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Capogrosso

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(54) **CARTON WITH CORNER CRUMPLE ZONES**

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(51) **Int. Cl.**

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B65D 81/17	(2006.01)
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B65D 81/05	(2006.01)
B65D 5/42	(2006.01)
B65D 5/44	(2006.01)
B65D 85/64	(2006.01)

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CPC ***B65D 5/50*** (2013.01); ***B65D 5/4266*** (2013.01); ***B65D 5/445*** (2013.01); ***B65D 81/053*** (2013.01); ***B65D 85/64*** (2013.01); *B65D 5/42* (2013.01)

(58) **Field of Classification Search**
CPC B65D 81/02; B65D 81/025; B65D 81/107; B65D 5/745
USPC 206/320, 586, 591, 592, 521; 229/152, 229/154, 193, 939
See application file for complete search history.

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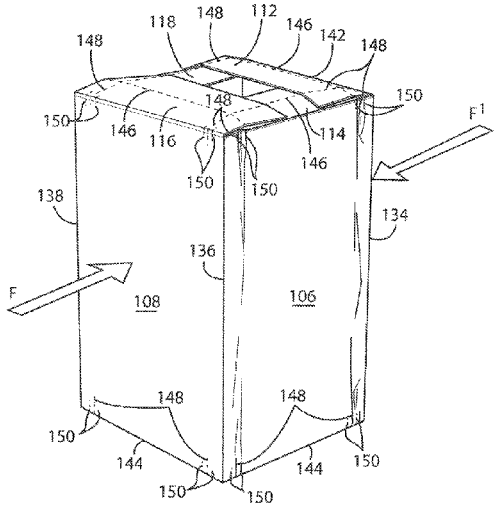
(57) **ABSTRACT**

A shipping carton having a force receiving area located adjacent opposing edges of the carton's top and bottom edges. The force receiving area is configured to deform in the presence of an external force and distribute that force through the force receiving area while minimizing the transfer of force directly to the appliance and minimizing damage to the surface panels of the shipping carton.

16 Claims, 10 Drawing Sheets



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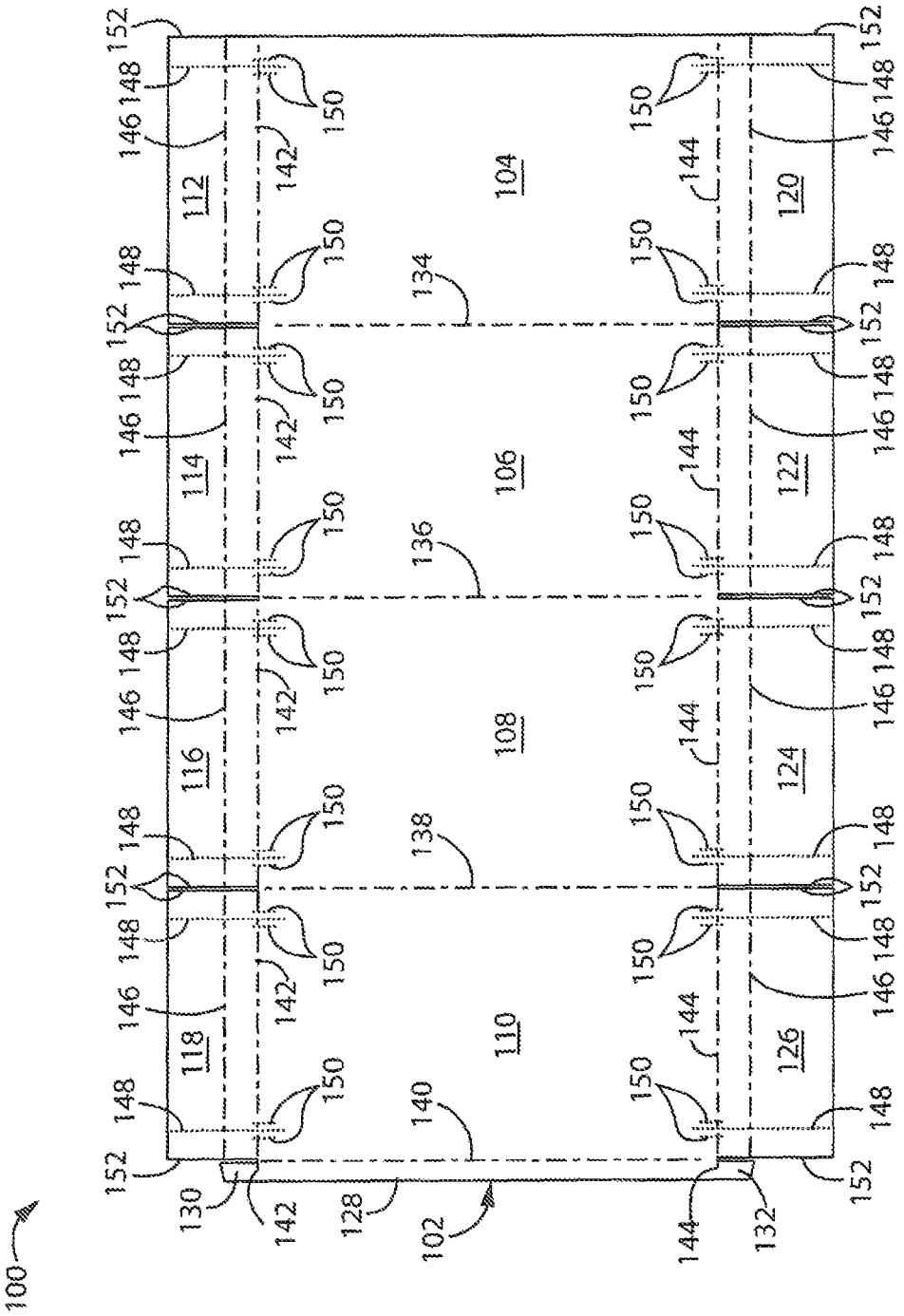
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FIG. 1

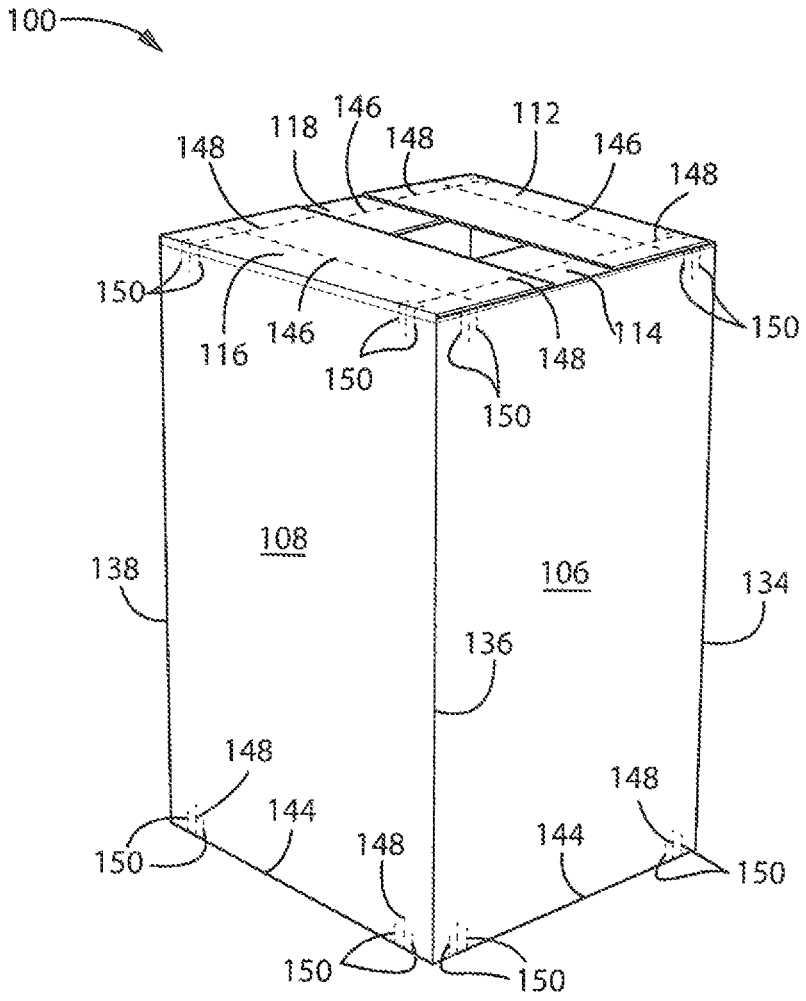
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FIG. 2

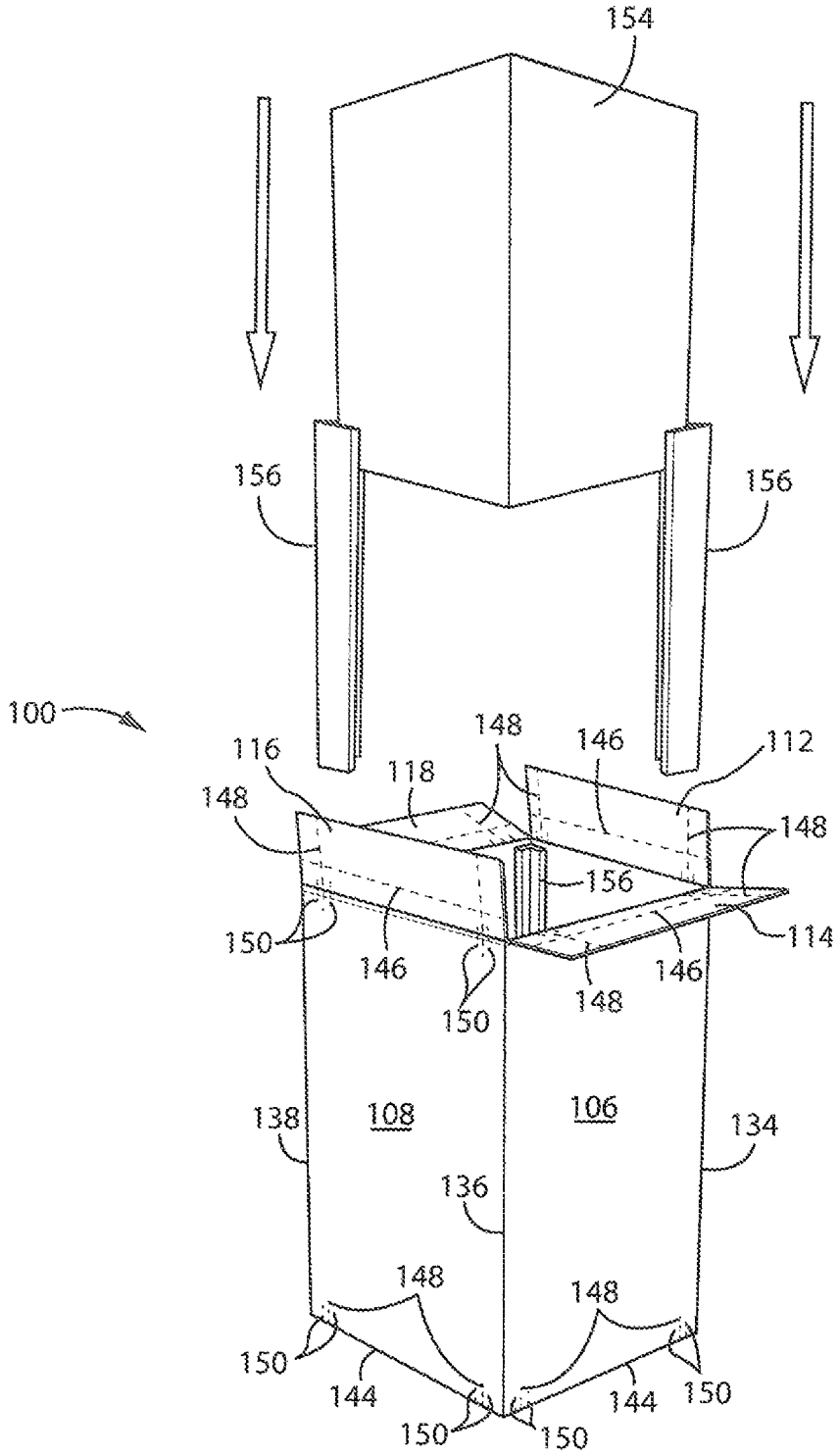
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FIG. 3

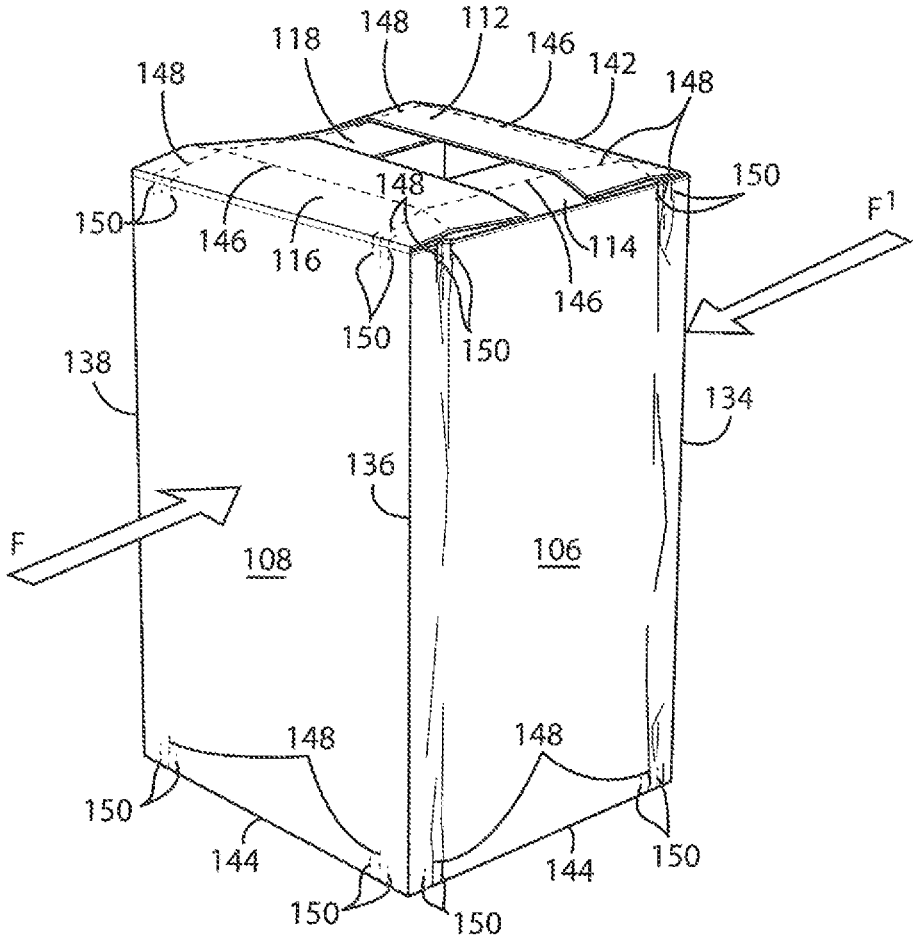
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FIG. 4

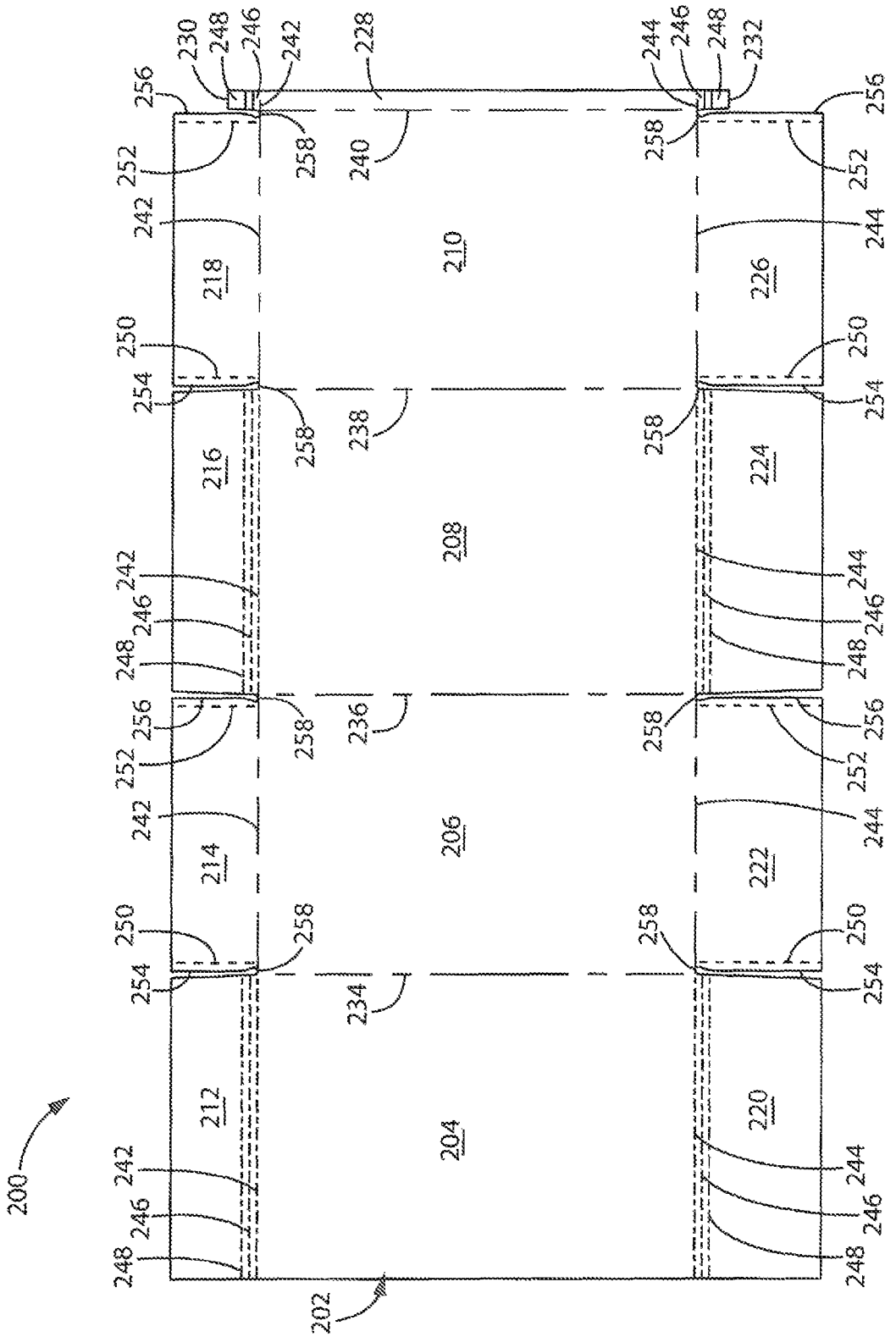
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FIG. 5

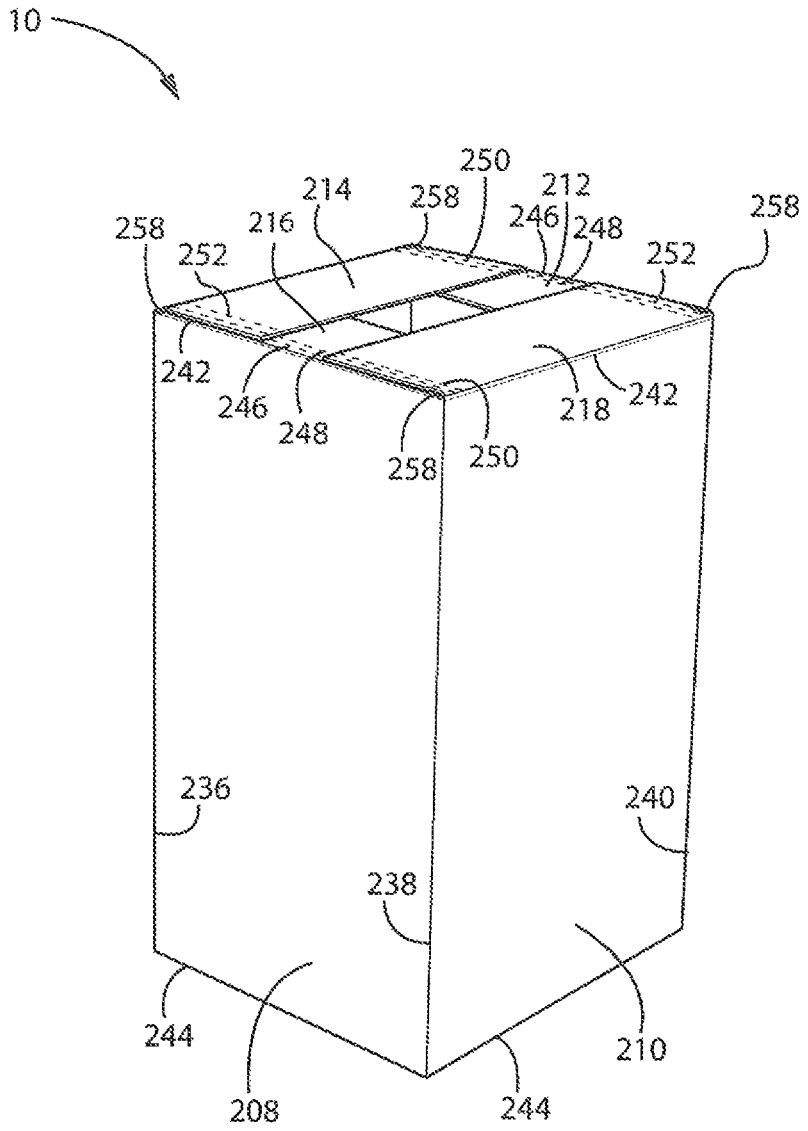
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FIG. 6

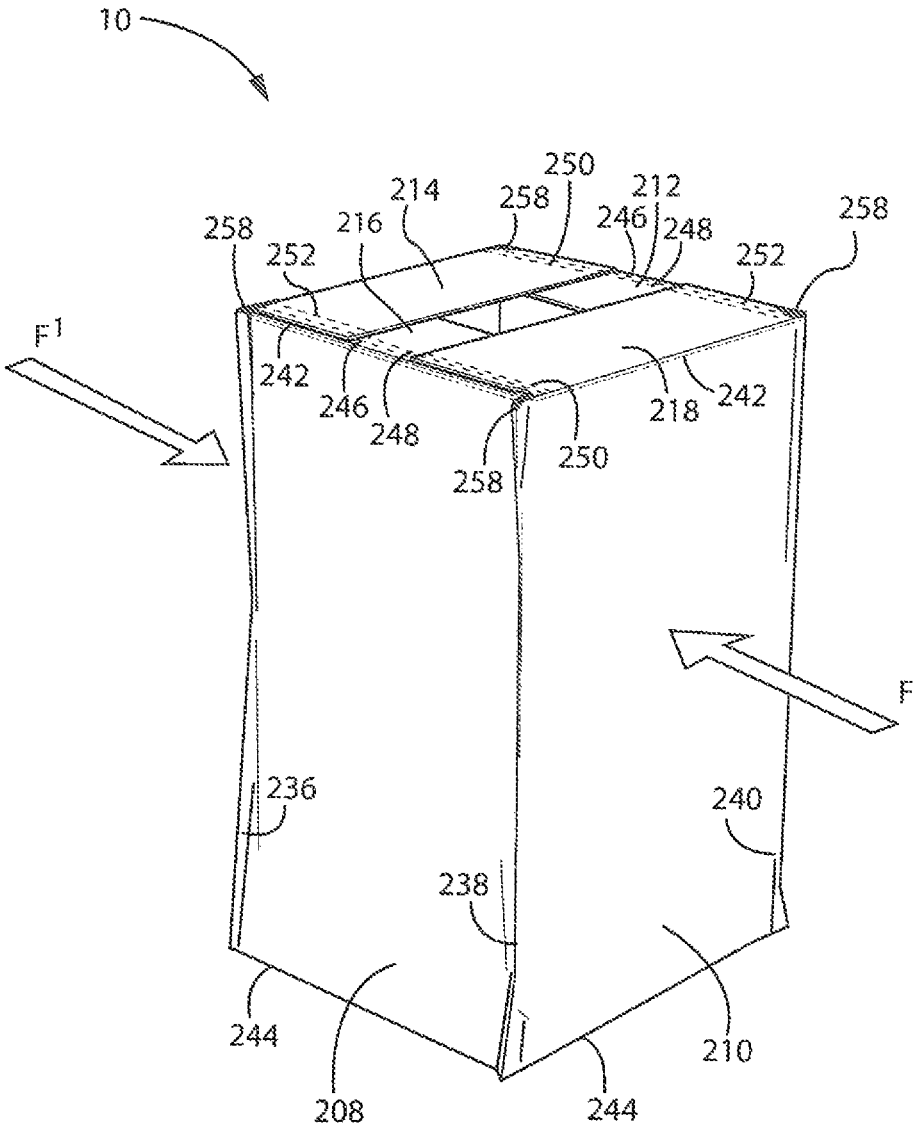
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FIG. 7

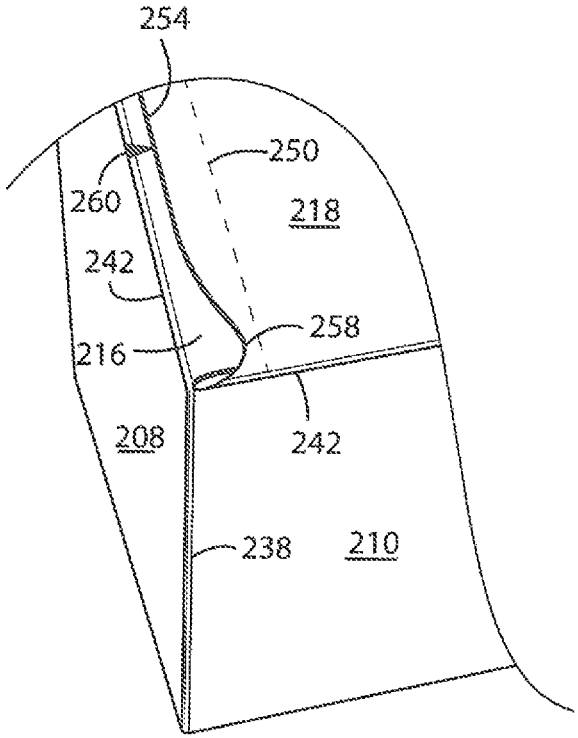
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FIG. 8

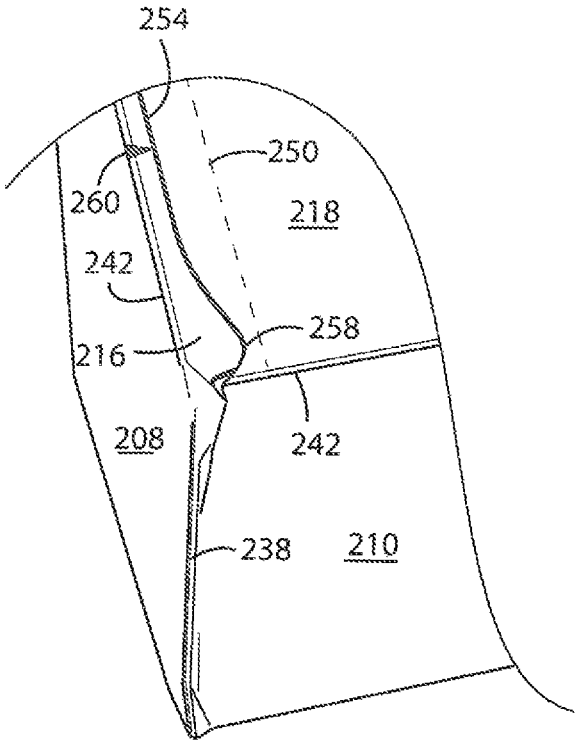
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FIG. 9

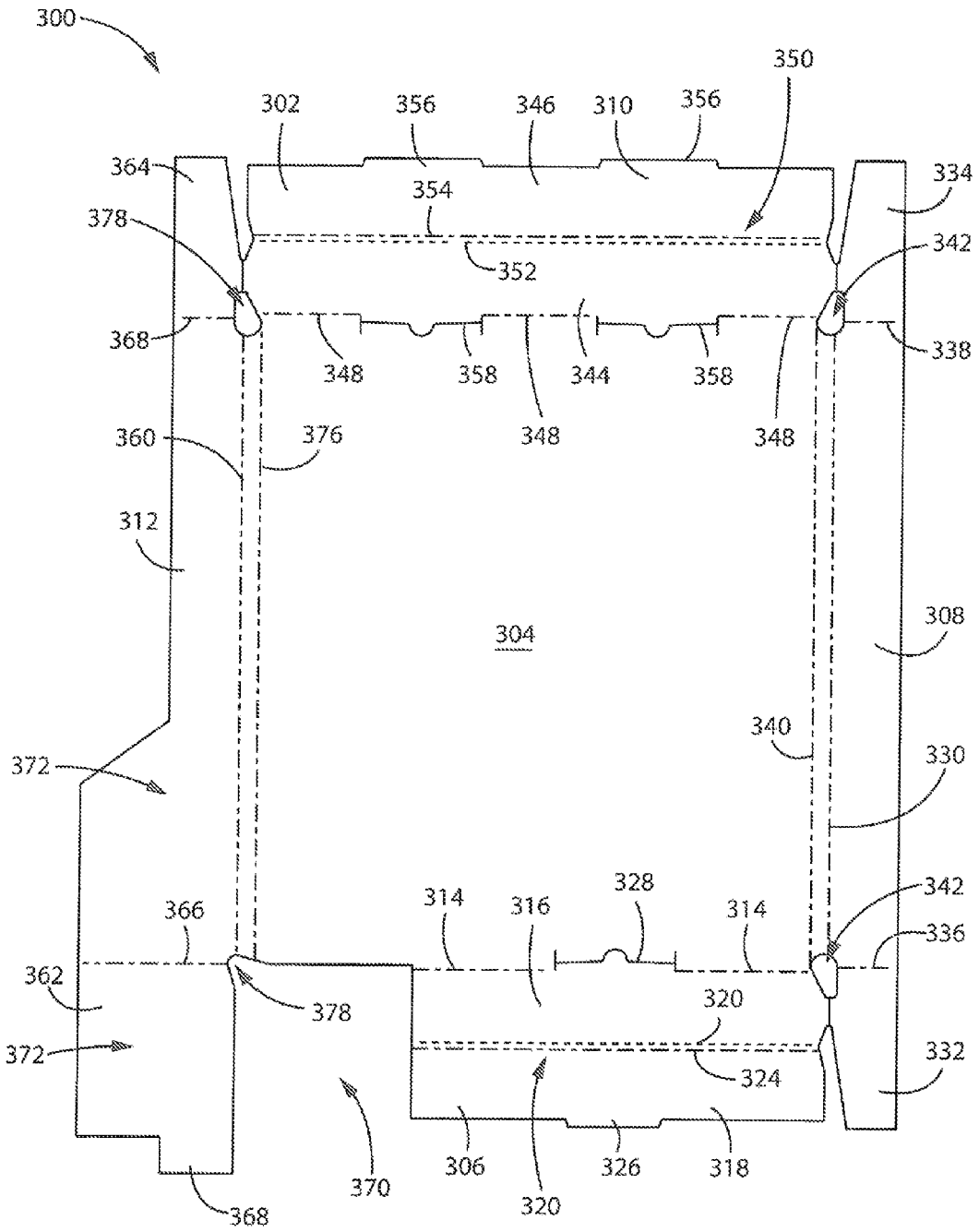
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FIG. 10

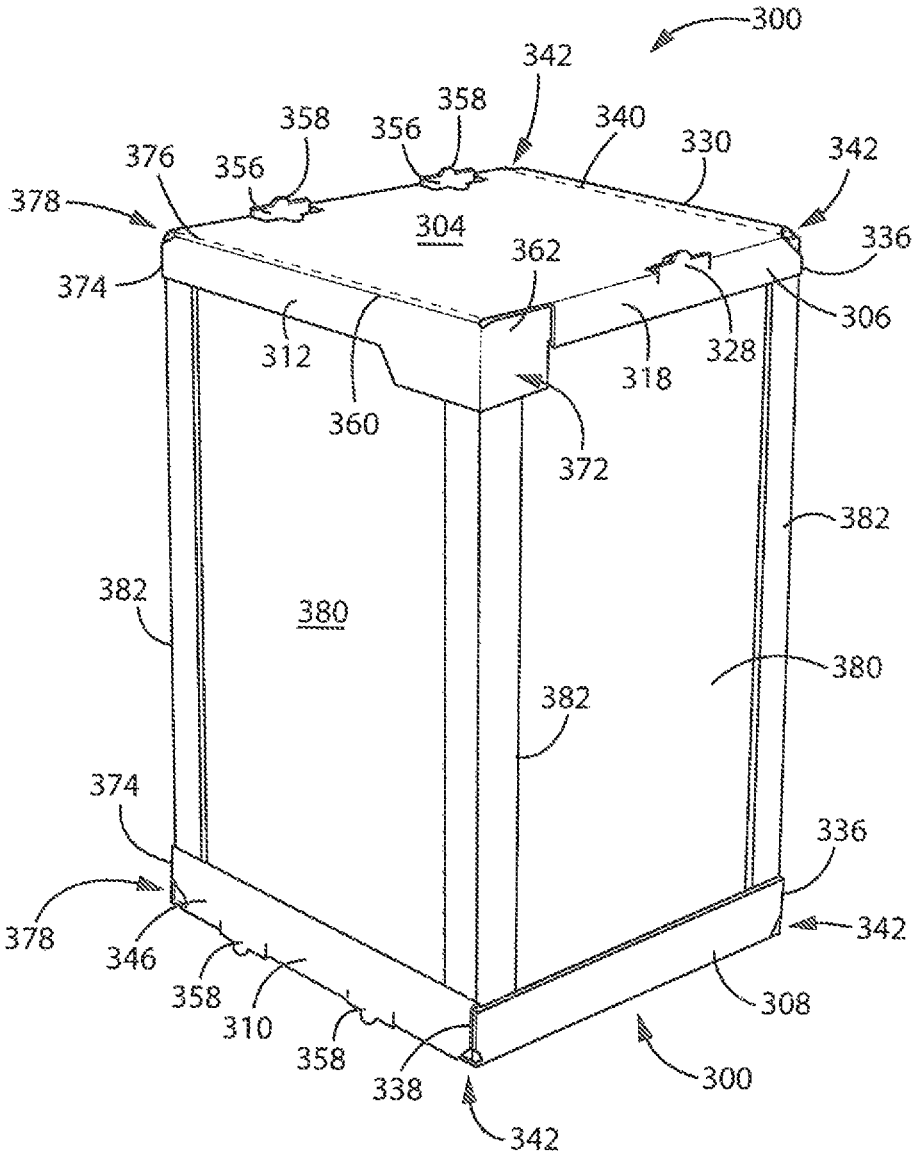
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FIG. 11

CARTON WITH CORNER CRUMPLE ZONES

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Ser. No. 61/827,882 filed May 28, 2013, the disclosure of which is incorporated herein in its entirety.

FIELD. OF THE INVENTION

The present invention relates to a shipping carton and, more particularly a shipping carton having integrated crumple zones for accepting lateral forces exerted on the carton during transportation.

BACKGROUND OF THE INVENTION

Large consumer appliances such as washing machines, dryers, dishwashers, ranges, freezers and refrigerators are typically packaged in individual cartons during their transportation from the manufacturer to the retailer, and ultimately to the end purchaser. The use of a carton is important in protecting the exterior of the appliance from potential damage, such as scratching and chipping the finish or even denting the appliance body. Conventional home appliance cartons are formed of one or more pieces of packaging material that form a six sided cuboid box surrounding the appliance. Due to the size and shape of these appliances, as well as the large quantity in which they are manufactured, they are typically shipped without being palletized. Accordingly, rather than use a forklift or similar lift truck to move the cartons, it is often more efficient to use a clamping lift truck that braces one or more cartons simultaneously with opposing lateral clamp arms.

However, the use of a clamping lift truck to lift and move appliance cartons can result in undesirable damage to the carton. In this regard, the opposing lateral forces exerted on the carton's side, from the clamps arms, compress the carton and transfer forces to the top and bottom of the carton, which are made up of folded and interconnected top and bottom flaps. These compressive forces are transmitted along the top and bottom corners of the carton at the front and the rear of carton, which can buckle to form a vertical crease along the front and/or rear panels of the carton. Typically this crease appears along the center of the carton and is visually unattractive. In some instances, this crease extends inwardly and can even contact the appliance contained therein, resulting in undesirable physical and esthetic damage to appliance.

An appliance carton typically includes L-shaped corner posts located between the carton wall and the appliance. These posts, which are typically made of a relatively stiff packaging material, assist in protecting the corners of the appliance and also provide sufficient strength to enable the cartons to be stacked. However, the corner posts also act to transfer the lateral clamping forces to the top and bottom of the carton, resulting in the crease mentioned above.

The present invention solves the aforementioned drawbacks by providing a shipping carton that includes an integrated corner crumple zone for accepting lateral forces exerted on the carton during handling and preventing transfer of the lateral clamping forces to the top and bottom corners of the carton. The present invention provides a carton that is particularly well suited for use in shipping appliances, but may also be beneficial for other shipping and distribution needs, including the shipment of products that have low tolerances to shipping related damage.

SUMMARY OF THE INVENTION

In one aspect, the present invention provides a shipping carton formed from a single blank or sheet of material, having a force receiving area located adjacent opposing edges of the carton's top and bottom edges. Each force receiving area is configured to deform in the presence of an external force and distribute that force through the force receiving area while minimizing the transfer of force directly to the appliance and minimizing deformation of the surface panels of the shipping carton.

In another aspect, the invention provides a dual layer top and bottom portion of the carton, where the force receiving areas of the top and bottom portions functionally cooperate.

In another aspect, the invention provides the force receiving areas of the top and bottom portions located at a position removed from the edge of the carton equal to a width of a support structure located within the carton, between the appliance and the carton.

In yet another aspect, the invention provides voids in at least one layer of the top and bottom of the carton configured to localize damage to the carton in the vicinity of the voids.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings illustrate a representative embodiment presently contemplated for carrying out the present invention. It should be understood that the invention is not limited to the embodiments disclosed, and is capable of variations within the scope of the appended claims.

In the Drawings:

FIG. **1** is a top plan view of an unfolded blank of a container, according to one aspect of the present invention;

FIG. **2** is a perspective view of a folded container that is formed using the blank of FIG. **1**, showing the container in a closed configuration;

FIG. **3** is an exploded perspective view of the folded container of FIG. **2** with the container in an open configuration receiving a plurality of corner posts and a home appliance therein;

FIG. **4** is a perspective view of the folded container of FIG. **2** showing the container in a closed configuration receiving an inwardly directed lateral force on opposing side walls, such as is experienced during clamping-type load handling, resulting in a controlled crumpling at select positions along the container walls and buckling of the container top and bottom;

FIG. **5** is a top plan view of an unfolded blank of a container, according to the first alternative embodiment of the present invention;

FIG. **6** is a perspective view of a folded container that is formed using the blank of FIG. **5** showing the container in a closed configuration;

FIG. **7** is a perspective view of the folded container of FIG. **6** showing the container in a closed configuration receiving an inwardly directed lateral force on opposing side walls, such as is experienced during clamping-type load handling, resulting in a controlled crumpling at select positions along the container walls and buckling of the container top and bottom;

FIG. **8** is a detail perspective view of a corner of the folded container of FIG. **6** showing the container in a closed configuration prior to receiving an inwardly directed force;

FIG. **9** is a detail perspective view similar to FIG. **8** showing the container in a closed configuration after receiving an inwardly directed force;

FIG. **10** is a top plan view of an unfolded blank of a top or bottom panel or cap of a shipping container, according to the second alternative embodiment of the present invention; and

FIG. **11** is a perspective view of an appliance to which top and bottom caps are secured, wherein each cap is formed from a folded blank of FIG. **10**, and including a plurality of corner posts between the top and bottom caps.

DETAILED DESCRIPTION

I. Embodiment One

Referring initially to FIGS. **1-4** and particularly FIG. **1**, there is shown a shipping carton **100** according to one embodiment of the present invention. The shipping carton **100** generally is made of a sheet or blank **102** of packaging material. The packaging material may consist of corrugated board or any similar material suitable for use in shipping container construction. In a manner as is known, the corrugated board consists of a fluted corrugated core located between two sheets of kraft paper or linerboard, in a manner as is known. In one embodiment the flutes of the inner core have a longitudinal axis that is parallel to the longitudinal axis of the folded and erected carton **100**. The blank **102** may be stamped or cut from a sheet of the packaging material while in a substantially flat orientation, and subsequently folded to form the carton **100**. The outer surface of the carton **100** may be printed to display information such as contents details, shipping information, removal instructions, orientation indicia and the like. The outer surface of the carton **100** may also contain advertising information or ornamental elements.

FIG. **1** illustrates the blank **102**, formed of a single piece of packaging material, in a flat orientation. The blank **102** includes primarily a first side panel **104**, a front panel **106**, a second side panel **108** and a rear panel **110**. Each of these four panels **104**, **106**, **108**, **110** also includes respective individual top panels **112**, **114**, **116**, **118** and individual bottom panels **120**, **122**, **124**, **126** extending from the top and bottom of each corresponding panel **104**, **106**, **108**, **110**. Lastly, the rear panel **110** also includes a fixation panel **128**, extending from a side of the rear panel **110** between the top panel **118** and bottom panel **126**. As illustrated in FIG. **1**, the fixation panel **128** may have a small top panel **130** and bottom panel **132** extending from the top and bottom of the fixation panel **128**, in line with the other top panels **112**, **114**, **116**, **118** and bottom panels **120**, **122**, **124**, **126** respectively.

Still referring to FIG. **1**, the first side panel **104** is hingedly attached to the front panel **106** about a crease line **134**. The opposing side of the front panel **106** is hingedly attached to the second side panel **108** about a crease line **136**. The opposing side of the second side panel **108** is hingedly attached to the rear panel **110** about a crease line **138**, and the opposing side of the rear panel **110** is hingedly attached to the fixation panel **128** about a crease line **140**. As illustrated in FIG. **1**, the crease lines **134**, **136**, **138**, **140** are parallel in orientation, allowing the panels **104**, **106**, **108**, **110**, **128** to be folded into a cuboid carton **100** as is described in further detail below.

In addition to the above indicated side crease lines **134**, **136**, **138**, **140** the blank **102** also includes a top crease line **142** and a bottom crease line **144**. The top crease line **142** extends along the upper side or edge of each panel **104**, **106**, **108**, **110**, **128** and hingedly attaches the top panels **112**, **114**, **116**, **118**, **130** respectively thereto. Similarly, the bottom crease line **144** extends along the lower side or edge of each panel **104**, **106**, **108**, **110**, **128** and hingedly attaches the bottom panels **120**, **122**, **124**, **126**, **132** respectively thereto. The top and bottom crease lines **142**, **144** are each formed of a continuous crease that extends the entire length of the blank **102**, and form upper and lower edges of the erected carton **100**, when folded. While the lines **134**, **136**, **138**, **104**, **142**, **144** have been described as "crease lines", it is well within the scope of the invention that these lines may be formed of other methods, including but not limited to scoring or perforating.

Still referring to FIG. **1**, the top and bottom panels **112**, **114**, **116**, **118**, **120**, **122**, **124**, **126**, **130**, **132** will be described in further detail. As illustrated in FIG. **1**, each of the top panels **112**, **114**, **116**, **118** and bottom panels **120**, **122**, **124**, **126** includes a similar pattern of crease lines and perforations, collectively referred to as a crumple zone described below. Specifically, each top and bottom panel **112**, **114**, **116**, **118**, **120**, **122**, **124**, **126**, includes a crumple zone crease line **146**. The crumple zone crease line **146** is located adjacent the respective crease line **142**, **144** and on the surface of the top or bottom panel **112**, **114**, **116**, **118**, **120**, **122**, **124**, **126**. In the illustrated embodiment, the crumple zone crease line **146** may be located approximately between 0.5 and 5.0 inches from the respective top or bottom crease line **142**, **144** and approximately 3.25 inches from the respective top or bottom crease line **142**, **144**. While the crumple zone crease line **146** had been described as "crease lines", it is well within the scope of the invention that this line **146** may be formed of other methods, including but not limited to scoring or perforating.

In addition to the crumple zone crease line **146**, each top and bottom panel **112**, **114**, **116**, **118**, **120**, **122**, **124**, **126** also includes at least one primary crumple zone perforation line **148**, and may include one or more secondary crumple zone perforation lines **150**. The primary crumple zone perforation line **148** and secondary crumple zone perforation lines **150** are oriented perpendicular to the crumple zone crease line **146**. In the illustrated embodiment in FIG. **1**, the blank **102** includes two secondary crumple zone perforation lines **150** for ever primary crumple zone perforation line **148**, with the secondary crumple zone perforation lines **150** being short lines located on opposing sides of the primary crumple zone perforation line **148**. As shown in FIG. **1**, the primary crumple zone perforation line **148** may be located approximately between 0.5 and 5.0 inches from the respective side edge **152** of the corresponding top or bottom panel **112**, **114**, **116**, **118**, **120**, **122**, **124**, **126**, and approximately 3.25 inches from the side edge **152** of the corresponding top or bottom panel **112**, **114**, **116**, **118**, **120**, **122**, **124**, **126**. Accordingly, in a folded configuration as will be described in further detail below, the primary crumple zone perforation line **148** will overlie crumple zone crease line **146**. Again, while the primary crumple zone perforation line **148** and secondary crumple zone perforation lines **150** have been described as "perforation lines", it is well within the scope of the invention that these lines **148**, **250** may be formed of other methods, including but not limited to scoring or creasing.

Turning now to FIGS. **2** and **3**, the blank **102** will be described in a folded and erected configuration to form carton **100**. The blank **102** is folded approximately 90 degrees around the score lines **134**, **136**, **138**, **140** until the outer surface of fixation panel **128** overlaps with the inner surface of the first side panel **104**. The blank **102** is then retained in this folded configuration by means of applying

adhesive between the outer surface of fixation panel **128** and the inner surface of the first side panel **104**. Alternatively, the fixation panel **128** and first side panel **104** may be retained in their folded configuration by means of fasteners such as staples, adhesive tape or any other known means of fixation. The bottom panels **120**, **122**, **124**, **126**, **132** are then folded inwardly, approximately 90 degrees around crease line **144** respectively to form a base of support on which the carton **100** rests. Once the bottom panels **120**, **122**, **124**, **126**, **132** have been folded they may be adhesively or alternatively fixed together to form an integrated base. The outer surfaces of bottom panels **122**, **126** may be adhesively affixed to the inner surfaces of bottom panels **120**, **124**; or alternatively the outer surfaces of bottom panels **120**, **124** may be adhesively affixed to the inner surfaces of the bottom panels **122**, **126**. As shown in FIG. **3**, after the bottom has been formed, an appliance **154** or other object may be inserted into the interior cavity formed within the carton **100**. Corner posts **156** and or other packaging materials may also be inserted into the carton **100**, surrounding the appliance **154**. The width of the corner posts **156** is representatively approximately equal to the distance from the crumple zone crease line **146** to the corresponding crease line **142**, **144** as well as the primary crumple zone perforation line **148** to the side edge **152**. Once all of the contents have been placed into the carton **100**, the top panels, **112**, **114**, **116**, **118**, **130** may be folded inwardly, approximately 90 degrees around crease line **142** respectively to form a top to the carton **100** and adhesively or alternatively fixed together. As shown in FIG. **2** the inner surfaces of top panels **112**, **116** may be adhesively affixed to the outer surfaces of top panels **114**, **118**; or alternatively the inner surfaces of top panels **114**, **118** may be adhesively affixed to the outer surfaces of the top panels **116**, **120**.

Turning now to FIG. **4**, once the carton **100** has been retained in its folded configuration described above, it may be subjected to opposing lateral forces such as those exerted by a clamp lift and indicated by arrows F, F'. When subjected to such forces, the first and second side panels **104**, **108** may be forced inwards, in the direction indicated by arrows F, F'. In response to such inward movement of the first and second side panels **104**, **108**, the forces applied to the first and second side panels **104**, **108** are transferred to the weakened crumple zone crease line **146**, primary crumple zone perforation line **148**, and one or more secondary crumple zone perforation lines **150**, rather than directly to the front and rear panels **106**, **110** and the top and bottom of carton **100**. This avoids buckling at the top and bottom corners of the front and rear panels **106**, **110** and instead results in upward and downward flexing, bending, and movement at crumple zone crease line **146**, primary crumple zone perforation line **148**, and one or more secondary crumple zone perforation lines **150** at the top and bottom of the carton **100**, respectively.

Still referring to FIG. **4**, the crumple zone crease line **146**, primary crumple zone perforation line **148**, and one or more secondary crumple zone perforation lines **150** are illustrated in a crumpled configuration in which a lateral force F has forced the second side panel **108** inwards, resulting in the vertical flexing or bending of the crumple zone at crease line **146**, primary crumple zone perforation line **148**, and one or more secondary crumple zone perforation lines **150** so as to absorb or receive the force F and thereby limit the carton **100** from undesirably and uncontrollably creasing or bending in other locations. The inward movement of the second side panel **108** is transitioned to upward bowing of the top of the carton **100**, downward bowing of the bottom of the carton **100**, and outward bowing of the front and rear panels **106**, **110**. That is to say that the crumple zone crease line **146**, primary crumple zone perforation line **148**, and one or more secondary crumple zone perforation lines **150**, in combination with the underlying corner posts **156** act as a relief to insure that lateral movement of the upper end of second side panel **108** does not result in application of a lateral force to the top corner of carton **100**. That is, the presence of the crumple zone crease line **146**, primary crumple zone perforation line **148**, and one or more secondary crumple zone perforation lines **150** will localize any potential creasing of carton **100** to the area of the carton **100** that is in the approximate vicinity of the crumple zone crease line **146**, primary crumple zone perforation line **148**, and one or more secondary crumple zone perforation lines **150**. By way of localizing the potential creasing of carton **100**, as is illustrated in FIG. **4**, the front and rear panels **106**, **110** do not exhibit creasing or alternative damage, particularly around the center or middle of the carton **100**. As a result, the carton **100** has an improved esthetic appearance after shipment. Additionally, by localizing any potential creasing or carton **100** to an area adjacent a corner post, the present invention greatly reduces the risk of abrading, scratching and chipping the finish of the appliance or denting the appliance body.

II. Embodiment Two

Turning now to FIGS. **5-9** and initially FIG. **5**, there is shown a shipping carton **200** according to a second embodiment of the present invention. The shipping carton **200** generally is made of a sheet or blank **202** of packaging material. The packaging material may consist of corrugated board or any similar material suitable for use in shipping container construction. In a manner as is known, the corrugated board consists of a fluted corrugated core located between two sheets of kraft paper or linerboard, in a manner as is known. In one embodiment the flutes of the inner core have a longitudinal axis that is parallel to the longitudinal axis of the folded and erected carton **200**. The blank **202** may be stamped or cut from a sheet of the packaging material while in a substantially flat orientation, and subsequently folded to form the carton **200**. The outer surface of the carton **200** may be printed to display information such as contents details, shipping information, removal instructions, orientation indicia and the like. The outer surface of the carton **200** may also contain advertising information or ornamental elements.

FIG. **1** illustrates the blank **202**, formed of a single piece of packaging material, in a flat orientation. The blank **202** includes primarily a first side panel **204**, a front panel **206**, a second side panel **208** and a rear panel **210**. Each of these four panels **204**, **206**, **208**, **210** also includes respective individual top panels **212**, **214**, **216**, **218** and individual bottom panels **220**, **222**, **224**, **226** extending from the top and bottom of each corresponding panel **204**, **206**, **208**, **210**. Lastly, the rear panel **210** also includes a fixation panel **228**, extending from a side of the rear panel **210** between the top panel **218** and bottom panel **226**. As illustrated in FIG. **5**, the fixation panel **228** may have a small top panel **230** and bottom panel **232** extending from the top and bottom of the fixation panel **228**, in line with the other top panels **212**, **214**, **216**, **218** and bottom panels **220**, **222**, **224**, **226** respectively.

Still referring to FIG. **5**, the first side panel **204** is hingedly attached to the front panel **206** about a crease line **234**. The opposing side of the front panel **206** is hingedly attached to the second side panel **208** about a crease line **236**. The opposing side of the second side panel **208** is hingedly

attached to the rear panel **210** about a crease line **238**, and the opposing side of the rear panel **210** is hingedly attached to the fixation panel **228** about a crease line **240**. As illustrated in FIG. **5**, the crease lines **234**, **236**, **238**, **240** are parallel in orientation, allowing the panels **204**, **206**, **208**, **210**, **228** to be folded into a cuboid carton **200** as is described in further detail below.

In addition to the above indicated side crease lines **234**, **236**, **238**, **240** the blank **202** also includes a top crease line **242** and a bottom crease line **244**. The top crease line **242** extends along the upper side or edge of each panel **204**, **206**, **208**, **210**, **228** and hingedly attaches the top panels **212**, **214**, **216**, **218**, **230** respectively thereto. Similarly, the bottom crease line **244** extends along the lower side or edge of each panel **204**, **206**, **208**, **210**, **228** and hingedly attaches the bottom panels **220**, **222**, **224**, **226**, **232** respectively thereto. The top and bottom crease lines **242**, **244** are each formed of a continuous crease that extends the entire length of the blank **202**, and form upper and lower edges of the erected carton **200**, when folded. While the lines **234**, **236**, **238**, **204**, **242**, **244** have been described as "crease lines", it is well within the scope of the invention that these lines may be formed of other methods, including but not limited to scoring or perforating.

Still referring to FIG. **5**, the top and bottom panels **212**, **214**, **216**, **218**, **220**, **222**, **224**, **226**, **230**, **232** will be described in further detail. As illustrated in FIG. **5**, the top and bottom panels **212**, **216**, **220**, **224** of the first and second side panels **204**, **208**, respectively, include first and second crumple zone crease lines **246**, **248**. The crumple zone crease lines **246**, **248** are located adjacent the respective crease lines **242**, **244** and on the surface of the top or bottom panel **212**, **214**, **216**, **218**, **220**, **222**, **224**, **226**, **230**, **232**. In the illustrated embodiment, the first crumple zone crease line **246** may be located approximately between 0.5 and 1.0 inches from the respective top or bottom crease line **242**, **244** and approximately 0.75 inches from the respective top or bottom crease line **242**, **244**. In this illustrated embodiment, the second crumple zone crease line **248** may be located approximately between 0.5 and 1.0 inches from the first crumple zone crease line **246**, and approximately 0.75 inches from the first crumple zone crease line **246**. While the crumple zone crease lines **246**, **248** have been described as "crease lines", it is well within the scope of the invention that these lines **246**, **248** may be formed of other methods, including but not limited to scoring or perforating.

The top and bottom panels **214**, **218**, **222**, **226** of the front and rear panels **206**, **210**, may also include respective first and second crumple zone crease lines **250**, **252**, which are positioned to correspond with the crumple zone crease lines **246**, **248** of the side panels **204**, **208** when the blank **202** is folded into a carton **200**. The crumple zone crease lines **250**, **252** are located adjacent the opposing sides **254**, **256** of the top and bottom panels **214**, **218**, **222**, **226** on the surface of the top or bottom panel **214**, **218**, **222**, **226**. The crumple zone crease lines **250**, **252** are also positioned approximately perpendicular to the crease lines **242**, **244**. In the illustrated embodiment, crumple zone crease line **250** may be located approximately between 0.75 and 1.5 inches from the first side **254** of the panel **214**, **218**, **222**, **226**, and approximately 1.1875 inches from the first side **254** of the respective panel **214**, **218**, **222**, **226**. Similarly, crumple zone crease line **252** may be located approximately between 0.75 and 1.5 inches from the second side **256** of the panel **214**, **218**, **222**, **226**, and approximately 1.1875 inches from the first side **254** of the respective panel **214**, **218**, **222**, **226**. As also illustrated in FIG. **5**, the first and second sides **254**, **256**, of the top and bottom panels **214**, **218**, **222**, **226** may include a taper or void **258** configured to facilitate folding blank **202** into carton **200** and crumpling of the crumple zone crease lines **246**, **248**, **250**, **252**. Again, while the crumple zone crease lines **250**, **252** have been described as "crease lines", it is well within the scope of the invention that these lines **250**, **252** may be formed of other methods, including but not limited to scoring or perforating.

Turning now to FIGS. **6** and **8**, the blank **202** will be described in a folded and erected configuration to form carton **200**. The blank **202** is folded approximately 90 degrees around the score lines **234**, **236**, **238**, **240** until the outer surface of fixation panel **228** overlaps with the inner surface of the first side panel **204**. The blank **202** is then retained in this folded configuration by means of applying adhesive between the outer surface of fixation panel **228** and the inner surface of the first side panel **204**. Alternatively, the fixation panel **228** and first side panel **204** may be retained in their folded configuration by means of fasteners such as staples, adhesive tape or any other known means of fixation. The bottom panels **220**, **222**, **224**, **226**, **232** are then folded inwardly, approximately 90 degrees around crease line **244** respectively to form a base of support on which the carton **200** rests. Once the bottom panels **220**, **222**, **224**, **226**, **232** have been folded they may be adhesively or alternatively fixed together to form an integrated base. As shown in FIG. **6** the outer surfaces of bottom panels **222**, **226** may be adhesively affixed to the inner surfaces of bottom panels **220**, **224**; or alternatively the outer surfaces of bottom panels **220**, **224** may be adhesively affixed to the inner surfaces of the bottom panels **222**, **226**. After the bottom has been formed, an appliance or other object may be inserted into the interior cavity formed within the carton **200**. Corner posts and or other packaging materials may also be inserted into the carton **200**, surrounding the appliance, as previously illustrated in FIG. **3**. Once all of the contents have been placed into the carton **200**, the top panels, **212**, **214**, **216**, **218**, **230** may be folded inwardly, approximately 90 degrees around crease line **242** respectively to form a top to the carton **200** and adhesively or alternatively fixed together. As shown in FIG. **6** the inner surfaces of top panels **214**, **218** may be adhesively affixed to the outer surfaces of top panels **212**, **216**; or alternatively the inner surfaces of top panels **212**, **216** may be adhesively affixed to the outer surfaces of the top panels **214**, **218**.

Turning now to FIGS. **7** and **9**, once the carton **200** has been retained in its folded configuration described above, it may be subjected to opposing lateral forces such as those exerted by a clamp lift and indicated by arrows F, F'. When subjected to such forces, the front and rear panels **206**, **210** may be forced inwards, in the direction indicated by arrows F. F'. In response to such inward movement of the front and rear panels **206**, **210**, the forces applied to front and rear panels **206**, **210** are transferred to the weakened crumple zone crease lines **246**, **248**, **250**, **252** rather than to the upper and lower corners between first and second side panels **204**, **208** and the top and bottom of carton **200**. This avoids buckling at the top and bottom corners of first and second side panels **204**, **208** and instead results in upward and downward flexing, bending, and movement at the crumple zone crease lines **246**, **248**, **250**, **252** at the top and bottom of the carton **10**, respectively.

Still referring to FIGS. **7** and **9**, the crumple zone crease lines **246**, **248**, **250**, **252** are illustrated in a crumpled configuration in which a lateral force F' has forced the rear panel **210** inwards, resulting in the flexing or bending of the crumple zone crease lines **246**, **248**, **250**, **252** which absorb

or receive the force F' and thereby limit the carton **200** from undesirably and uncontrollably creasing or bending in other locations. The inward movement of the rear panel **210** at its intersection with top panel **218** is accommodated by the enlarged void area **258** of slot **260**, which acts as a relief to insure that lateral movement of the upper end of rear panel **210** does not result in application of a lateral force to the top corner of carton **200**. That is, the presence of the crumple zone crease lines **246**, **248**, **250**, **242** will localize any potential creasing of carton **200** to the area of the carton **200** that is in the approximate vicinity of the crumple zone crease lines **246**, **248**, **250**, **252**. By way of localizing the potential creasing of carton **200**, as is illustrated in FIGS. **7** and **9**, the first and second side panels **204**, **208** do not exhibit creasing or alternative damage, particularly around the center or middle of the carton **200**. As a result, the carton **200** has an improved esthetic appearance after shipment. Additionally, by localizing any potential creasing or carton **200** to an area adjacent a corner post, the present invention greatly reduces the risk of abrading, scratching and chipping the finish of the appliance or denting the appliance body.

III. Embodiment Three

Turning now to FIGS. **10** and **11** and initially FIG. **10**, there is shown a shipping carton cap **300** according to another embodiment of the present invention. The shipping carton cap **300** generally is made of a sheet or blank **302** of packaging material. The packaging material may consist of corrugated board or any similar material suitable for use in shipping container construction. In a manner as is known, the corrugated board consists of a fluted corrugated core located between two sheets of kraft paper or linerboard, in a manner as is known. In one embodiment the flutes of the inner core have a longitudinal axis that is parallel to the longitudinal axis of the folded and erected carton cap **300**. The blank **302** may be stamped or cut from a sheet of the packaging material while in a substantially flat orientation, and subsequently folded to form the carton cap **300**. The outer surface of the carton cap **300** may be printed to display information such as contents details, shipping information, removal instructions, orientation indicia and the like. The outer surface of the carton cap **300** may also contain advertising information or ornamental elements.

FIG. **10** illustrates the blank **302**, formed of a single piece of packaging material, in a flat orientation. The blank **302** includes primarily a center panel **304**, and four edge panels extending therefrom; namely, a front panel **306**, a first side panel **308**, a rear panel **310** and a second side panel **312**. Each of these four edge panels **306**, **308**, **310** and **312** is hingedly attached to the sides of the center panel **304** about a crease line **314**, which also defines the edge of the center panel **304**.

Still referring to FIG. **10**, the front panel **306** is formed in part from a double layer of packaging material, and is formed from a first front panel section **316** and a second front panel section **318**. The first front panel section **316** is located between the center panel **304** and the second front panel section **318**. On one side, the first front panel section **316** is hingedly attached to the side of the center panel **304** about a crease line **314** while on the opposing side the first front panel section **316** is hingedly attached to the second front panel section **318** about a crease line **320**. In one embodiment of the present invention, as shown in FIG. **10**, the crease line **320**, which divides the first and second front panel sections **316**, **318**, includes a first crease line **322** and a second crease line **324** wherein the first and second crease lines **322**, **324** are slightly offset such that when the first and second front panel sections **316**, **318** are rotated approximately 180 degrees about the crease line **320** a void or space is left between the two panel sections **316**, **318**. As will be described in further detail below, the void or space left between the two panel sections **316**, **318** as a result of the two crease lines **322**, **324** will accommodate portions of the first and second side panels **308**, **312** therein when the blank **302** is in the folded configuration. Additionally, the second front panel section **318** includes a outwardly protruding tab **326**, which is configured to be received within a slot **328** that intersects the crease line **314** when the first and second front panel sections **316**, **318** are rotated approximately 180 degrees about the crease line **320**, as to lock the front panel **306** in its folded configuration. While the crease lines **314**, **320**, **322**, **324** have been described as "crease lines", it is well within the scope of the invention that these lines **314**, **320**, **322**, **324** may be formed of other methods, including but not limited to scoring or perforating.

Still referring to FIG. **10**, the first side panel **308** is formed from a single layer of packaging material hingedly attached to the center panel **304** about a crease line **330**, and includes a first locking tab **332** and second locking tab **334** extending from the first side panel **308** in opposing directions. Specifically, the first locking tab **332** is located adjacent the front panel **306**, and is hingedly attached to the first side panel **308** about a crease line **336**, which is a continuation of the crease line **314** that divides the center panel **304** from the front panel **306**. In this arrangement, rotation of the first side panel **308** about the crease line **330** combined with rotation of the first locking tab **332** about the crease line **336** will allow the first locking tab **332** to be positioned within the void or space left between the two panel sections **316**, **318** of the front panel **306**. That is to say that the front panel **306** and first side panel **308** will form an approximately 90 degree angle by way of retaining the first locking tab **332** between the two panel sections **316**, **318**.

On the opposing end of the first side panel **308**, the second locking tab **334** is similarly located adjacent the rear panel **310**, and is hingedly attached to the first side panel **308** about a crease line **338**, which is a continuation of the crease line that divides the center panel **304** from the rear panel **310**. As will be described in further detail below, rotation of the first side panel **308** about the crease line **330** combined with rotation of the second locking tab **334** about the crease line **338** will allow the second locking tab **334** to be positioned between the two sections of the rear panel **310**, thereby forming an approximately 90 degree angle by way of retaining the second locking tab **334** within the rear panel **310**.

Additionally, the first side panel **308** includes a crumple zone crease line **340** which extends from two voids **342**, located at opposing ends of the crease line **330**, and which are configured to facilitate folding blank **302** into carton cap **300** and maintaining localized crumpling of the crumple zone crease line **340**. In the illustrated embodiment, crumple zone crease line **340** may be located in the center panel **304** approximately between 0.5 and 4.0 inches from the crease line **330** of the first side panel **308**, and approximately 1.5 inches from the first side panel **330**.

Still referring to FIG. **10**, the rear panel **310** is formed in part from a double layer of packaging material, and is formed from a first rear panel section **344** and a second rear panel section **346**. The first rear panel section **344** is located between the center panel **304** and the second rear panel section **346**. On one side, the first rear panel section **344** is hingedly attached to the side of the center panel **304** about

a crease line **348** while on the opposing side the first rear panel section **344** is hingedly attached to the second rear panel section **346** about a crease line **350**. In one embodiment of the present invention, as shown in FIG. **10**, the crease line **350**, which divides the first and second rear panel sections **344**, **346**, includes a first crease line **352** and a second crease line **354** wherein the first and second crease lines **352**, **354** are slightly offset such that when the first and second rear panel sections **344**, **346** are rotated approximately 180 degrees about the crease line **350** a void or space is left between the two panel sections **344**, **346**. As was previously described, the void or space left between the two panel sections **344**, **346** as a result of the two crease lines **352**, **254** will accommodate the second locking tab **334** of the first side panel **308** therein along with a portion of the second side panel **312** when the blank **302** is in the folded configuration. Additionally, the second rear panel section **346** includes two outwardly protruding tabs **356**, which are configured to be received within slots **358** that intersect the crease line **348** when the first and second rear panel sections **344**, **346** are rotated approximately 180 degrees about the crease line **350**, so as to lock the rear panel **106** in its folded configuration. While the crease lines **348**, **350**, **352**, **354** have been described as "crease lines", it is well within the scope of the invention that these lines **348**, **350**, **352**, **354** may be formed of other methods, including but not limited to scoring or perforating.

Lastly, the second side panel **312** is formed from a single layer of packaging material hingedly attached to the center panel **304** about a crease line **360**, and includes a first locking tab **362** and second locking tab **364** extending from the second side panel **312** in opposing directions. Specifically, the first locking tab **362** is located adjacent the front panel **306**, and is hingedly attached to the second side panel **312** about a crease line **366**, which is a continuation of the crease line **314** that divides the center panel **304** from the front panel **306**. In this arrangement, rotation of the second side panel **312** about the crease line **360** combined with rotation of the first locking tab **362** about the crease line **364** will allow the first locking tab **362**, and particularly the end extension **368** to be positioned within the void or space left between the two panel sections **316**, **318** of the front panel **306**. That is to say that the front panel **306** and second side panel **312** will form an approximately 90 degree angle by way of retaining the end extension **368** of the first locking tab **362** between the two panel sections **316**, **318**.

The first locking tab **362** of the second side panel **312** differs from its counterpart on the first side panel **308** in part due to its shape. As shown in FIG. **10**, the front panel **306** does not extend across the full length of the lower edge of the center panel **304**, resulting in a void **370** located adjacent the center panel **304** and front panel **306**. The void **370** is configured to allow a single thickness portion of the packaging material, from the first locking tab **362** of the second side panel **312** to extend across the void **370**, when the blank **302** is in a folded configuration. The single thickness packaging material located at the first locking tab **362**, and extending past the crease line **366** and into the lower portion of the second side panel **312** provides an area **372** for the application of a name plate, product identification information, advertising or other indicia to be applied to the carton cap **300**, while allowing the name plate or other indicia to remain flush relative to the dual thickness packaging material of the front panel **306**.

Continuing onto the opposing end of the second side panel **312**, the second locking tab **364** is similarly located adjacent the rear panel **310**, and is hingedly attached to the second side panel **312** about a crease line **374**, which is a continuation of the crease line **348** that divides the center panel **304** from the rear panel **310**. As was previously described, rotation of the second side panel **312** about the crease line **360** combined with rotation of the second locking tab **364** about the crease line **374** will allow the second locking tab **364** to be positioned between the two sections **344**, **346** of the rear panel **310**, thereby forming an approximately 90 degree angle by way of retaining the second locking tab **364** within the rear panel **310**.

Additionally, the first side panel includes a crumple zone crease line **376** which extends from two voids **378**, located at opposing ends of the crease line **360**, and which is configured to facilitate folding blank **302** into carton cap **300** and maintaining localized crumpling of the crumple zone crease line **376**. In the illustrated embodiment, crumple zone crease line **376** may be located in the center panel **304** approximately between 0.5 and 4.0 inches from the crease line **360** of the second side panel **312**, and approximately 1.5 inches from the second side panel **312**.

Turning now to FIG. **11**, the blank **302** will be described in a folded and erected configuration to form carton cap **300**. The blank **302** is folded approximately 90 degrees around the crease lines **314**, **330**, **348**, **360**. The locking tabs **332**, **334**, **362**, **364** of the first and second side panels **308**, **312** are then folded approximately 90 degrees until they engage the first sections **316**, **344** of the front and rear panels **306**, **310** respectively. The second sections **318**, **346** of the front and rear panels **306**, **310** are then folded approximately 180 degrees about their crease lines **320**, **350**, respectively. When fully folded the tabs **326**, **356** of the front and rear panels **306**, **310** are received within the corresponding slots **328**, **358**, with the locking tabs **332**, **334**, **362**, **264** held securely between the two sections of the front and rear panels **306**, **310**, respectively. In this configuration the carton cap **300** is held in a folded configuration without the need for adhesive or any other fixation means.

As shown in FIG. **11**, the bottom and top caps of the appliance packaging are formed from two identical carton caps **300**. After the bottom carton cap **300** has been formed, an appliance **380** or other object may be inserted into the interior cavity formed within the bottom carton cap **300**. Corner posts **382** and or other packaging materials may also be inserted into the bottom carton cap **300**, surrounding the appliance **380**. Once all of the contents have been placed into the bottom carton cap **300**, the top carton cap **302** is placed on top of the appliance **380** and corner posts **382**. The top and bottom carton caps **302**, appliance **380**, corner posts **382** and any additional packaging material are then stretch or shrink wrapped or alternatively fixed together.

Once the carton cap **300** has been retained in its folded configuration described above, it may be subjected to opposing lateral forces such as those exerted by a clamp lift and previously discussed in the preceeding embodiments. When subjected to such forces, the first and second side panels **308**, **312** may be forced inwards. In response to such inward movement of the first and second side panels **308**, **312**, the forces applied to first and second side panels **308**, **312** are transferred to the weakened crumple zone crease lines **340**, **376** rather than to the upper and lower corners between front and rear panels **306**, **310** at the top and bottom carton caps **300**. This avoids buckling at the top and bottom corners of front and rear panels **306**, **310** and instead results in upward and downward flexing, bending, and movement at the crumple zone crease lines **308**, **312** at the top and bottom of the carton cap **300**, namely the center panel **302**, respectively.

Although specific embodiments are illustrated and discussed above, it is understood that the size and shape of the carton **100**, **200**, **300** may vary greatly to accommodate the size and shape of the appliance or other device contained within the carton **100**, **200**, **300**. While the figures have illustrated carton **100**, **200**, **300** approximately configured to receive a conventional consumer appliance, larger or smaller cartons **100**, **200**, **300** are considered well within the scope of the present invention. In this regard, carton **100**, **200**, **300** for other home appliances, furniture, or electronics are within the scope of this invention. Similarly, any number, location, variation or combination in the multiple styles of panels and crumple zone crease lines described herein is considered within the scope of the present invention.

It should be understood that the invention is not limited in its application to the details of construction and arrangements of the components set forth herein. The invention is capable of other embodiments and of being practiced or carried out in various ways. Variations and modifications of the foregoing are within the scope of the present invention. It also being understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text and/or drawings. All of these different combinations constitute various alternative aspects of the present invention. The embodiments described herein explain the best modes known for practicing the invention and will enable others skilled in the art to utilize the invention.

I claim:

1. A packaging arrangement for an article such as an appliance having a pair of ends and a series of sides extending therebetween, wherein the packaging arrangement includes at least a pair of end packaging structures for enclosing the ends of the article, wherein each end packaging structure comprises:

a series of side walls and at least one end panel, wherein a series of end edges are defined between each side wall and the at least one end panel, and wherein a series of side edges are defined between the series of side walls, wherein a corner is defined at a location where a pair of end edges and one of the side edges come together;

a first crumple zone at each corner, wherein the first crumple zone comprises a transversely extending linear weakened buckle-inducing structure in the end panel spaced inwardly from and extending generally parallel to a first one of the end edges defining the corner, wherein the weakened buckle-inducing structure deforms outwardly upon application of a compressive force to the side wall defining the first end edge; and

a second crumple zone at each corner, wherein the second crumple zone comprises a plurality of spaced apart weakened collapse-inducing structures in the second one of the end edges defining the corner and spaced inwardly from the corner, wherein the collapse-inducing structures collapse the second end edge and accommodate inward movement of the side wall defining the first end edge upon application of the compressive force to the side wall defining the first end edge.

2. The packaging arrangement of claim **1**, wherein the external force is applied at an angle approximately parallel to a plane defined by each end panel.

3. The packaging arrangement of claim **1**, wherein the article defines a series of corners, and wherein the packaging arrangement further includes a corner support member located outwardly of each corner of the article.

4. A packaging arrangement comprising first and second end caps, wherein each end cap is constructed as set forth in claim **1**.

5. The packaging arrangement of claim **4**, wherein the first and second end caps are configured to receive the article and a plurality of support members therein, wherein the support members are located about the article and extend between the end caps.

6. The packaging arrangement of claim **1**, wherein the weakened buckle-inducing structure comprises a crease line formed in the end panel and extending generally parallel to the first end edge defining the corner.

7. The packaging arrangement of claim **1**, wherein the end panel comprises a series of end flaps, wherein the weakened buckle-inducing structure is formed in the end flap.

8. The packaging arrangement of claim **1**, wherein the plurality of spaced apart weakened collapse-inducing structures in the second one of the end edges comprises a plurality of spaced-apart perforations formed in the top panel and in the side wall defining the second end edge.

9. The packaging arrangement of claim **1**, wherein the series of side walls extend between and interconnect the pair of end packaging structures, and wherein each end panel is defined by a series of overlapping end flaps that are foldably connected to and extend from the series of side walls.

10. A packaging arrangement for an article such as an appliance having a pair of ends and a series of sides extending therebetween, wherein the packaging arrangement includes at least a pair of end packaging structures for enclosing the ends of the article, wherein each end packaging structure comprises:

a series of side walls and at least one end panel, wherein a series of end edges are defined between each side wall and the at least one end panel, and wherein a series of side edges are defined between the series of side walls, wherein a corner is defined at a location where a pair of end edges and one of the side edges come together;

a first crumple zone at each corner, wherein the first crumple zone comprises a transversely extending linear weakened buckle-inducing structure in the end panel spaced inwardly from and extending generally parallel to a first one of the end edges defining the corner, wherein the weakened buckle-inducing structure deforms outwardly upon application of a compressive force to the side wall defining the first end edge; and

a second crumple zone at each corner, wherein the second crumple zone comprises a void area in the second one of the end edges defining the corner and extending inwardly from the corner, wherein the void area collapses the second end edge and accommodates inward movement of the side wall defining the first end edge upon application of the compressive force to the side wall defining the first end edge.

11. The packaging arrangement of claim **10**, wherein the weakened buckle-inducing structure comprises a crease line formed in the end panel and extending generally parallel to the first end edge defining the corner.

12. The packaging arrangement of claim **10**, wherein the end panel comprises a series of end flaps, wherein the weakened buckle-inducing structure is formed in the end flap.

13. The packaging arrangement of claim **10**, wherein the end panel comprises a series of end flaps, and wherein the void area is defined between each end flap and the side wall defining the first end edge.

14. A packaging arrangement comprising first and second end caps, wherein each end cap is constructed as set forth in claim **10**.

15. The packaging arrangement of claim **14**, wherein the first and second end caps are configured to receive the article and a plurality of support members therein, wherein the support members are located about the article and extend between the end caps.

16. The packaging arrangement of claim **10**, wherein the series of side walls extend between and interconnect the pair of end packaging structures.

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