achieved by folding back the end panels of the suspension package to form acute angles with the product-containing platform.

5 The phrase "bottom out" or "under bottom out conditions" refers to a maximum degree of compression that may be applied to a suspension package in an outer container subjected to a bottom drop.

10 The presently preferred embodiments described herein may possess one or more advantages relative to conventional product packaging, which may include but are but not limited to: ease of use; reduced cost of materials and fabrication; ability to control performance levels through design variation (e.g., length of hinged end panels, number of folds in hinged panels, type of scoring in folds, type of corrugated material, type of elastomeric film, length of elastomeric film, folded width of elastomeric film, etc.); ability to store and/or
15 ship suspension packages in substantially flat configurations, thereby minimizing storage space and shipping costs; reduction in the deflection space required for effective protection against bottom drops; reduction in overall package size; improved protection against end drops; improved consistency of front and back drops through reduction in product twisting in
20 product restraint; improved immobilization of product within product restraint through tighter stretching of elastomeric enclosure around product; minimization of buckling, creasing, and cracking of suspension package; facile immobilization of product within elastomeric enclosure when suspension package is outside container; and increased ease of removal of activated
25 suspension package from outer container.

30 A first series of presently preferred suspension packages embodying features of the present invention is shown in FIGS. 1-9. For the purpose of illustrating a context in which presently preferred embodiments of the present invention may be practiced, a representative product **P** is depicted in several of the drawing figures. The suspension package **2** includes (a) a product-supporting platform **4** having first and second opposed faces, **6** and **8**, respectively; (b) two end panels **10**, each pivotally connected to a respective

end of the product-supporting platform **4**; (c) two side panels **12**, each pivotally connected to a respective side of the product-supporting platform **4**; and (d) an elastomeric enclosure **14** mounted between the two end panels **10** and extending over the first face **6** of the product-supporting platform **4**.

5 The two side panels **12** are configured to pivot towards the first face **6** of the product-supporting platform **4**, such that the two side panels **12** may be configured substantially perpendicular thereto. In alternative embodiments (not shown), the side panels **12** are fixedly connected (rather than pivotally connected) to the respective sides of the product-supporting platform **4**. In
10 additional alternative embodiments, the side panels **12** are replaced with one or more spacing elements (not shown), which may be pivotally or fixedly connected to the product-supporting platform **4**. The spacing elements may include segmented portions of side panel **12** (e.g., one or more rectangular strips used in place of the contiguous rectangular element comprising side
15 panels **12**) or other regular or irregular geometric shapes.

 The two end panels **10** are configured to pivot towards the second face **8** of the product-supporting platform **4**, thereby stretching the elastomeric enclosure **14**, such that acute angles **16** may be formed between the second
20 face **8** of the product-supporting platform **4** and each of the end panels **10**.

20 The springiness of an activated end panel **10** is determined by a combination of factors including the length of the end panels **10**, the length of the elastomeric enclosure **14**, and the folded width of the elastomeric enclosure **14**. The elastomeric enclosure **14**, preferably selected to have good stretch and recovery characteristics, fulfills at least two roles—namely, that of
25 securing a product **P** and that of applying spring-like tension to end panels **10**.

 While not wishing to be bound by a particular theory, nor intending to limit in any measure the scope of the appended claims or their equivalents, it is presently believed that products secured in suspension packages
30 embodying features of the present invention are protected against damage caused by top and edge drops primarily through the action of the elastomeric enclosure **14**, and against damage caused by bottom drops primarily through the action of the spring-cushioning effect described above.

Presently preferred designs for achieving the above-mentioned spring-like cushioning effect involve establishing angles that are sufficiently large to prevent the end panels **10** from contacting the second face **8** of the product-supporting platform **4** (e.g., such as in FIGS. 9 and 17 described below), yet not so large as to eliminate the spring-like action of the end panels **10** against a surface (e.g., the bottom of an outer container) on which they rest.

The magnitude of acute angles **16** is not limited. However, it is preferred that acute angles **16** be sufficiently small (e.g., not greater than about 50 degrees, more preferably not greater than about 45 degrees) so that when the suspension package **2** is enclosed in an outer container, there will be a reduced tendency for the end panels **10** to expand to a 90 degree perpendicular orientation with concomitant reduction in desired spring-like cushioning ability. It is especially preferred that the magnitude of acute angles **16** be such that they will not spring to 90 degrees even after multiple compression and recovery cycles (e.g., bottom drops). Furthermore, it is preferred that acute angles **16** be sufficiently large (e.g., at least 15 degrees, more preferably at least 20 degrees) so that a product **P** contained in an activated suspension package **2** subjected to a bottom drop will be substantially undamaged (i.e., energy and/or forces imparted by the drop will be substantially absorbed by the spring-like cushioning effect).

Suspension packages embodying features of the present invention may be formed from any suitable material, including but not limited to paperboard, corrugated paperboard, plastics, fiberboard, metals, and the like, and combinations thereof. Corrugated paperboard (e.g., 275 pound single wall, kraft, C-flute board, 200 pound double wall, 275 or 300 pound double wall, kraft, B/C-flute board, etc.) is a presently preferred material. Preferably, all portions of suspension packages embodying features of the present invention, except for the elastomeric enclosure, are formed from a single sheet of material. For example, each of the two end panels and the two side panels may be formed from a single sheet of corrugated paperboard that is simply folded along designated fold, crease, or score lines to provide the desired design of suspension package. Such an assembly process minimizes

cost and simplifies fabrication. However, alternative embodiments are contemplated in which various pieces of the suspension package are fabricated separately and then assembled to provide a completed suspension package.

5 The elastomeric enclosure **14**, depicted in several of the drawings as a hammock **18** for purposes of illustration, includes any mechanism capable of securing a product, including but not limited to hammocks (i.e., materials suspended across distances, which are attached to supports at opposite ends thereof) and nets (i.e., meshed fabrics which may include a drawstring mechanism for contracting an interior space). Hammocks are presently
10 preferred elastomeric enclosures.

 All manner of retention mechanisms have been contemplated for use with elastomeric enclosures embodying features of the present invention. Throughout this description and in the appended claims, the term "enclosure"
15 is to be understood in a very broad sense as referring to any product retention mechanism, regardless of whether the complete product or only a portion thereof is enclosed in or physically contacts the retention mechanism. In certain embodiments such as the above-described hammock **18**, elastomeric enclosures preferably include interior regions capable of substantially
20 enclosing a product (e.g., enveloping the product on at least a portion of each of its sides). However, such interior regions and such a substantial enclosure are not required.

 The key characteristics of elastomeric enclosures embodying features of the present invention are that they (a) be stretchable so as to absorb
25 energy and/or forces imparted during drops, and (b) exhibit a tendency to return to their original configurations (i.e., have "memory"). Accordingly, elastomeric enclosures may be formed from any suitable elastomeric material, including but not limited to polymeric films, spandex cloths, and the like. Polymeric films such as polyurethane and polyethylene are especially
30 preferred materials at present. Polyurethane is an especially preferred polymeric film inasmuch as it exhibits both good stretch and good recovery characteristics. Polyethylene, which exhibits good stretch but not as good

recovery, is still a suitable polymeric film in certain applications. In accordance with certain embodiments of the present invention, increased protection may be afforded to particularly sensitive products by using a film capable of more elastic deformation than might be required for less sensitive products in combination with an outer container that is larger than might be required for less sensitive products.

As best seen in FIGS. 1, 2, 4, 5, and 7, the hammock **18** includes a lower portion **20** and at least two upper portions **22** that define a product insertion and removal region. This representative and non-limiting arrangement, known as a C-fold, provides a film that is C-shaped in cross section, and which may be used to substantially enclose a product packaged therein. The film may include product retention regions, such as welded dots and/or knurled patterns formed by sonic welding, to further restrict movement of a product restrained therein.

The polymeric film forming elastomeric enclosures **14** may be attached to each of the two end panels **10** by any suitable fastener, including but not limited to staples, adhesives, tapes, stitches, and combinations thereof. Staples **24** are presently preferred fasteners that may also be used to conveniently secure folded portions of the suspension package. Although the points of attachment of fasteners to the elastomeric enclosure **14** is not limited, it is preferred that the fasteners, for example staples **24**, be introduced at opposite ends of elastomeric enclosure **14**, more preferably at opposite points defining the furthest distance between the two ends of elastomeric enclosure **14**, in order to provide for maximum stretchability of elastomeric enclosure **14**. As best shown in FIGS. 3 and 12, it is especially preferred that the staples **24** be introduced on the face of end panels **10** that is adjacent to the second face **8** of product-supporting platform **4**. More preferably, the staples **24** are introduced near an outer edge **30** of end panels **10**, on the faces of end panels **10** that are adjacent to the second face **8** of product-supporting platform **4**.

Preferably, suspension packages embodying features of the present invention further include two reinforcing flaps **28**, each pivotally connected to

an inner edge **36** of the end panels **10**, such that the reinforcing flaps **28** are configured to contact the second face **8** of the product-supporting platform **4** when the elastomeric enclosure **14** is tensioned. Reinforcing flaps **28** serve to strengthen the edges of the product-supporting platform **4**.

5 In the first series of presently preferred suspension packages shown in FIGS. 1-9, the product-supporting platform **4**, the two end panels **10**, the two side panels **12**, and the two reinforcing flaps **28** are formed from a single sheet of material, with the product-supporting platform **4**, the two side panels **12**, and the two reinforcing flaps **28** having a single-wall thickness and the two
10 end panels **10** having a double-wall thickness (i.e., the corrugated paperboard forming the end panels **10** has been folded back upon itself). As best shown in FIG. 6, the single sheet of material is folded along the outer edge **30** of the end panel **10**, such that first and second opposed layers—**32** and **34**, respectively—of the double-wall are formed.

15 A second series of presently preferred suspension packages embodying features of the present invention is shown in FIGS. 10-17. This series differs from the suspension packages shown in FIGS. 1-9 in the folding pattern used to form the end panels **10** and reinforcing flaps **28**. The folding pattern used to form the suspension packages shown in FIGS. 10-17 further
20 reinforces the edges of the product-supporting platform **4**. As in the first series, the product-supporting platform **4**, the two end panels **10**, the two side panels **12**, and the two reinforcing flaps **28** are formed from a single sheet of material. However, in the embodiments shown in FIGS. 10-17, the product-supporting platform **4** and the two side panels **12** have a single-wall thickness,
25 the two end panels **10** have a double-wall thickness, and the two reinforcing flaps **28** have a triple-wall thickness. As best shown in FIG. 15, the single sheet of material is folded along an inner edge **36** and an outer edge **30** of the end panel **10**, such that first and second opposed layers—**32** and **34**, respectively—of the double-wall are formed, and first, second, and third
30 layers—**38**, **40**, and **42**, respectively—of the triple-wall are formed.

Suspension packages embodying features of the present invention may further include side panels **12** having double-wall thickness. Such

double-wall thick side panels may be formed starting from double-length single-wall side panels **12**, the end portions **26** of which are folded back toward the middle of side panels **12** and secured (e.g., with tape, staples, etc.), as best shown in FIG. 14. The end portions **26** of side panels **12** are
5 pivotally connected thereto unless secured as noted above. The double-wall thickness imparted to side panels **12** may provide additional protection against damage caused by certain types of drops.

Suspension systems embodying features of the present invention are shown in FIGS. 7, 8, 9, 16, and 17 and include (a) a suspension package of a
10 type described hereinabove, and (b) an outer container **44** for enclosing the suspension package. Preferably, the outer container **44** contains a plurality of fixed panels **46** and at least one pivotally connected flap **48** defining an insertion and removal region. Preferably, the outer container **44** is a top-loading box.

15 It is preferred that the outer container **44** be dimensioned such that when the elastomeric enclosure **14** of the suspension package **2** is tensioned and the suspension package **2** is enclosed by the outer container **44** under activated conditions, the side panels **12** of the suspension package **2** are prevented from pivoting towards a configuration substantially coplanar with
20 the product-supporting platform (i.e., are prevented from returning to the ambient condition depicted in FIGS. 5 and 14). Moreover, it is preferred that the outer container **44** be dimensioned such that the side panels **12** are held in a configuration substantially perpendicular to the product-supporting platform.

25 Preferred dimensions of the outer container **44** are such that the activated height of the suspension package **2** enclosed therein (i.e., the height of a product-containing suspension package **2** measured from the bottom edge of the end panels **10** to the top edge of side panels **12**) is slightly greater (i.e., less than about ten percent) than an internal height of the outer container
30 **44** when the latter is open. Furthermore, it is preferred that the outer container **44** be dimensioned such that the activated height of the suspension package **2** enclosed therein is substantially equal to the internal height of the

outer container **44** when the latter is closed, as shown in FIGS. 8 and 16. Thus, a pressure is exerted against at least one interior surface of the closed outer container **44** by the spring-cushioning action of the activated suspension package **2** enclosed therein.

5 If a suspension system embodying features of the present invention is subjected to an excessive bottom drop force, a point of maximum compression of the suspension package **2** within the outer container **44** may result, as shown in FIGS. 9 and 17. Under such bottom out conditions, the product has an increased susceptibility to damage. Thus, it is preferred that
10 the degree of spring-cushioning effect that is provided by the elastomeric film under activated conditions be sufficient to prevent or at least significantly reduce the frequency of bottom out events.

In general, the dimensions of the outer container **44** are selected in view of the packaging requirements for a specific product (e.g., amount of
15 deflection space required to protect a product, degree of elasticity of polymeric film, requisite degree of spring-cushioning effect needed to protect against bottom drops, etc.).

A cushioning panel **50** embodying features of the present invention is shown in FIG. 18 and includes (a) a platform **52** having first and second
20 opposed faces, **54** and **56**, respectively; (b) two end panels **58**, each pivotally connected to a respective end of the platform **52**; and (c) an elastomeric member **60** mounted between the two end panels **58** and extending over the first face **54** of the platform **52**. The end panels **58** may be pivoted towards the second face **56** of the platform **52**, thereby stretching the elastomeric
25 member **60**. Acute angles **62** may be formed between the second face **56** of the platform **52** and each of the end panels **58**, such that a biasing force acting to restore the end panels **58** to their ambient positions is established.

Preferably, the elastomeric member **60** is slightly (i.e., less than about
30 ten percent) shorter than the distance between the ends of the end panels **58**, which may be multi-folded. When the hinged end panels **58** are rotated towards the second face **56** of the platform **52**, an outward tension is exerted by the elastomeric member **60**, which biases the end panels **58** towards their

ambient positions. Thus, when cushioning panels **50** embodying features of the present invention are placed in spatially restricted regions that prevent the end panels **58** from returning to their ambient positions, the cushioning panels **50** will function as spring-like devices when energy and/or forces are imparted thereto. For example, activated cushioning panels **50** positioned around a product within an outer container will act as shock absorbers by deflecting and then recovering in response to a force, thus attenuating the effects of potentially damaging external shocks. Cushioning panels **50** embodying features of the present invention may be used as the sole form of product protection, or in conjunction with one or more other protective systems.

Elastomeric members **60** for use in accordance with cushioning panels **50** embodying features of the present invention may be formed from any suitable elastomeric material, including but not limited to polymeric films, rubber, spandex cloth, and the like. Polymeric films such as polyurethane and polyethylene, such as may be used to form the elastomeric hammocks **18** described above, are preferred materials at present, with polyurethane being especially preferred. All manner of geometries, widths, thicknesses, and the like are contemplated for the elastomeric members **60** embodying features of the present invention.

A first series of methods for packaging products in accordance with the present invention includes (a) placing a product in any of the suspension packages embodying features of the present invention described hereinabove; (b) tensioning the elastomeric enclosure of the suspension package, thereby substantially immobilizing the product; and (c) placing the suspension package in an outer container that is dimensioned such that the side panels of the suspension package are held in a configuration substantially perpendicular to the product-supporting platform.

A second series of methods for packaging products in accordance with the present invention includes (a) placing a product in a container having a plurality of walls; (b) tensioning a cushioning panel embodying features of the present invention; and (c) placing at least one tensioned cushioning panel between the product and at least one of the plurality of walls, such that the

first face of the platform is adjacent to the product. Preferably, the container is dimensioned such that the end panels of the cushioning panel are prevented from returning to ambient positions.

5 The foregoing detailed description and accompanying drawings have been provided by way of explanation and illustration, and are not intended to limit the scope of the appended claims. Many variations in the presently preferred embodiments illustrated herein will be obvious to one of ordinary skill in the art (e.g., alternative shapes and relative dimensions of the suspension packages, elastomeric enclosures, etc.), and remain within the
10 scope of the appended claims and their equivalents.

CLAIMS

1. A suspension package comprising:
a product-supporting platform having first and second opposed
faces;
5 two end panels, each pivotally connected to a respective end of
the product-supporting platform;
two side panels, each pivotally connected to a respective side of
the product-supporting platform; and
an elastomeric enclosure mounted between the two end panels
10 and extending over the first face of the product-supporting platform;
wherein

the two side panels are configured to pivot towards the
first face of the product-supporting platform, such that the two
side panels may be configured substantially perpendicular
15 thereto; and

the two end panels are configured to pivot towards the
second face of the product-supporting platform, thereby
tensioning the elastomeric enclosure, such that acute angles
may be formed between the second face of the product-
20 supporting platform and each of the end panels.

2. The invention of claim 1 wherein the acute angles are not
greater than about fifty degrees.

3. The invention of claim 1 wherein each of the two end panels and
the two side panels is connected to the product-supporting platform along a
score line.

4. The invention of claim 1 wherein the product-supporting
platform, the two end panels, and the two side panels are formed from a
30 single sheet of material.

5. The invention of claim 4 wherein the material is selected from the group consisting of paperboard, corrugated paperboard, plastics, and fiberboard.

5

6. The invention of claim 4 wherein the material is corrugated paperboard.

7. The invention of claim 1 wherein the elastomeric enclosures comprises a polymeric film.

10

8. The invention of claim 1 wherein the elastomeric enclosure is selected from the group consisting of a hammock and a net.

9. The invention of claim 1 wherein the elastomeric enclosure is a hammock comprising a lower portion and at least two upper portions, and wherein the at least two upper portions define a product insertion and removal region.

15

10. The invention of claim 9 wherein the hammock comprises a polymeric film.

20

11. The invention of claim 10 wherein the polymeric film is arranged in a C-fold.

25

12. The invention of claim 10 wherein the polymeric film is attached to each of the two end panels by a fastener selected from the group consisting of staples, adhesives, stitches, and combinations thereof.

13. The invention of claim 1 further comprising two reinforcing flaps, each pivotally connected to an inner edge of the end panels, such that the

30

reinforcing flaps are configured to contact the second face of the product-supporting platform.

5 14. The invention of claim 13 wherein the product-supporting platform, the two end panels, the two side panels, and the two reinforcing flaps are formed from a single sheet of material.

10 15. The invention of claim 14 wherein the product-supporting platform, the two side panels, and the two reinforcing flaps are single-wall and the two end panels are double-wall.

15 16. The invention of claim 15 wherein the single sheet of material is folded along outer edges of the end panels, such that first and second opposed layers of the double-wall are formed.

 17. The invention of claim 14 wherein the product-supporting platform and the two side panels are single-wall, wherein the two end panels are double-wall, and wherein the two reinforcing flaps are triple-wall.

20 18. The invention of claim 17 wherein the single sheet of material is folded along inner and outer edges of the end panels, such that first and second opposed layers of the double-wall are formed, and first, second, and third layers of the triple-wall are formed.

25 19. The invention of claim 14 wherein the product-supporting platform is single-wall, wherein the two side panels and the two end panels are double-wall, and wherein the two reinforcing flaps are triple-wall.

30 20. A suspension package comprising:
 a product-supporting platform having first and second opposed faces;

two end panels, each pivotally connected to a respective end of the product-supporting platform;

two side panels, each pivotally connected to a respective side of the product-supporting platform; and

5 an elastomeric hammock comprising a polymeric film arranged in a C-fold, mounted between the two end panels and extending over the first face of the product-supporting platform; wherein

the product-supporting platform, the two end panels, and the two side panels are formed from a single sheet of corrugated paperboard;

10 the two side panels are configured to pivot towards the first face of the product-supporting platform, such that the two side panels may be configured substantially perpendicular thereto; and

15 the two end panels are configured to pivot towards the second face of the product-supporting platform, thereby tensioning the elastomeric enclosure, such that acute angles may be formed between the second face of the product-supporting platform and each of the end panels.

20 21. A suspension system comprising:

a suspension package comprising:

a product-supporting platform having first and second opposed faces;

25 two end panels, each pivotally connected to a respective end of the product-supporting platform;

two side panels, each pivotally connected to a respective side of the product-supporting platform; and

30 an elastomeric enclosure mounted between the two end panels and extending over the first face of the product-supporting platform; wherein

the two side panels are configured to pivot towards the first face of the product-supporting platform, such that the two side panels may be configured substantially perpendicular thereto; and

the two end panels are configured to pivot towards the second face of the product-supporting platform, thereby tensioning the elastomeric enclosure, such that acute angles may be formed between the second face of the product-supporting platform and each of the end panels; and

an outer container for enclosing the suspension package.

22. The invention of claim 21 wherein the outer container comprises a plurality of fixed panels and at least one pivotally connected flap defining an insertion and removal region.

23. The invention of claim 22 wherein the outer container is dimensioned such that when the elastomeric enclosure of the suspension package is tensioned and the suspension package is enclosed by the outer container, the side panels of the suspension package are prevented from pivoting towards a configuration substantially coplanar with the product-supporting platform.

24. The invention of claim 23 wherein the side panels are held in a configuration substantially perpendicular to the product-supporting platform.

25. The invention of claim 23 wherein the outer container is dimensioned such that an activated height of the suspension package enclosed therein is greater than an internal height of the outer container when the outer container is open.

26. The invention of claim 23 wherein the outer container is dimensioned such that an activated height of the suspension package enclosed therein is substantially equal to an internal height of the outer container when the outer container is closed.

5

27. A cushioning panel comprising:
a platform having first and second opposed faces;
two end panels, each pivotally connected to a respective end of
the platform; and
10 an elastomeric member mounted between the two end panels
and extending over the first face of the platform; wherein
when the end panels are pivoted towards the second face
of the platform, thereby tensioning the elastomeric member,
acute angles may be formed between the second face of the
15 platform and each of the end panels, such that a biasing force
acting to restore the end panels to ambient positions is
established.

15

28. A method of packaging a product comprising:
20 placing the product in the suspension package of claim 1;
tensioning the elastomeric enclosure, thereby substantially
immobilizing the product;
placing the suspension package in an outer container
dimensioned such that the side panels of the suspension package are
25 held in a configuration substantially perpendicular to the product-
supporting platform.

25

29. The invention of claim 28 wherein the tensioning of the elastomeric enclosure involves pivoting the end panels towards the first face
30 of the product-supporting platform.

30

30. A method of packaging a product comprising:

placing the product in a container having a plurality of walls;
tensioning the cushioning panel of claim 27; and

placing at least one tensioned cushioning panel between the
product and at least one of the plurality of walls, such that the first face
5 of the platform is adjacent to the product; wherein

the container is dimensioned such that the end panels of
the cushioning panel are substantially prevented from returning
to ambient positions.

FIG. 1

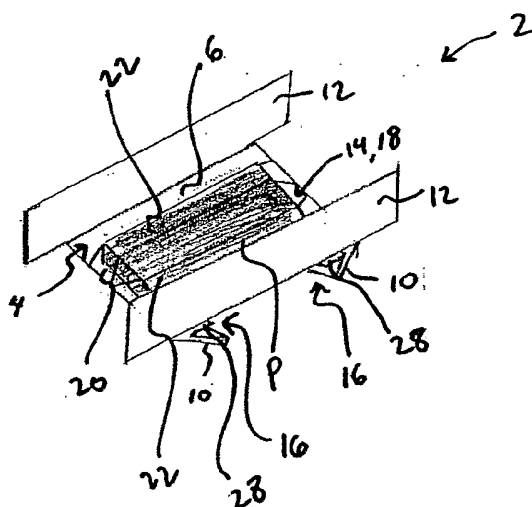


FIG. 2

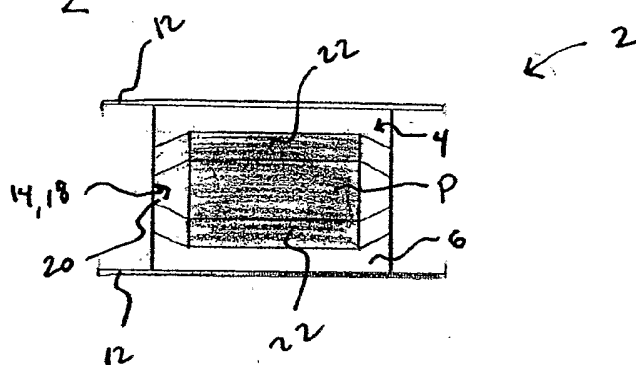


FIG. 3

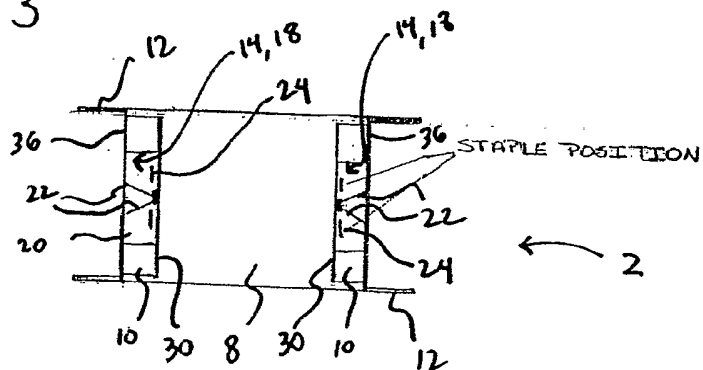


FIG. 4

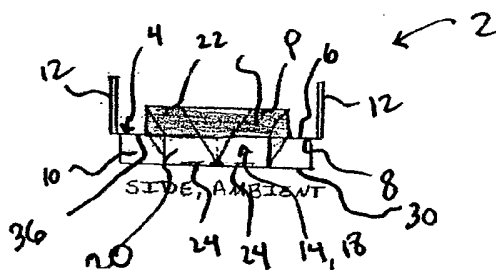


FIG. 5

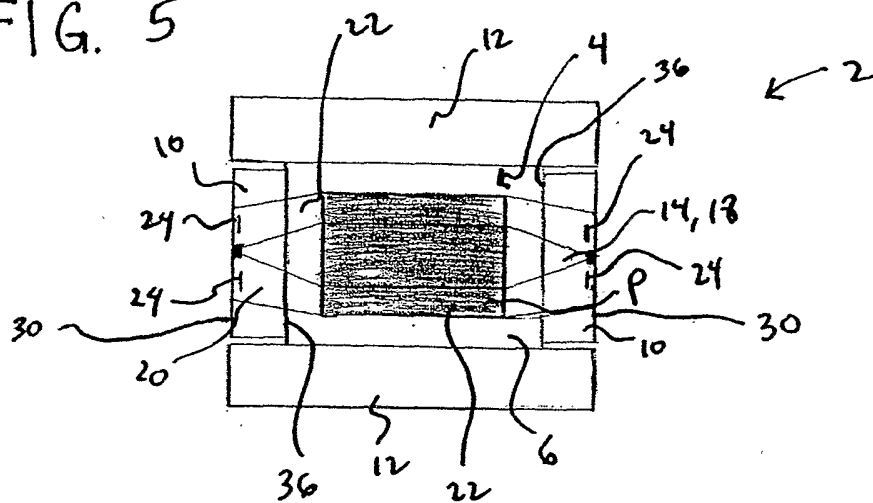


FIG. 6

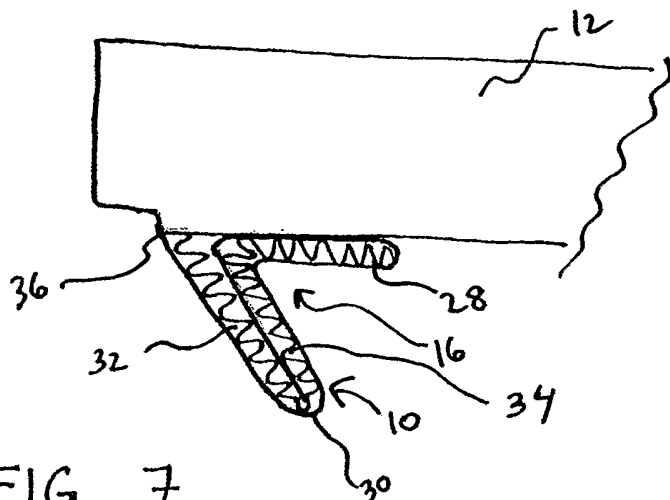


FIG. 7

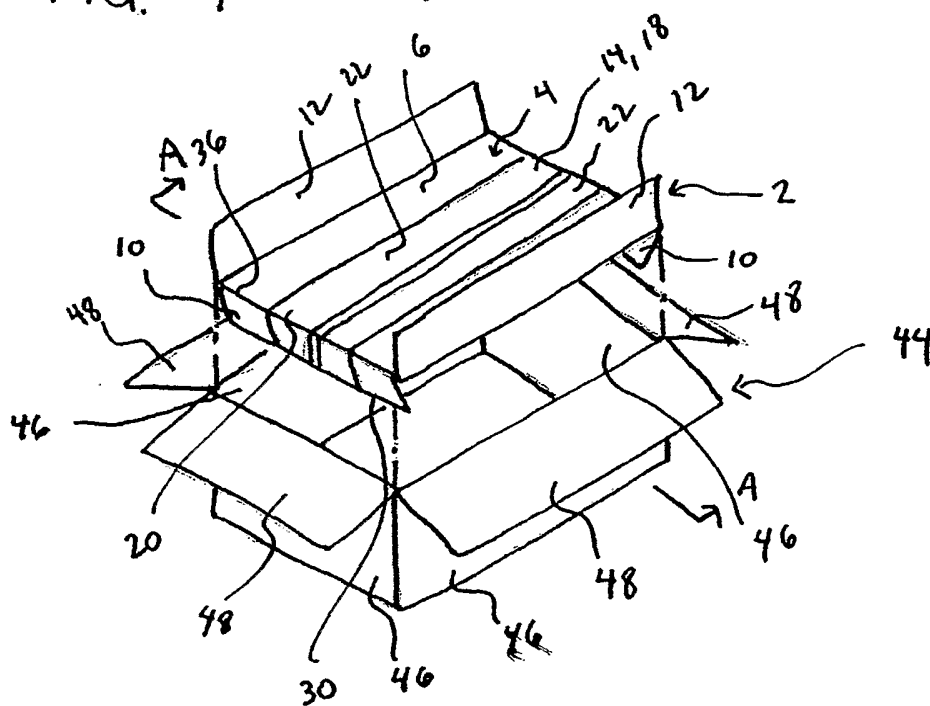


FIG. 8

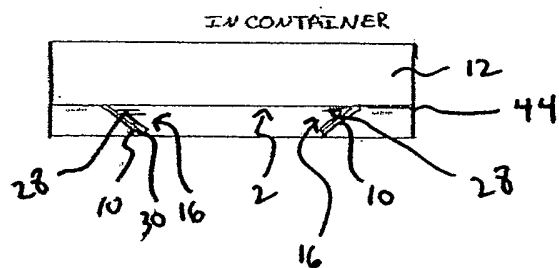


FIG. 9

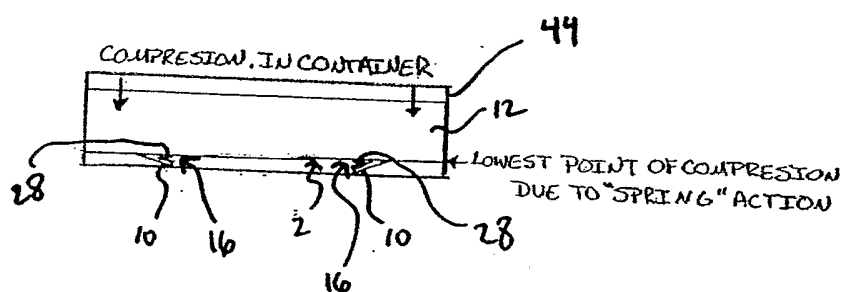


FIG. 10

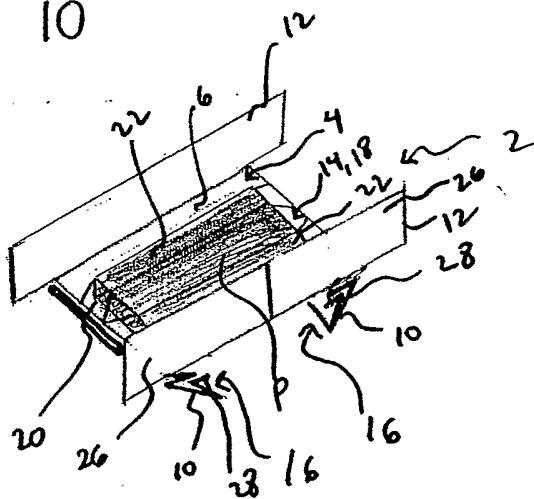


FIG. 11

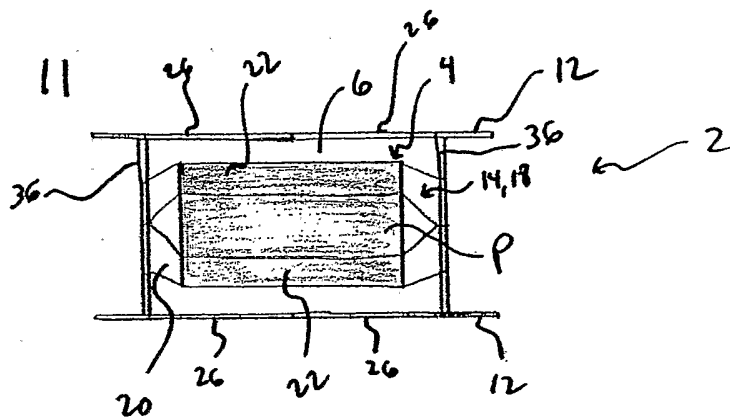


FIG. 12

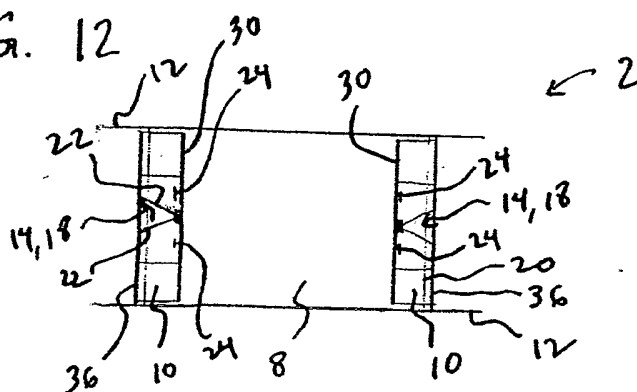


FIG. 13

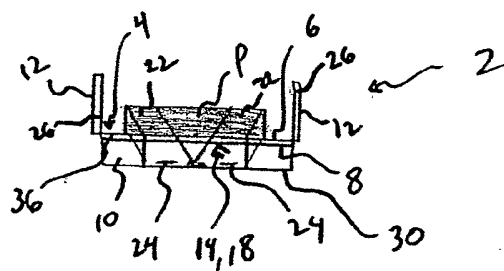


FIG. 14

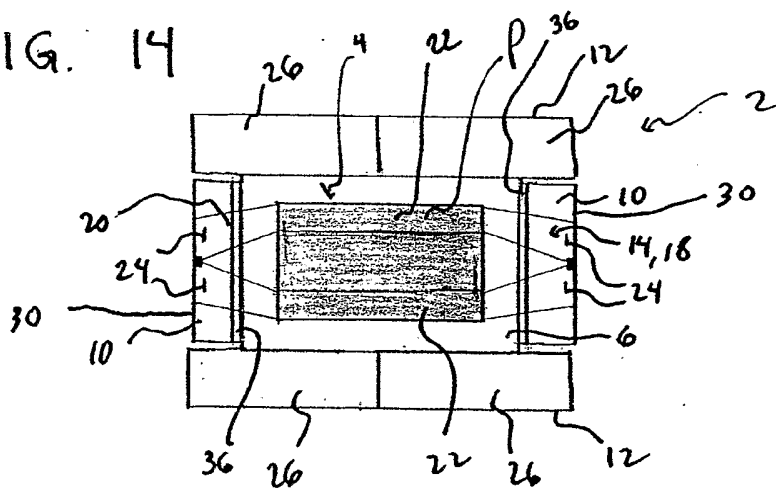


FIG. 15

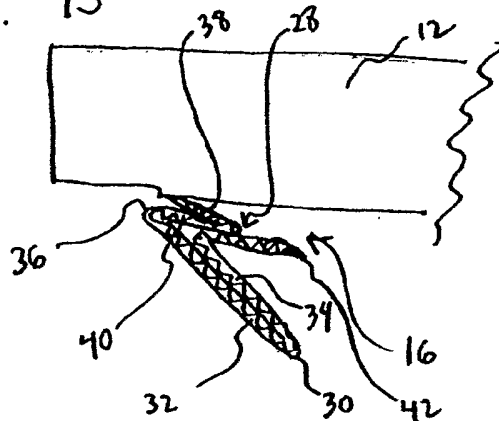


FIG. 16

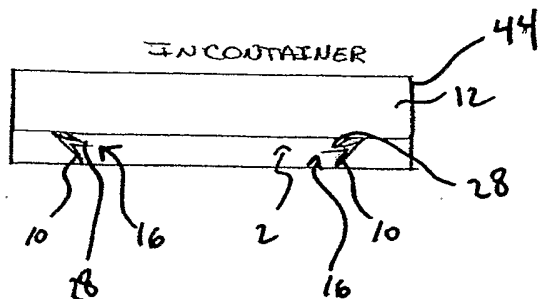


FIG. 17

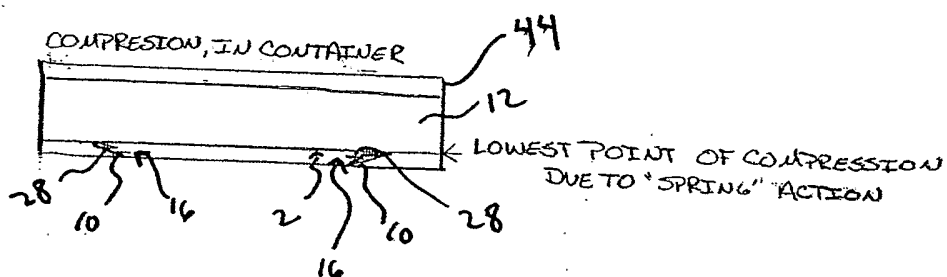
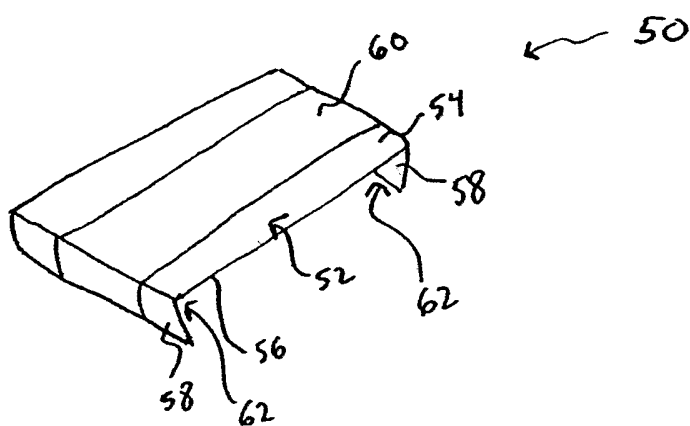


FIG. 18



INTERNATIONAL SEARCH REPORT

In International Application No
PCT/US 03/41565

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65D81/07 B65D5/50

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)

PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 311 844 B1 (RIDGEWAY) 6 November 2001 (2001-11-06)	1-7, 21-26, 28, 29
Y	column 4, line 53 -column 6, line 26; figures 1-5, 21, 22	8-14, 20, 27, 30
Y	US 5 894 932 A (HARDING) 20 April 1999 (1999-04-20) cited in the application the whole document	8-14, 20
Y	DE 299 21 203 U (SCHILLING) 24 February 2000 (2000-02-24) page 13, line 33 -page 14, line 28; figure 9	27, 30
	-/--	

☒ 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

E earlier document but published on or after the international filing date

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.

G document member of the same patent family

Date of the actual completion of the international search

19 May 2004

Date of mailing of the international search report

02/06/2004

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Martens, L

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/41565

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2001/047950 A1 (BENEROFF) 6 December 2001 (2001-12-06) paragraph '0031! - paragraph '0033!; figure 6 ---	1-7, 21-24, 28,29
P,X	DE 202 17 626 U (SCHILLING) 9 January 2003 (2003-01-09) page 4, line 4 -page 5, line 20; figures 1,2 ---	1-7, 21-23, 28,29
E	US 6 675 973 B1 (MC DONALD) 13 January 2004 (2004-01-13) column 6, line 27 - line 37 column 7, line 38 - line 49 column 14, line 41 -column 17, line 15; figures 17-22 ---	1-7, 21-26, 28,29
A	US 5 975 307 A (HARDING) 2 November 1999 (1999-11-02) cited in the application -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 03/41565

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6311844	B1	06-11-2001	US 6148590 A	21-11-2000
			US 5678695 A	21-10-1997
			US 6289655 B1	18-09-2001
			US 6148591 A	21-11-2000
			US 6010006 A	04-01-2000
US 5894932	A	20-04-1999	EP 0895944 A1	10-02-1999
			JP 11105935 A	20-04-1999
DE 29921203	U	24-02-2000	DE 29909647 U1	07-10-1999
			DE 29921203 U1	24-02-2000
			AT 246630 T	15-08-2003
			DE 50003189 D1	11-09-2003
			WO 0053499 A2	14-09-2000
			EP 1165376 A2	02-01-2002
			DE 29907333 U1	17-08-2000
			EP 1035019 A1	13-09-2000
US 2001047950	A1	06-12-2001	AU 5717701 A	07-11-2001
			WO 0181204 A1	01-11-2001
DE 20217626	U	09-01-2003	DE 20217626 U1	09-01-2003
US 6675973	B1	13-01-2004	NONE	
US 5975307	A	02-11-1999	EP 0940351 A2	08-09-1999
			JP 11314635 A	16-11-1999