

FIGURE 1

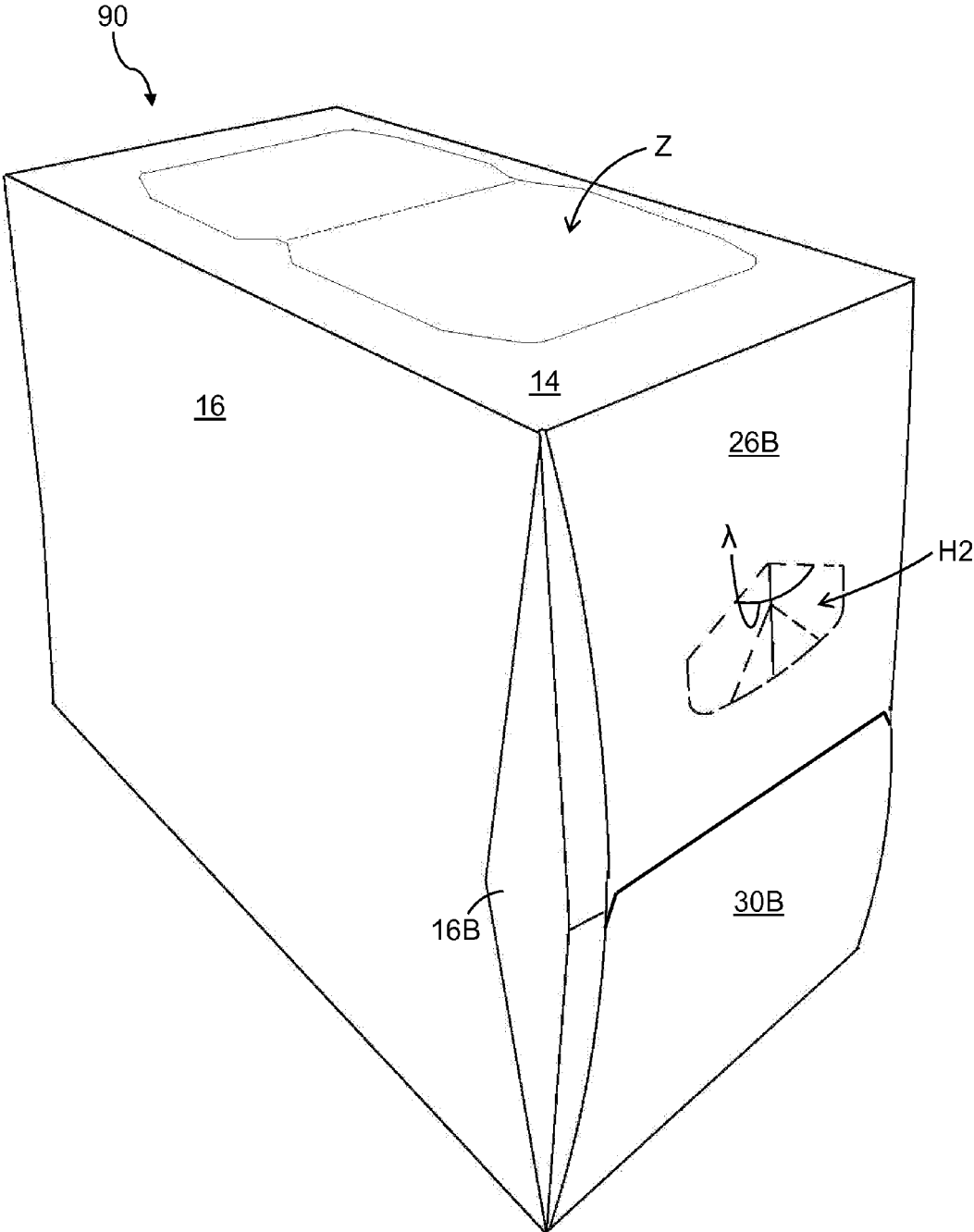


FIGURE 2



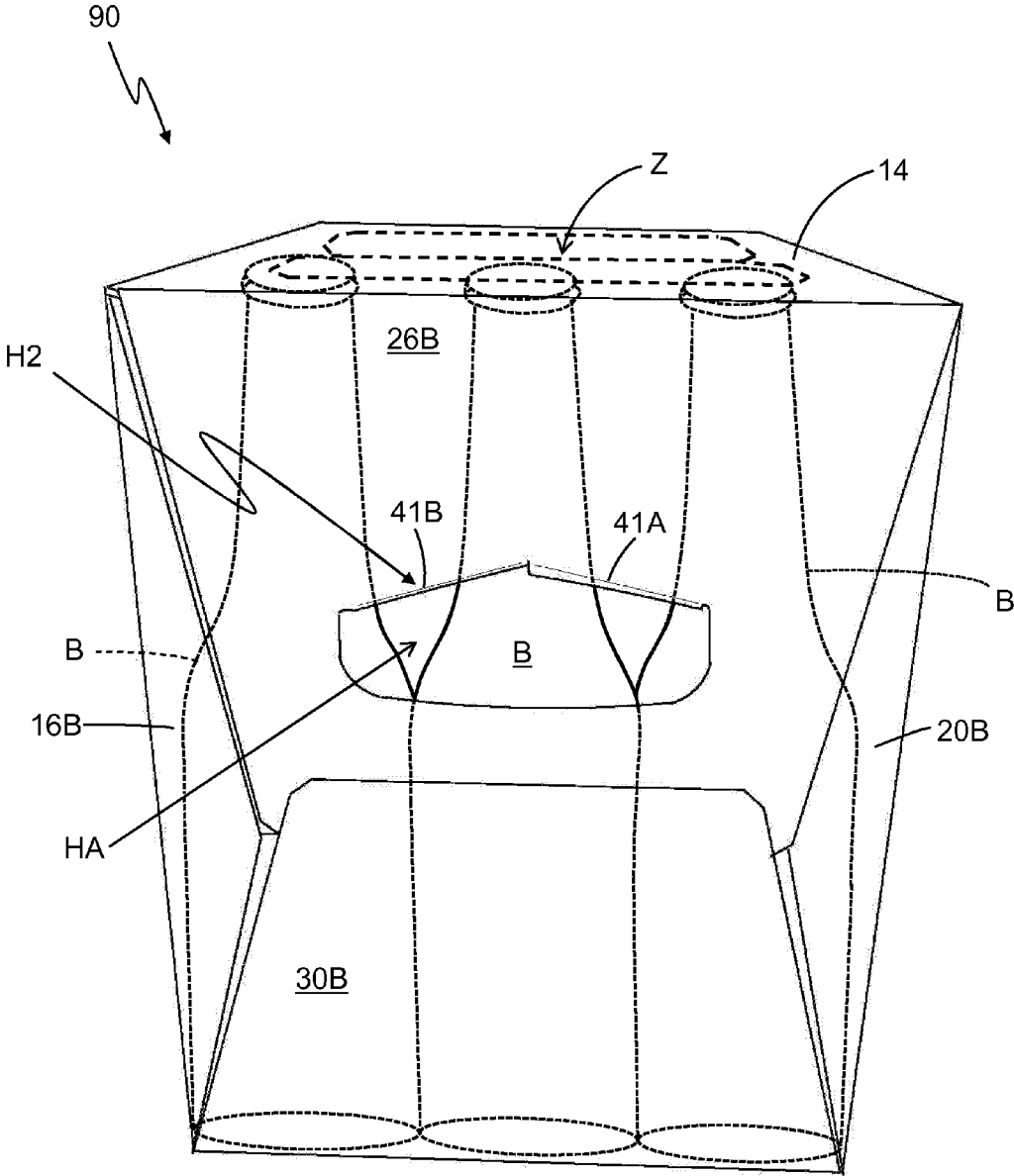


FIGURE 4

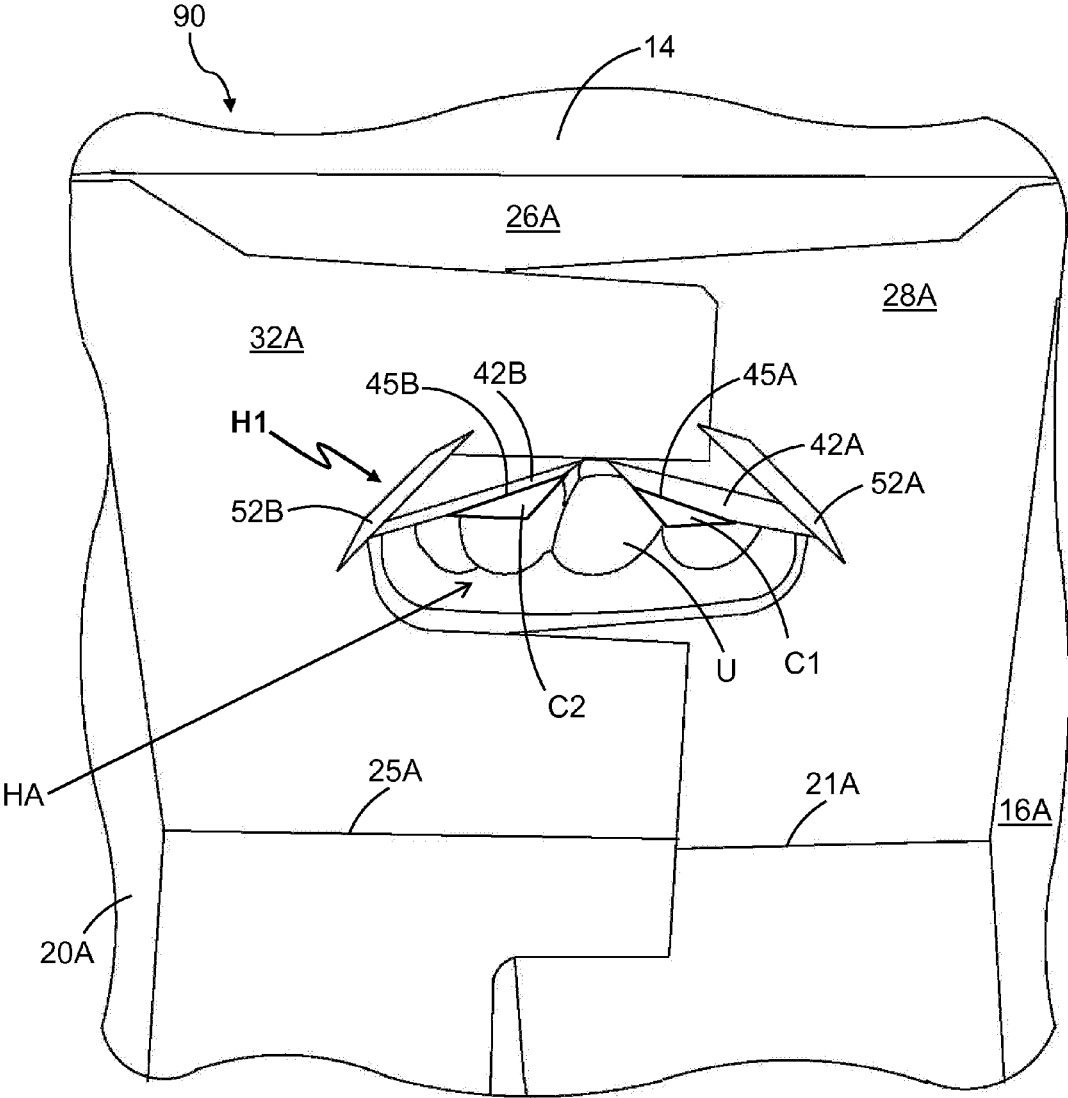


FIGURE 5





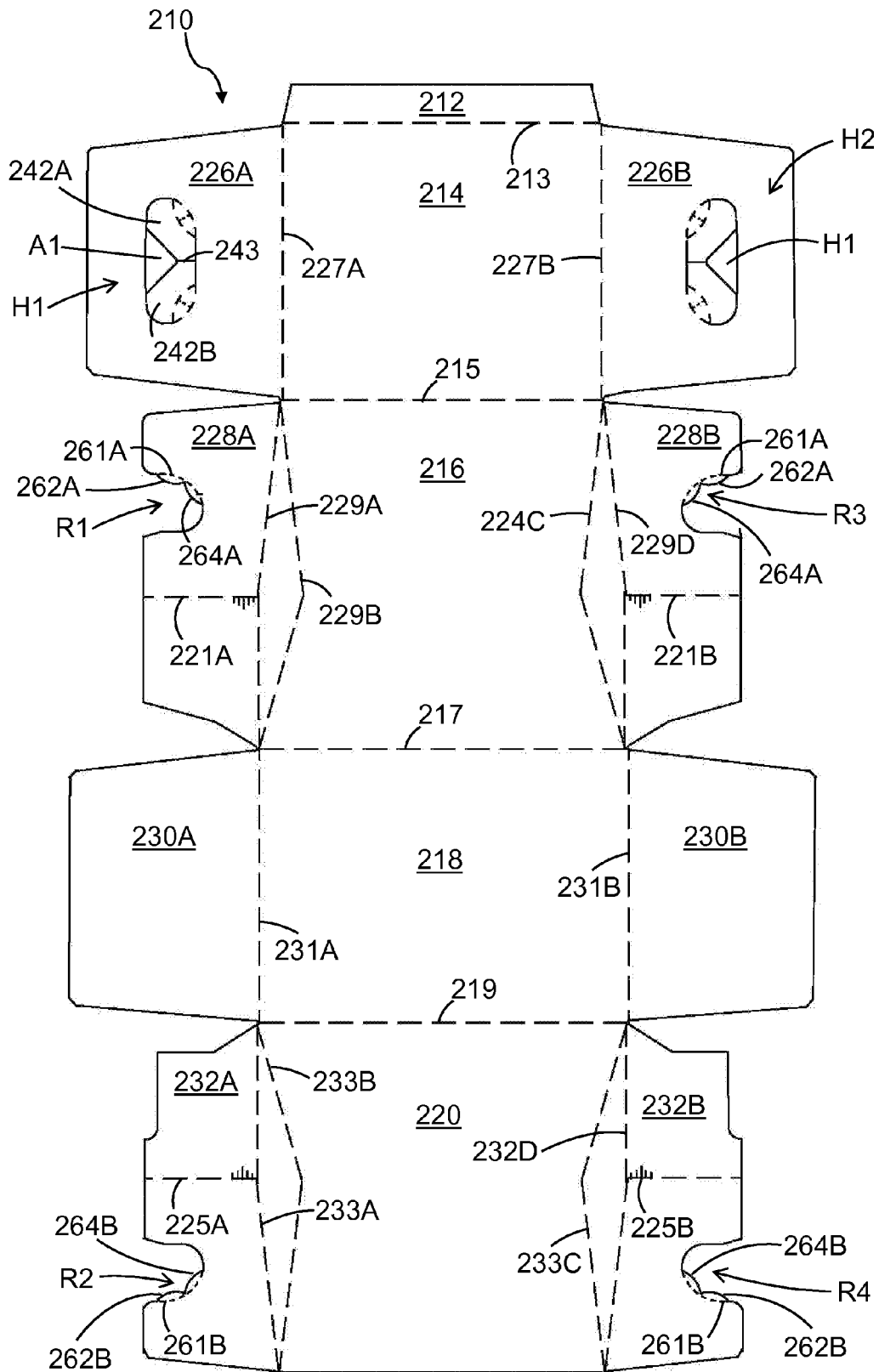


FIGURE 8



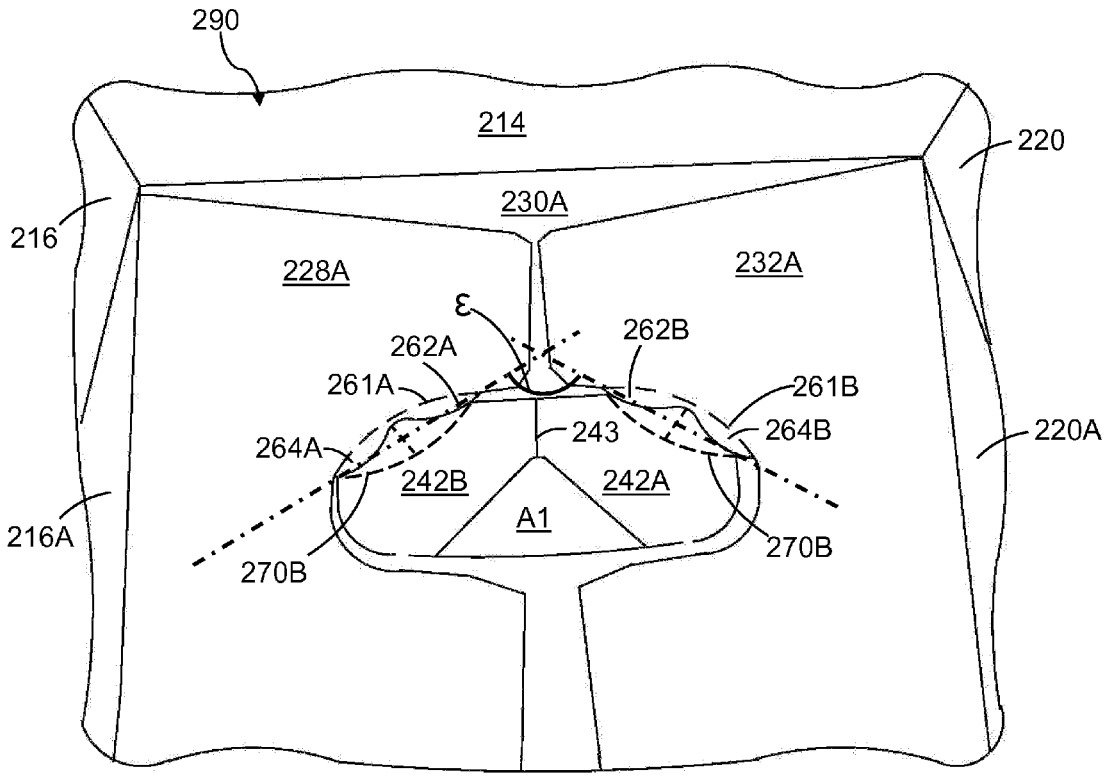


FIGURE 10

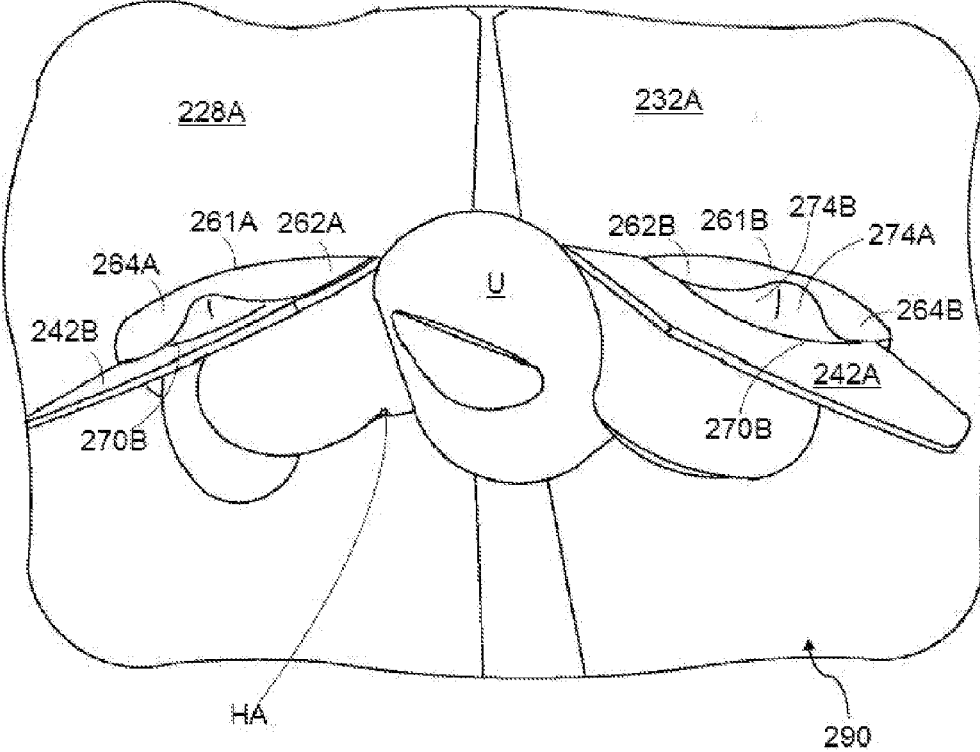


FIGURE 11

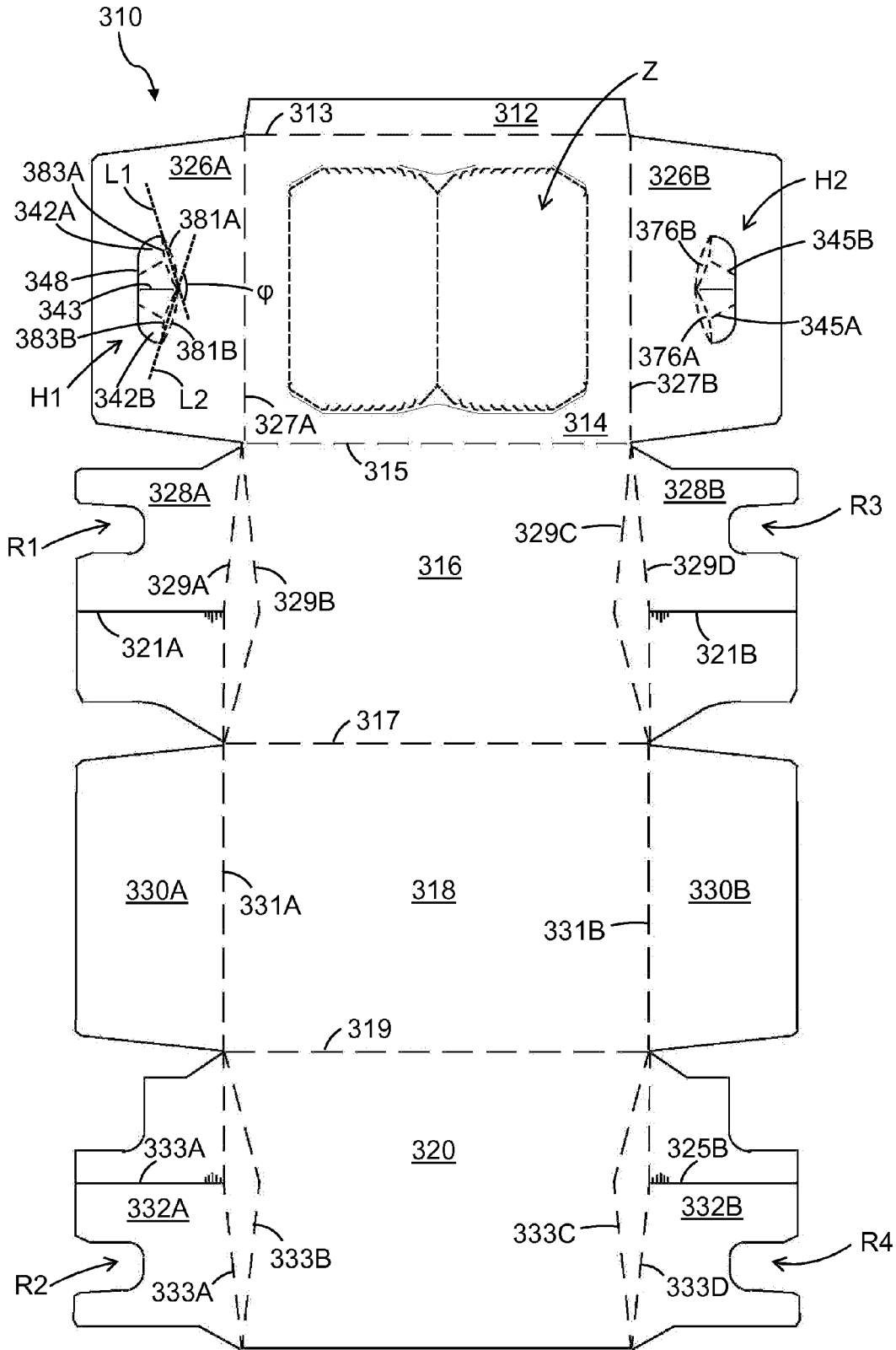


FIGURE 12

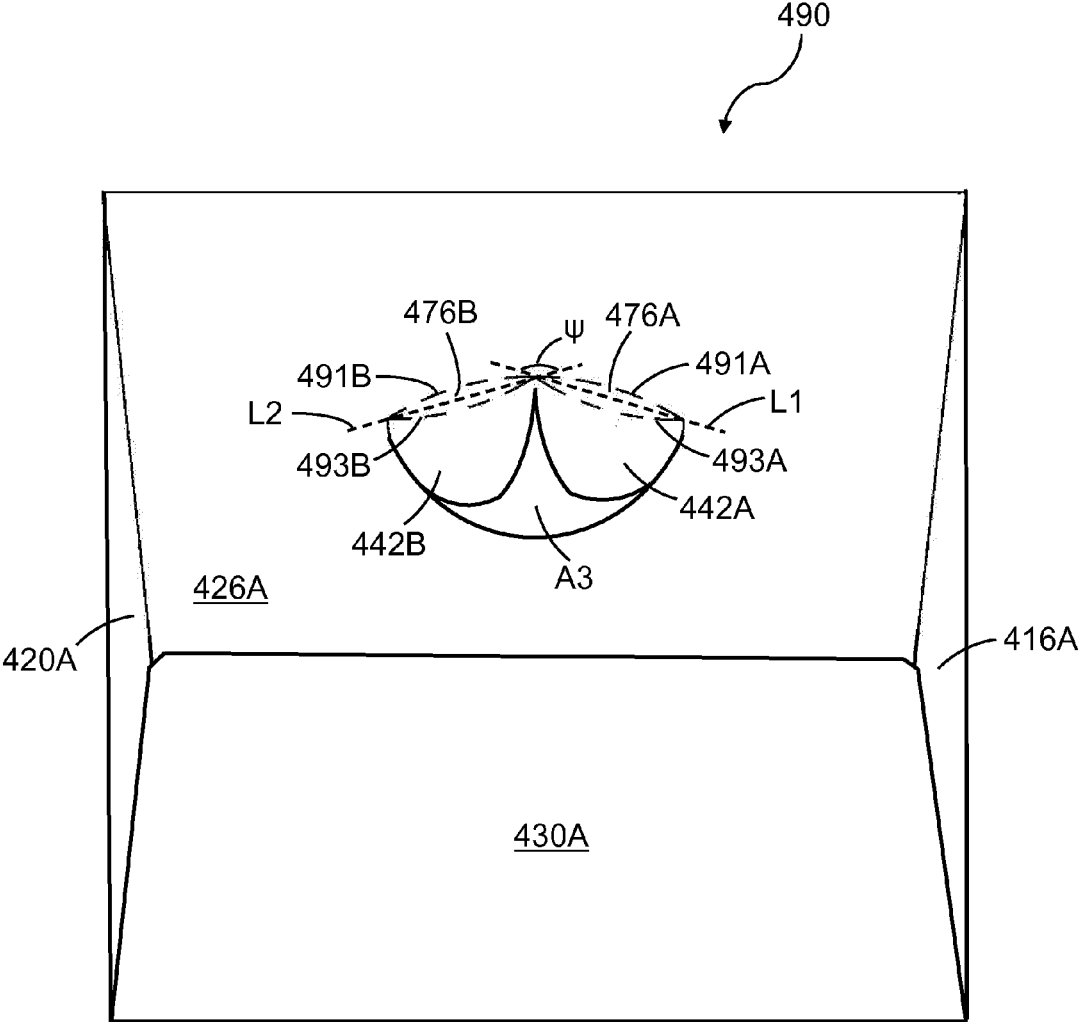
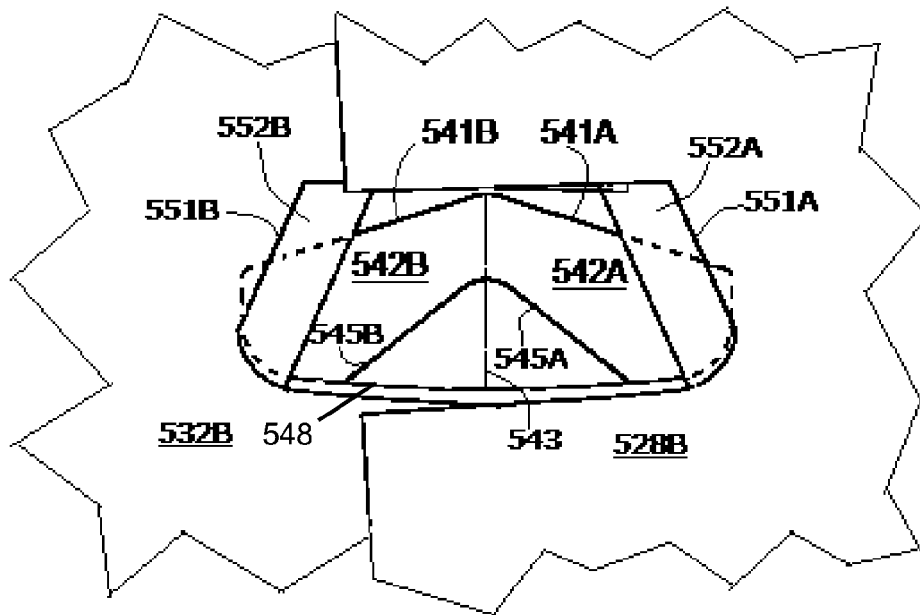
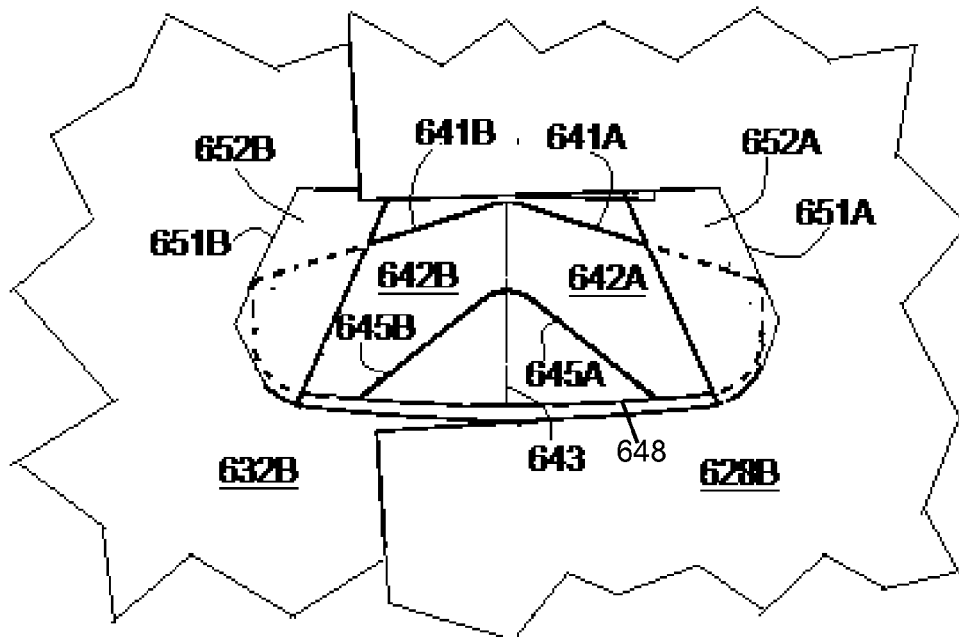


FIGURE 13

**FIGURE 14**



**FIGURE 15**



## CARTON AND CARTON BLANK

### TECHNICAL FIELD

**[0001]** The present invention relates to a carton and to a blank for forming the carton more specifically, but not exclusively, to a carton having a carrying handle for carrying the carton.

### BACKGROUND

**[0002]** In the field of packaging it is often required to provide consumers with a package comprising multiple primary product containers. Such multi-packs are desirable for shipping and distribution and for display of promotional information. For cost and environmental considerations, such cartons or carriers need to be formed from as little material as possible and cause as little wastage in the materials from which they are formed as possible. Another consideration is the strength of the packaging and its suitability for holding and transporting large weights of articles.

**[0003]** It is desirable to provide a carton with a carrying handle for carrying the carton and its contents; it is an object of the present invention to provide a carrying handle which is robust and strong and is comfortable for a user. A further object of the invention is to provide a carrying handle which is readily deployed by the user.

**[0004]** The present invention seeks to overcome or at least mitigate the problems of the prior art.

### SUMMARY

**[0005]** According to a first aspect of the present invention there is provided a handle structure for a carton, the handle structure comprising a pair of adjoining hand flaps hingedly connected to a handle panel by a pair of hinged connections, each hinged connection having a longitudinal axis disposed at an acute angle with respect to the vertical, the longitudinal axes of the hinged connections defining an obtuse angle therebetween and extending divergently downwards.

**[0006]** Optionally, a first one of the pair of adjoining hand flaps is separated from a second one of the pair of adjoining hand flaps by a severance line.

**[0007]** Optionally, the handle panel is a unitary, substantially upright handle panel.

**[0008]** Optionally, each hinged connection comprises at least one linear fold line.

**[0009]** Optionally, each longitudinal axis extends coincidentally with one of the at least one linear fold lines.

**[0010]** Optionally, each hinged connection comprises a pair of opposed arcuate fold lines intersecting at two points such that they define an elliptical panel therebetween.

**[0011]** Optionally, each longitudinal axis extends through each of two intersecting points of a respective one of the elliptical panels.

**[0012]** Optionally, each longitudinal axis extends through each of two pointed ends of a respective one of the elliptical panels.

**[0013]** Optionally, each hand flap comprises a flap fold line therein for facilitating folding of a first portion of the hand flap with respect to a second portion of the handle flap.

**[0014]** Optionally, the flap fold lines in the hand flaps together define an inverted V shape.

**[0015]** Optionally, a first hand flap comprises a first fold line therein for facilitating folding of a first portion of the first hand flap with respect to a second portion of the first

handle flap and a second hand flap comprises a second fold line therein for facilitating folding of a first portion of the second hand flap with respect to a second portion of the second handle flap.

**[0016]** Optionally, the first portion of the first hand flap is disposed adjacent to the first portion of the second hand flap.

**[0017]** Optionally, the handle structure comprises an aperture defining in part at least a portion of each of the pair of adjoining hand flaps.

**[0018]** Optionally, the handle structure comprises at least one inner panel, the at least one inner panel comprising a cutaway or recess configured and arranged to be in registry with at least a portion of a hand opening defined at least in part by the pair of adjoining hand flaps.

**[0019]** Optionally, the at least one inner panel comprises at least one inner flap hinged thereto by an inner hinged connection and the at least one inner flap defining at least a portion of the cutaway.

**[0020]** Optionally, the handle structure comprises a pair of inner flaps each having an inner hinged connection.

**[0021]** Optionally, each of the pair of inner flaps partially overlaps with a respective one of the pair of adjoining hand flaps.

**[0022]** Optionally, the inner hinged connection of each of the pair of inner flaps is disposed above the hinged connection of the respective one of the pair of adjoining hand flaps with which it is in partially overlapping relationship.

**[0023]** Optionally, the inner hinged connection of each of the pair of inner flaps is spaced apart from the hinged connection of the respective one of the pair of adjoining hand flaps with which it is in partially overlapping relationship.

**[0024]** Optionally, the inner hinged connection of each of the pair of inner flaps is convergently arranged with respect to the hinged connection of the respective one of the pair of adjoining hand flaps with which it is in partially overlapping relationship, so as to define an acute angle therebetween.

**[0025]** Optionally, the handle structure comprises a pair of inner flaps provided by at least one inner panel.

**[0026]** Optionally, the handle structure comprises a pair of inner flaps each having pair of lobes configured and arranged for facilitating folding of the elliptical panel substantially transversely with respect to the longitudinal axis.

**[0027]** Optionally, each elliptical panel comprises a fold line for facilitating folding of the elliptical panel substantially transversely with respect to the longitudinal axis.

**[0028]** According to a second aspect of the present invention there is provided a carton for packaging one or more articles, the carton comprising a plurality of panels including a top panel, a bottom panel, a first side panel and a second side panel forming a tubular structure, a first end panel for at least partially closing a first end of the tubular structure, a second end panel for at least partially closing a second end of the tubular structure, wherein the carton comprises a handle structure comprising a handle panel formed by one of said plurality of panels, the handle structure comprising a pair of adjoining hand flaps hingedly connected to the handle panel by a pair of hinged connections, each hinged connection having a longitudinal axis disposed at an acute angle with respect to the vertical, the longitudinal axes of the hinged connections defining an obtuse angle therebetween and extending divergently downwards.

**[0029]** Optionally, the handle panel is a unitary, substantially upright handle panel.

[0030] Optionally, each hinged connection comprises at least one linear fold line.

[0031] Optionally, each longitudinal axis extends coincidentally with one of the at least one linear fold lines.

[0032] Optionally, each hinged connection comprises a pair of opposed arcuate fold lines intersecting at two points such that they define an elliptical panel therebetween.

[0033] Optionally, each longitudinal axis extends through each of two intersecting points of a respective one of the elliptical panels.

[0034] Optionally, each longitudinal axis extends through each of two pointed ends of a respective one of the elliptical panels.

[0035] According to a third aspect of the present invention there is provided a blank for forming a carton, the blank comprising a plurality of panels including a top panel, a bottom panel, a first side panel and a second side panel for forming a tubular structure, a first end panel for at least partially closing a first end of the tubular structure, a second end panel for at least partially closing a second end of the tubular structure, wherein the blank comprises a handle structure comprising a handle panel formed by one of said plurality of panels, the handle structure comprising a pair of adjoining hand flaps hingedly connected to the handle panel by a pair of hinged connections, each hinged connection having a longitudinal axis disposed at an acute angle with respect to the vertical, the longitudinal axes of the hinged connections defining an obtuse angle therebetween and extending divergently downwards in a set-up carton.

[0036] Within the scope of this application it is intended that the various aspects, embodiments, examples, features and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings may be taken independently or in any combination thereof. For example, features described in connection with one embodiment are applicable to all embodiments unless there is incompatibility of features.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0037] Exemplary embodiments of the invention will now be described with reference to the accompanying drawings, in which:

[0038] FIG. 1 is a plan view of a blank for forming a carton according to a first embodiment;

[0039] FIG. 2 is a perspective view from above of a carton formed from the blank of FIG. 1;

[0040] FIG. 3 is an internal elevation, partially cut away, of an end portion of the carton of FIG. 2;

[0041] FIG. 4 is a perspective view, from above, of an end of the carton of FIG. 3 showing the carrying handle in a deployed condition;

[0042] FIG. 5 is an internal elevation, partially cut away, of an end portion of the carton of FIG. 2 showing the carrying handle in a deployed condition;

[0043] FIG. 6 is a plan view of a blank for forming a carton according to a second embodiment;

[0044] FIG. 7A is a fragmentary external elevation of a carrying handle of a carton formed from the blank of FIG. 6 showing the carrying handle in a first stowed position;

[0045] FIG. 7B is a fragmentary external elevation of a carrying handle of a carton formed from the blank of FIG. 6 showing the outer cushioning tabs of the carrying handle folded outwardly of the carton so as to illustrate the position of the inner tabs with respect thereto;

[0046] FIG. 8 is a plan view of a blank for forming a carton according to a third embodiment;

[0047] FIG. 9 is a perspective view, from above, of a carton formed from the blank of FIG. 8;

[0048] FIG. 9A is a fragmentary enlarged perspective view of a carrying handle of the carton of FIG. 9;

[0049] FIG. 10 is a fragmentary internal elevation of an end portion of the carton of FIG. 9, showing the carrying handle in a stowed or undeployed condition;

[0050] FIG. 11 is a fragmentary internal elevation of the carrying handle of the carton of FIG. 9, showing the carrying handle in a deployed condition;

[0051] FIG. 12 is a plan view of a blank for forming a carton according to a fourth embodiment;

[0052] FIG. 13 is an end elevation of a carton showing a carrying handle according to a fifth embodiment;

[0053] FIG. 14 is a fragmentary internal elevation of a carrying handle of a carton according to a sixth embodiment; and

[0054] FIG. 15 is a fragmentary internal elevation of a carrying handle of a carton according to a seventh embodiment.

#### DETAILED DESCRIPTION OF EMBODIMENTS

[0055] Detailed descriptions of specific embodiments of the package, blanks and cartons are disclosed herein. It will be understood that the disclosed embodiments are merely examples of the way in which certain aspects of the invention can be implemented and do not represent an exhaustive list of all of the ways the invention may be embodied. As used herein, the word “exemplary” is used expansively to refer to embodiments that serve as illustrations, specimens, models, or patterns. Indeed, it will be understood that the packages, blanks and cartons described herein may be embodied in various and alternative forms. The Figures are not necessarily to scale and some features may be exaggerated or minimized to show details of particular components. Well-known components, materials or methods are not necessarily described in great detail in order to avoid obscuring the present disclosure. Any specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the invention.

[0056] FIG. 1 shows a plan view of a blank 10 capable of forming a carton 90, as shown in FIG. 2, for primary products such as, but not limited to, bottles, hereinafter referred to as articles B.

[0057] In the embodiments detailed herein, the terms “carton” and “carrier” refer, for the non-limiting purpose of illustrating the various features of the invention, to a container for engaging, carrying, and/or dispensing articles, such as product containers. It is contemplated that the teachings of the invention can be applied to various product containers, which may or may not be tapered and/or cylindrical. Exemplary containers include bottles (for example metallic, glass or plastics bottles), cans (for example aluminum cans), tins, pouches, packets and the like.

[0058] The blanks are formed from a sheet of suitable substrate. It is to be understood that, as used herein, the term “suitable substrate” includes all manner of foldable sheet material such as paperboard, corrugated board, cardboard, plastic, combinations thereof, and the like. It should be recognized that one or other numbers of blanks may be

employed, where suitable, for example, to provide the carrier structure described in more detail below.

**[0059]** In the exemplary embodiment, the blanks are configured to form a carton or carrier for packaging an exemplary arrangement of exemplary articles. In a first illustrated exemplary embodiment, the arrangement is a 3×4 matrix or array and the articles are bottles. The blank can be alternatively configured to form a carrier for packaging other types, number and size of article and/or for packaging articles in a different arrangement or configuration.

**[0060]** The blank **10** comprises a plurality of main panels **12**, **14**, **16**, **18**, **20** hinged one to the next in a linear series. The blank **10** comprises a glue panel **12** hinged to a top panel **14** by a fold line **13**. The top panel **14** is hinged to a first side panel **16** by a fold line **15**. The first side panel **16** is hinged to a bottom panel **18** by a fold line **17**. The bottom panel **18** is hinged to a second side panel **20** by a fold line **19**.

**[0061]** The plurality of main panels **12**, **14**, **16**, **18**, **20** of the blank **10** form an open-ended tubular structure when in a set-up condition.

**[0062]** Each of the ends of the tubular structure is at least partially closed by end closure panels. In the illustrated embodiment the ends of the tubular structure are fully closed by end closure panels **26A**, **28A**, **30A**, **32A**, **26b**, **28B**, **30B**, **32B**.

**[0063]** End closure panels **26A**, **28A**, **30A**, **32A** are configured to close a first end of the tubular structure and end panels **26b**, **28B**, **30B**, **32B** are configured to close a second end of the tubular structure.

**[0064]** A first top end closure panel **26A** is hinged to a first end of top panel **14** by a fold line **27a**. A first side end closure panel **28A** is hinged to a first end of first side panel **16** by a pair of fold lines **29a**, **29B**. A first bottom end closure panel **30A** is hinged to a first end of bottom panel **18** by a fold line **31A**. A second side end closure panel **32A** is hinged to a first end of the second side panel **20** by a pair of fold lines **33A**, **33B**. The pair of fold lines **29a**, **29B** define a first corner panel **16A** disposed between the first side panel **16** and the first side end closure panel **28A**. The pair of fold lines **33A**, **33B** define a second corner panel **20A** disposed between the second side panel **20** and the second side end closure panel **32A**.

**[0065]** A second top end closure panel **26b** is hinged to a second end of top panel **14** by a fold line **27B**. A third side end closure panel **28B** is hinged to a second end of the first side panel **16** by a pair of fold lines **29c**, **29d**. A second bottom end closure panel **30B** is hinged to a second end of bottom panel **18** by a fold line **31B**. A fourth side end closure panel **32B** is hinged to a second end of second side panel **20** by a pair of fold lines **33c**, **33d**.

**[0066]** The pair of fold lines **29c**, **29d** define a third corner panel **16B** disposed between the first side panel **16** and the third side end closure panel **28B**. The pair of fold lines **33c**, **33d** define a fourth corner panel **20B** disposed between the second side panel **20** and the fourth side end closure panel **32B**.

**[0067]** The first side end closure panel **28A** and the second side end closure panel **32A** each form a minor side end closure panel. The third side end closure panel **28B** and the fourth side end closure panel **32B** form a minor side end closure panel.

**[0068]** The first top end closure panel **26A** and the second top end closure panel **26B** each form a major upper end

closure panel. The first bottom end closure panel **30A** and the second bottom end closure panel **30B** each form a major lower end closure panel.

**[0069]** The first side end closure panel **28A** comprises a fold line **21A** extending between fold line **29a** and a free end edge of the first side end closure panel **28A**. The first side end closure panel **28A** can be folded about fold line **21A** when closing the end of the carton **90**.

**[0070]** The second side end closure panel **32A** comprises a fold line **25A** extending between fold line **33A** and a free end edge of the second side end closure panel **32A**. The second side end closure panel **32A** can be folded about fold line **25A** when closing the end of the carton **90**.

**[0071]** The third side end closure panel **28B** comprises a fold line **21B** extending between fold line **29d** and a free end edge of the third side end closure panel **28B**. The third side end closure panel **28B** can be folded about fold line **21B** when closing the end of the carton **90**.

**[0072]** The fourth side end closure panel **32B** comprises a fold line **25B** extending between fold line **33d** and a free end edge of the fourth side end closure panel **32B**. The fourth side end closure panel **32B** can be folded about fold line **25B** when closing the end of the carton **90**.

**[0073]** The top panel **14** comprises an access device **Z**. The access device **Z** comprises a first gate panel **24A** and a second gate panel **24B**. The first gate panel **24A** is hinged to the top panel **14** by a fold line **23A**. The second gate panel **24B** is hinged to the top panel **14** by a fold line **23B**. The first and second gate panels **24A**, **24B** are arranged in opposition to one another. Optionally the first and second gate panels **24A**, **24B** are severably coupled to one another; the first and second gate panels **24A**, **24B** share a common inner edge defined by a severance line **23c**. The first gate panel **24A** and the second gate panel **24B** are further defined by a first severance line **23d** and a second severance line **23e**. The first severance line **23d** extends between a first end of the fold line **23A** and a first end of the fold line **23B**. The second severance line **23e** extends between a second end of the fold line **23A** and a second end of the fold line **23B**. The common severance line **23c** extends between the first severance line **23d** and the second severance line **23e**.

**[0074]** The blank **10** comprises a first handle structure **H1** in the first top end closure panel **26A**, and a second handle structure **H2** in the second top end closure panel **26B**. Each of the handle structures **H1**, **H2** is substantially the same in construction, and comprises a pair of adjoining hand flaps or tabs; a first hand tab **42A** and a second hand tab **42B** are struck from the respective one of the first top end closure panel **26A** or second top end closure panel **26B**. The first top end closure panel **26A** and/or second top end closure panel **26B** each form a substantially upright handle panel.

**[0075]** The first hand tab **42A** is hinged along an upper edge to the respective one of the first top end closure panel **26A** or second top end closure panel **26B** by a hinged connection in the form of a first fold line **41A**. The second hand tab **42B** is hinged along an upper edge to the respective one of the first top end closure panel **26A** or second top end closure panel **26B** by a hinged connection in the form of a second fold line **41B**. The first and second fold lines **41A**, **41B** are arranged to form an inverted V shape. The first and second fold lines **41A**, **41B** are convergently arranged with respect to one another and define an obtuse angle therebetween. Each of the first and second hand tabs **42A**, **42B** is defined in part by a portion of a U-shaped cutline or

severance line 48. The first hand tab 42A is disposed adjacent to the second hand tab 42B. The first hand tab 42A and the second hand tab 42B share a common edge defined by a severance line or cut line 43.

[0076] Each of the hinged connections, first and second fold lines 41A, 41B, have a longitudinal axis which, in the illustrated embodiment of FIGS. 1-5, is coincidental with that fold line. The longitudinal axis of each hinged connection 41A, 41B is disposed at an acute angle ( $\alpha+\beta$ ), less than 90°, with respect to a notional vertical axis N2 (FIG. 3). The longitudinal axes of the hinged connections define an obtuse angle  $\lambda$  therebetween and extend divergently downwards from the converging point of the hinged connections 41A, 41B (FIG. 2).

[0077] The first hand tab 42A comprises a first flap fold line 45A and the second hand tab 42B comprises a second flap fold line 45B. The first and second flap fold lines 45A, 45B facilitate folding of a first portion of the respective first or second hand tab 42A, 42B with respect to a second portion of the first or second hand tabs 42A, 42B. The first and second flap fold lines 45A, 45B are arranged to form an inverted V shape. The first and second flap fold lines 45A, 45B are convergently arranged with respect to one another and define an acute or obtuse angle therebetween. The first and second flap fold lines 45A, 45B provide that adjacent lower corners of the first and second hand tabs 42A, 42B can be folded with respect to the rest of the respective one of the first or second hand tabs 42A, 42B.

[0078] In the illustrated embodiment the first hand tab 42A and the second hand tab 42B together define a single hand opening HA (FIGS. 4 and 5) when the first and second hand tabs 42A, 42B are folded inward of the carton, out of the plane of the first top end closure panel 26A or the second top end closure panel 26B.

[0079] The hand opening HA provides a carrying handle for a user to insert their hand into the carton 90. The first and second hand tabs 42A, 42B provide cushioning flaps when folded internally of the carton 90 so as to provide a comfortable handle.

[0080] The first side end closure panel 28A comprises a first inner opening such as a cutaway or recess R1 struck from an end edge thereof. The first recess R1 is configured such that it is in alignment or registry with the second hand tab 42B of the first handle structure H1 or the hand opening HA of the first handle structure H1. The first recess R1 is defined in part by a first inner tab 52A hinged to the first side end closure panel 28A by a fold line 51A.

[0081] The second side end closure panel 32A comprises a second inner opening such as a cutaway or recess R2 struck from an end edge thereof. The second recess R2 is configured such that it is in alignment or registry with the first hand tab 42A of the first handle structure H1, or the hand opening HA of the first handle structure H1. The second recess R2 is defined in part by a second inner tab 52B hinged to the second side end closure panel 32A by a fold line 51B.

[0082] The third side end closure panel 28B comprises a third inner opening such as a cutaway or recess R3 struck from an end edge thereof. The third recess R3 is configured such that it is in alignment or registry with the second hand tab 42B of the second handle structure H2, or the hand opening HA of the second handle structure H2. The third recess R3 is defined in part by a first inner tab 52A hinged to the third side end closure panel 28B by a fold line 51A.

[0083] The fourth side end closure panel 32B comprises a fourth inner opening such as a cutaway or recess R4 struck from an end edge thereof. The fourth recess R4 is configured such that it is in alignment or registry with the first hand tab 42A of the second handle structure H2, or the hand opening HA of the second handle structure H2. The fourth recess R4 is defined in part by a second inner tab 52B hinged to the fourth side end closure panel 32B by a fold line 51B.

[0084] Turning to the construction of the carton 90 as illustrated in FIG. 2, the carton 90 may be formed by a series of sequential folding operations in a straight line machine such that the carton 90 is not required to be rotated or inverted to complete its construction. The folding process is not limited to that described below and may be altered according to particular manufacturing requirements.

[0085] The blank 10 is folded about fold line 15, such that the glue panel 12 and top panel 14 are folded thereabouts. The top panel 14 is brought into face contacting relationship with the first side panel 16; the glue panel 12 is brought into face contacting relationship with the first side panel 16 and/or bottom panel 18.

[0086] Glue or other adhesive treatment is applied to the glue panel 12 or, in alternative embodiments, to a corresponding portion of the second side panel 20.

[0087] The second side panel 20 is folded about the fold line 19 such that the second side panel 20 overlies the glue panel 12.

[0088] The second side panel 20 is secured to the glue panel 12 to form a flat collapsed carton. The carton may be shipped or distributed in this flat collapsed form.

[0089] In alternative embodiments the second side panel 20 may be secured to the glue panel 12 by alternative securing means for example, but not limited to, staples or other mechanical fixing means.

[0090] The flat collapsed carton may be erected into a tubular structure by separating the top panel 14 from the bottom panel 18.

[0091] The carton 90, in its open-ended tubular form, may be loaded with articles B through one or both open ends. It will be appreciated that in other embodiments one of the open ends of the carton 90 may be closed before loading the carton 90 with articles B through the remaining open end.

[0092] In some embodiments, one or more of the end closure panels 26A, 28A, 30A, 32A, 26B, 28B, 30B, 32B are folded outwardly so as to create a funnel at one or both of the open ends of the tubular structure for facilitating loading of the carton with articles B.

[0093] Once the carton 90 is loaded with articles B the ends of the tubular structure are closed.

[0094] A first end of the tubular structure is closed by folding the second and second side end closure panels 28A, 32A about fold lines 29A, 33A respectively.

[0095] Glue or other adhesive treatment may be applied to the first side end closure panel 28A, or in alternative embodiments, to a corresponding portion of the first top end closure panel 26A.

[0096] Glue or other adhesive treatment may be applied to the second side end closure panel 32A, or in alternative embodiments, to a corresponding portion of the first top end closure panel 26A.

[0097] The first top end closure panel 26A is then folded about the fold line 27A to be brought into contact with the second and second side end closure panels 28A, 32A and optionally secured thereto.

[0098] Glue or other adhesive treatment may be applied to the first side end closure panel 28A, or in alternative embodiments, to a corresponding portion of the first bottom end closure panel 30A.

[0099] Glue or other adhesive treatment may be applied to the second side end closure panel 32A, or in alternative embodiments, to a corresponding portion of the first bottom end closure panel 30A.

[0100] Glue or other adhesive treatment is applied to an inner surface of the first bottom end closure panel 30A, or in alternative embodiments, to an outer surface of the first top end closure panel 26A.

[0101] The first bottom end closure panel 30A is then folded about the fold line 31A to be brought into contact with the second and second side end closure panels 28A, 32A and the first top end closure panel 26A.

[0102] The first bottom end closure panel 30A is secured to the first top end closure panel 26A. Optionally, the first bottom end closure panel 30A is secured to the second and second side end closure panels 28A, 32A.

[0103] In alternative embodiments the first bottom end closure panel 30A may be folded about fold line 31A prior to folding the first top end closure panel 26A about fold line 27A. It will be appreciated that in such embodiments the first top end closure panel 26A is disposed outermost.

[0104] A second end of the tubular structure is closed by folding the sixth and fourth side end closure panels 28B, 32B about fold lines 29d, 33d respectively.

[0105] Glue or other adhesive treatment may be applied to the third side end closure panel 28B, or in alternative embodiments, to a corresponding portion of the second top end closure panel 26B.

[0106] Glue or other adhesive treatment may be applied to the fourth side end closure panel 32B, or in alternative embodiments, to a corresponding portion of the second top end closure panel 26B.

[0107] The second top end closure panel 26B is then folded about the fold line 27B to be brought into contact with the sixth and fourth side end closure panels 28B, 32B and optionally secured thereto.

[0108] Glue or other adhesive treatment may be applied to the third side end closure panel 28B, or in alternative embodiments, to a corresponding portion of the second bottom end closure panel 30B.

[0109] Glue or other adhesive treatment may be applied to the fourth side end closure panel 32B, or in alternative embodiments to a corresponding portion of the second bottom end closure panel 30B.

[0110] Glue or other adhesive treatment is applied to an inner surface of the second bottom end closure panel 30B, or in alternative embodiments, to an outer surface of the second top end closure panel 26B.

[0111] The second bottom end closure panel 30B is then folded about the fold line 31B to be brought into contact with the sixth and fourth side end closure panels 28B, 32B and the second top end closure panel 26B.

[0112] The second bottom end closure panel 30B is secured to the second top end closure panel 26B. Optionally, the second bottom end closure panel 30B is secured to the sixth and fourth side end closure panels 28B, 32B.

[0113] In alternative embodiments the second bottom end closure panel 30B may be folded about fold line 31B prior to folding the second top end closure panel 26B about fold

line 27B. It will be appreciated that in such embodiments the second top end closure panel 26B is disposed outermost.

[0114] In order to deploy the carrying handle, a user inserts at least a portion of their hand into a hand opening HA created by folding the first and second hand tabs 42A, 42B of the first handle structure H1 and/or second handle structure H2 internally of the carton 90 as shown in FIGS. 4 and 5. As a consequence of folding the first and second hand tabs 42A, 42B, the first and second inner tabs 52A, 52B of the respective one of the first and second handle structures H1, H2 are folded internally of the carton about fold lines 51A, 51B.

[0115] Referring to FIG. 3, the fold line 51A and the fold line 41A are arranged divergently with respect to each other. The fold line 51A is arranged such that it does not overlie, or intersect with, the fold line 41A. The fold line 51A is disposed above the fold line 41A with their respective lower ends positioned on a notional horizontal line N1 and spaced from each other. The fold lines 51A, 41A extend upwardly divergently from their respective lower ends toward the top panel 14. The fold line 51A and the fold line 41A are arranged to define an acute angle  $\beta$  with respect to each other. The fold line 51A is arranged to define an acute angle  $\gamma$  with respect to the notional horizontal line N1. The acute angle  $\gamma$  is substantially greater than the acute angle  $\beta$ . The fold line 51A is arranged to define an acute angle  $\alpha$  with respect to a notional vertical line N2 perpendicular to the notional horizontal line N1.

[0116] The fold line 41A is arranged to define an acute angle  $\theta$  with respect to the notional horizontal line N1. The angle  $\theta$  is less than the angle  $\gamma$  and may optionally be less than angle  $\beta$ .

[0117] The angle  $\beta$  may be between approximately 25° to 30°; for example, in one embodiment the angle  $\beta$  is approximately 28.5°. The angle  $\gamma$  may be between approximately 40° to 60°; for example, in one embodiment the angle  $\gamma$  is approximately 50°. The angle  $\theta$  may be between approximately 10° to 35°; for example, in one embodiment the angle  $\theta$  is approximately 21.5°.

[0118] As best shown in FIG. 3, the first hand tab 42A is arranged in a partially overlapping or overlying relationship with the first inner tab 52A. The second hand tab 42B is arranged in a partially overlapping or overlying relationship with the second inner tab 52B. The fold line 51A is disposed above the fold line 41A. The fold line 51B is disposed above the fold line 41B.

[0119] The arrangement of the second hand tab 42B with respect to the second inner tab 52B is substantially the same as the arrangement of the first hand tab 42A with respect to the first inner tab 52A described above, albeit a mirror image of the arrangement of the first hand tab 42A and the first inner tab 52A.

[0120] The fold line 51B and the fold line 41B are arranged divergently with respect to each other. The fold line 51B is arranged such that it does not overlie, or intersect with, the fold line 41B. The fold line 51B is disposed above the fold line 41B with their respective lower ends positioned on a notional horizontal line and spaced from each other. The fold lines 51B, 41B extend upwardly divergently from their respective lower ends toward the top panel 14. The fold line 51B and the fold line 41B are arranged to define an acute angle with respect to each other, as shown in FIG. 3. The fold line 51B is arranged to define an acute angle with respect to a notional horizontal line. The fold line 51B is

arranged to define an acute angle with respect to a notional horizontal line. The fold line 41B is arranged to define an acute angle with respect to a notional horizontal line.

[0121] As shown in FIG. 4 the carton 90 comprises rows of articles B, optionally three articles B. A central article B is disposed substantially in the middle of the carton 90, and the handle structures H1, H2 are also disposed centrally between the side walls 16, 20. In this way an article B is disposed centrally with respect to the hand opening HA created by folding the first and second hand tabs 42A, 42B. The arrangement of the handle structures H1, H2 allows the first and second hand tabs 42A, 42B to be folded on opposing sides of the centrally located article B. FIG. 5 shows an internal view of the carton 90; a user U has partially inserted a hand through the hand opening HA created by folding the first and second hand tabs 42A, 42B of the first handle structure H1. The fold lines 45A, 45B facilitate folding of the first and second hand tabs 42A, 42B respectively about the central article B. The corner portions C1, C2 of the first and second hand tabs 42A, 42B fold about fold lines 45A, 45B when the corner portions C1, C2 come into contact with the central article B, best shown in the internal view of FIG. 5, in which the articles B have been omitted for clarity.

[0122] Referring now to FIGS. 6 to 15, there is shown alternative embodiments of the present invention. In the further illustrated embodiments like numerals have, where possible, been used to denote like parts, albeit with the addition of the prefix "100", "200", "300", "400", "500" or "600" to indicate that these features belong to the second, third, fourth, fifth, sixth or seventh embodiments, respectively. The alternative embodiments share many common features with the first embodiment and therefore only the differences from the embodiment illustrated in FIGS. 1 to 5 will be described in any greater detail.

[0123] FIG. 6 shows a plan view of a blank 110 according to a second embodiment. The blank 110 comprises a plurality of main panels 112, 114, 116, 118, 120 hinged one to the next in a linear series. The blank 110 comprises a glue panel 112 hinged to a top panel 114 by a fold line 113. The top panel 114 is hinged to a first side panel 116 by a fold line 115. The first side panel 116 is hinged to a bottom panel 118 by a fold line 117. The bottom panel 118 is hinged to a second side panel 120 by a fold line 119.

[0124] The plurality of main panels 112, 114, 116, 118, 120 of the blank 110 form an open-ended tubular structure when in a set-up condition.

[0125] Each of the ends of the tubular structure is at least partially closed by end closure panels. In the illustrated embodiment the ends of the tubular structure are fully closed by end closure panels 126A, 128A, 130A, 132A, 126B, 128B, 130B, 132B.

[0126] End closure panels 126A, 128A, 130A, 132A are configured to close a first end of the tubular structure and end panels 126B, 128B, 130B, 132B are configured to close a second end of the tubular structure.

[0127] The blank 110 comprises a first handle structure H1 in a first top end closure panel 126A, and a second handle structure H2 in a second top end closure panel 126B. Each of the handle structures H1, H2 is substantially the same in construction, and comprises a first hand tab 142A and a second hand tab 142B struck from the respective one of the first top end closure panel 126A or second top end closure panel 126B.

[0128] The first hand tab 142A is hinged along an upper edge to the respective one of the first top end closure panel 126A or second top end closure panel 126B by a first fold line 141A. The second hand tab 142B is hinged along an upper edge to the respective one of the first top end closure panel 126A or second top end closure panel 126B by a second fold line 141B. The first and second fold lines 141A, 141B are arranged to form an inverted V-shape. The first and second fold lines 141A, 141B are convergently arranged with respect to one another and define an obtuse angle therebetween. Each of the first and second hand tabs 142A, 142B is defined in part by cut lines or severance lines 148A, 148B and in part by an aperture A1. The aperture A1 is substantially triangular in shape, although other shapes may be employed in alternative embodiments. The first hand tab 142A is disposed adjacent to the second hand tab 142B. The first hand tab 142A and the second hand tab 142B share a common edge defined by a severance line or cut line 143. The common severance line or cut line 143 extends from the aperture A1 to a vertex at which first and second fold lines 141A, 141B meet.

[0129] In the illustrated embodiment the first hand tab 142A, second hand tab 142B and aperture A1 define a hand opening HA when the first and second hand tabs 142A, 142B are folded out of the plane of the first top end closure panel 126A or the second top end closure panel 126B.

[0130] The hand opening HA provides a carrying handle for a user to insert their hand into a carton 190, see FIG. 7A. The first and second hand tabs 142A, 142B provide cushioning flaps when folded internally of the carton 190 so as to provide a comfortable handle.

[0131] The first side end closure panel 128A comprises a first inner opening such as a cutaway or recess R1 struck from an end edge thereof. The first recess R1 is configured such that it is in alignment or registry with the second hand tab 142B of the first handle structure H1 or the hand opening defined by the tabs 142A, 142B of the first handle structure H1. The first recess R1 is defined in part by a first inner tab 152A hinged to the first side end closure panel 128A by a fold line 151A.

[0132] The second side end closure panel 132A comprises a second inner opening such as a cutaway or recess R2 struck from an end edge thereof. The second recess R2 is configured such that it is in alignment or registry with the first hand tab 142A of the first handle structure H1, or the hand opening HA (FIG. 7B) defined by the tabs 142A, 142B of the first handle structure H1. The second recess R2 is defined in part by a second inner tab 152B hinged to the second side end closure panel 132A by a fold line 151B.

[0133] The third side end closure panel 128B comprises a third inner opening such as a cutaway or recess R3 struck from an end edge thereof. The third recess R3 is configured such that it is in alignment or registry with the second hand tab 142B of the second handle structure H2, or the hand opening HA defined by the tabs 142A, 142B of the second handle structure H2. The third recess R3 is defined in part by a first inner tab 152A hinged to the third side end closure panel 128B by a fold line 151A.

[0134] The fourth side end closure panel 132B comprises a fourth inner opening such as a cutaway or recess R4 struck from an end edge thereof. The fourth recess R4 is configured such that it is in alignment or registry with the first hand tab 142A of the second handle structure H2 or the hand opening HA defined by the tabs 142A, 142B of the second handle

structure H2. The fourth recess R4 is defined in part by a second inner tab 152B hinged to the fourth side end closure panel 132B by a fold line 151B.

[0135] FIG. 7A shows a partial view of an end of a carton 190 in which the carrying handle is in a stowed or undeployed condition.

[0136] FIG. 7B shows a partial view of an end of the carton 190 in which the first and second hand tabs 142A, 142B of the carrying handle have been folded outwardly of the carton 190 as indicated by direction arrows D1, D2 respectively. The first and second hand tabs 142A, 142B have been folded outwardly for illustrative purposes only; in use the first and second hand tabs 142A, 142B of the carrying handle will be folded internally or inwardly of the carton 190. FIG. 7B illustrates the position and orientation of the first and second inner tabs 152A, 152B. The first and second inner tabs 152A, 152B are located internally with respect to first and second inner tabs 152A, 152B. It will be appreciated from FIG. 7B that the first hand tab 142A partially overlaps or overlays the first inner tab 152A, and that the second hand tab 142B partially overlaps or overlays the second inner tab 152B.

[0137] FIG. 8 shows a plan view of a blank 210 according to a third embodiment. The blank 210 comprises a plurality of main panels 212, 214, 216, 218, 220 hinged one to the next in a linear series. The blank 210 comprises a glue panel 212 hinged to a top panel 214 by a fold line 213. The top panel 214 is hinged to a first side panel 216 by a fold line 215. The first side panel 216 is hinged to a bottom panel 218 by a fold line 217. The bottom panel 218 is hinged to a second side panel 220 by a fold line 219.

[0138] The plurality of main panels 212, 214, 216, 218, 220 of the blank 210 form an open-ended tubular structure when in a set-up condition.

[0139] Each of the ends of the tubular structure is at least partially closed by end closure panels. In the illustrated embodiment the ends of the tubular structure are fully closed by end closure panels 226A, 228A, 230A, 232A, 226B, 228B, 230B, 232B.

[0140] End closure panels 226A, 228A, 230A, 232A are configured to close a first end of the tubular structure and end panels 226B, 228B, 230B, 232B are configured to close a second end of the tubular structure.

[0141] The blank 210 comprises a first handle structure H1 in a first top end closure panel 226A and a second handle structure H2 in a second top end closure panel 226B. Each of the handle structures H1, H2 is substantially the same in construction, and comprises a first hand tab 242A and a second hand tab 242B struck from the respective one of the first top end closure panel 226A or second top end closure panel 226B.

[0142] The first hand tab 242A is hinged to the respective one of the first top end closure panel 226A or second top end closure panel 226B by a pair of fold lines 270A, 270B. The second hand tab 242B is hinged the respective one of the first top end closure panel 226A or second top end closure panel 226B by a pair of fold lines 270A, 270B. The pairs of fold lines 270A, 270B are non-linear in shape; in the illustrated embodiment the fold lines 270A, 270B are arcuate in shape. The fold lines 270A, 270B converge towards each other at both ends thereof to form a vertex or point of intersection at each end. The fold lines 270A, 270B together define web panel 276 which in the illustrated embodiment has a pointed oval or pointed elliptical shape. Optionally, the

web panel 276 comprises a fold line 272 which bisects the web panel 276 into a first part 274A and a second part 274B. The web panel 276 comprises a first vertex defined by first ends of the fold lines 270A, 270B. The web panel 276 comprises a second vertex defined by second ends of the fold lines 270A, 270B. The first and second vertices of the web panel 276 hinged to the first hand tab 242A define a first notional linear line L1 as shown in FIG. 9. The first and second vertices of the web panel 276 hinged to the second hand tab 242B define a second notional linear line L2.

[0143] The first and second notional linear lines L1, L2 are arranged to form an inverted V-shape. The first and second notional linear lines L1, L2 define an obtuse angle  $\epsilon$  therebetween.

[0144] The first hand tab 242A is defined in part by cut lines or severance lines 248A, 248c, fold line 270B and in part by an aperture A1. The second hand tab 242B is defined in part by cut lines or severance lines 248B, 248d, fold line 270B and in part by an aperture A1. The aperture A1 is substantially triangular in shape, although other shapes may be employed in alternative embodiments. The first hand tab 242A is disposed adjacent to the second hand tab 242B. The first hand tab 242A and the second hand tab 242B share a common edge defined by a severance line or cut line 243. The common severance line or cut line 243 extends from the aperture A1 to a vertex at which first and second fold lines 241A, 241B meet.

[0145] The cut lines or severance lines 248A, 248B are interrupted by nick portions or connecting portions N1, N2 respectively. The connecting portions N1, N2 facilitate maintenance of the first and second hand tabs 242A, 242B in the plane of the first top end closure panel 226A or second top end closure panel 226B until the carrying handle is employed.

[0146] It will be appreciated that the web panel 276 and the fold lines 270A, 270B are substantially equivalent to the linear fold lines 41A, 41B; 141A, 141B used in the previously described embodiments, providing means for the first and second hand tabs 242A, 242B to fold when the carrying handle is employed. The first and second hand tabs 242A, 242B are foldable about the first and second notional linear lines L1, L2.

[0147] In the illustrated embodiment, the area occupied by the first hand tab 242A, second hand tab 242B and aperture A1 defines a hand opening HA when the first and second hand tabs 242A, 242B are folded out of the plane of the first top end closure panel 226A or the second top end closure panel 226B.

[0148] The hand opening HA provides a carrying handle for a user to insert their hand into a carton 290. The first and second hand tabs 242A, 242B provide cushioning flaps when folded internally of the carton 290 so as to provide a comfortable handle.

[0149] The first side end closure panel 228A comprises a first inner opening such as a cutaway or recess R1 struck from an end edge thereof. The first recess R1 is configured such that it is in alignment or registry with the second hand tab 242B of the first handle structure H1, or the hand opening HA the first handle structure H1. The first recess R1 is defined in part by a pair of conjoined first inner tabs 262A, 264A which are hinged to the first side end closure panel 228A by a common fold line 261A. Optionally, the fold line 261A is non-linear in shape, and may, for example as illustrated, be arcuate or curvilinear in shape. The two first

hand tabs **262A**, **264A**, as best shown in FIG. **11**, are joined together through a narrowed portion having a concaved outline which is spaced apart from the common fold line **261A**.

[0150] Optionally, however, the concaved outline of the narrowed portion may in contact or intersect with the fold line **261A** to divide the inner tabs **262A**, **264A** into two substantially separated tabs.

[0151] The second side end closure panel **232A** comprises a second inner opening such as a cutaway or recess **R2** struck from an end edge thereof. The second recess **R2** is configured such that it is in alignment or registry with the first hand tab **242A** of the first handle structure **H1**, or the hand opening **HA** of the first handle structure **H1**. The second recess **R2** is defined in part by a pair of second inner tabs **262B**, **264B** which are hinged to the first side end closure panel **232A** by a common fold line **261B**. Optionally, the fold lines **261B** is non-linear in shape, and may, for example as illustrated, be arcuate or curvilinear in shape. The two first hand tabs **262B**, **264B**, as best shown in FIG. **11**, are joined together through a narrowed portion having a concaved outline which is spaced apart from the common fold line **261B**. Optionally, however, the concaved outline of the narrowed portion may contact or intersect with the fold line **261B** to divide the inner tabs **262B**, **264B** into two substantially separated tabs.

[0152] The third side end closure panel **228B** comprises a third inner opening such as a cutaway or recess **R3** struck from an end edge thereof. The third recess **R3** is configured such that it is in alignment or registry with the second hand tab **242B** of the second handle structure **H2**, or the hand opening **HA** of the second handle structure **H2**. The third recess **R3** is defined in part by a pair of first inner tabs **262A**, **264A** which are hinged to the first side end closure panel **228B** by a common fold line **261A**. Optionally, the fold line **261A** is non-linear in shape, and may, for example as illustrated, be arcuate or curvilinear in shape. The two first hand tabs **262A**, **264A** of the second handle structure **H2** are joined together through a narrowed portion having a concaved outline which is spaced apart from the common fold line **261A**. Optionally, however, the concaved outline of the narrowed portion may contact or intersect with the fold line **261A** to divide the inner tabs **262A**, **264A** into two substantially separated tabs.

[0153] The fourth side end closure panel **232B** comprises a fourth inner opening such as a cutaway or recess **R4** struck from an end edge thereof. The fourth recess **R4** is configured such that it is in alignment or registry with the first hand tab **242A** of the second handle structure **H2**, or the hand opening **HA** of the second handle structure **H2**. The fourth recess **R4** is defined in part by a pair of second inner tabs **262B**, **264B** which is hinged to the first side end closure panel **232B** by a common fold line **261B**. Optionally, the fold line **261B** is non-linear in shape, and may, for example as illustrated, be arcuate or curvilinear in shape. The two first hand tabs **262B**, **264B** of the second handle structure **H2** are joined together through a narrowed portion having a concaved outline which is spaced apart from the common fold line **261B**. Optionally, however, the concaved outline of the narrowed portion may contact or intersect with the fold lines **261B** to divide the inner tabs **262B**, **264B** into two substantially separated tabs.

[0154] In the illustrated embodiment, each of the pair of first inner tabs **262A**, **264A** comprises a substantially oval shape having one pointed end as best shown in FIGS. **10** and

**11**, although in other embodiments other shapes may be employed. In some embodiments, each of the first inner tabs **262A**, **264A** may have a substantially oval shape having a pair of opposed pointed ends such that the first inner tabs **262A**, **264A** are not coupled together but in contact with each other at their adjacent pointed ends. In FIGS. **10** and **11**, the pair of the first inner tabs **262A**, **264A** together form a single tab having a pair of lobes **262A**, **264A**, each of the lobes having a substantially oval shape having one pointed end.

[0155] In the illustrated embodiment the each of the pair of second inner tabs **262B**, **264B** comprises a substantially oval shape having one pointed end as best shown in FIGS. **10** and **11**, although in other embodiments other shapes may be employed. In some embodiments, each of the first inner tabs **262B**, **264B** may have a substantially oval shape having a pair of opposed pointed ends such that the second inner tabs **262B**, **264B** are not coupled together but in contact with each other at their adjacent pointed ends. In FIGS. **10** and **11**, the pair of the second inner tabs **262B**, **264B** form a single tab having a pair of lobes **262B**, **264B**, each of the lobes having a substantially oval shape having one pointed end.

[0156] FIG. **10** shows an internal view of the carrying handle structure. The pair of second inner tabs **262B**, **264B** are in overlapping or overlaying relationship with the web panel **276** hinged to the first hand tab **242A**. The pair of first inner tabs **262A**, **264A** is in overlapping or overlaying relationship with the web panel **276** hinged to the first hand tab **242B**. The pair of first inner tabs **262A**, **264A** and the pair of second inner tabs **262B**, **264B** each provide a mandrel for guiding or facilitating folding of the respective web panel **276** when the carrying handle is deployed. The first inner tabs **262A**, **264A** and the second inner tabs **262B**, **264B** encourage the web panel **276** to bend about the fold line **272** such that it takes a convex shape when viewed from an internal vantage point above the carrying handle structure, as shown in FIG. **11**. In this way the web panel **276** adopts a non-planar form. When viewing the outer external surface of the sheet material from which the carton **290** is formed, the web panel **276** will have a concave shape; the web panel **276** may, in some embodiments, be valley shaped, that is to say forming a trough having a “V”-shaped cross section. This enhances the strength of the web panel **276** and prevents or mitigates against the web panel **276** folding about itself about a longitudinal axis of the web panel **276** defined by the first or second linear notional line **L1**, **L2**.

[0157] FIG. **12** shows a plan view of a blank **310** according to a third embodiment. The blank **310** comprises a plurality of main panels **312**, **314**, **316**, **318**, **320** hinged one to the next in a linear series. The blank **310** comprises a glue panel **312** hinged to a top panel **314** by a fold line **313**. The top panel **314** is hinged to a first side panel **316** by a fold line **315**. The first side panel **316** is hinged to a bottom panel **318** by a fold line **317**. The bottom panel **318** is hinged to a second side panel **320** by a fold line **319**.

[0158] The plurality of main panels **312**, **314**, **316**, **318**, **320** of the blank **310** form an open-ended tubular structure when in a set-up condition.

[0159] Each of the ends of the tubular structure is at least partially closed by end closure panels. In the illustrated embodiment the ends of the tubular structure are fully closed by end closure panels **326A**, **328A**, **330A**, **332A**, **326B**, **328B**, **330B**, **332B**.

[0160] End closure panels 326A, 328A, 330A, 332A are configured to close a first end of the tubular structure and end panels 326B, 328B, 330B, 332B are configured to close a second end of the tubular structure.

[0161] The blank 310 comprises a first handle structure H1 in a first top end closure panel 326A and a second handle structure H2 in a second top end closure panel 326B. Each of the handle structures H1, H2 is substantially the same in construction, and comprises a first hand tab 342A and a second hand tab 342B struck from the respective one of the first top end closure panel 326A or second top end closure panel 326B.

[0162] The first hand tab 342A is hinged to the respective one of the first top end closure panel 326A or second top end closure panel 326B by a first pair of fold lines 381A, 383A. The second hand tab 342B is hinged to the respective one of the first top end closure panel 326A or second top end closure panel 326B by a second pair of fold lines 381B, 383B.

[0163] Each of the first pair of fold lines 381A, 383A are non-linear in shape; in the illustrated embodiment the fold lines 381A, 383A are arcuate in shape. The fold lines 381A, 383A converge towards each other at both ends thereof to form a vertex or point of intersection at each end. The fold lines 381A, 383A together define first web panel 376A which in the illustrated embodiment has a pointed oval shape. The first web panel 376A comprises a first vertex defined by first ends of the fold lines 381A, 383A. The first web panel 376A comprises a second vertex defined by second ends of the fold lines 381A, 383A. The first and second vertices of the first web panel 376A hinged to the first hand tab 342A define a first notional linear line L1.

[0164] Each of the second pair of fold lines 381B, 383B are non-linear in shape; in the illustrated embodiment the fold lines 381B, 383B are arcuate in shape. The fold lines 381B, 383B converge towards each other at both ends thereof to form a vertex or point of intersection at each end. The fold lines 381B, 383B together define second web panel 376B which in the illustrated embodiment has a pointed oval shape. The second web panel 376B comprises a first vertex defined by first ends of the fold lines 381B, 383B. The second web panel 376B comprises a second vertex defined by second ends of the fold lines 381B, 383B. The first and second vertices of the second web panel 376B hinged to the second hand tab 342B define a second notional linear line L2.

[0165] The first and second notional linear lines L1, L2 are arranged to form an inverted V shape. The first and second notional linear lines L1, L2 define an obtuse angle  $\phi$  therebetween.

[0166] The first hand tab 342A is defined in part by fold line 383A and in part by a portion of a U-shaped cut line or severance line 348. The second hand tab 342B is defined in part by fold line 383B and in part by a portion of the U-shaped cut line or severance line 348. The first hand tab 342A is disposed adjacent to the second hand tab 342B. The first hand tab 342A and the second hand tab 342B share a common edge defined by a severance line or cut line 343. The common severance line or cut line 343 extends from the U-shaped cut line or severance line 348 to a vertex at which fold line 383A meets fold line 383B.

[0167] The first hand tab 342A comprises a first flap fold line 345A and the second hand tab 342B comprises a second flap fold line 345B. The first and second flap fold lines

345A, 345B facilitate folding of a first portion of the respective first or second hand tab 342A, 342B with respect to a second portion of the first or second hand tab 342A, 342B. The first flap fold line 345A extends between the fold line 383A and the U-shaped outline 348. The second flap fold line 345B extends between the fold line 383B and the U-shaped outline 348. The first and second flap fold lines 345A, 345B are divergently arranged with respect to one another and define an acute angle therebetween. The first and second flap fold lines 345A, 345B provide that outermost portions of the first and second hand tabs 342A, 342B can be folded with respect to the rest of the respective one of the first or second hand tab 342A, 342B.

[0168] In the illustrated embodiment the first hand tab 342A and the second hand tab 342B together define a hand opening when the first and second hand tabs 342A, 342B are folded out of the plane of the first top end closure panel 326A or the second top end closure panel 326B.

[0169] The hand opening provides a carrying handle for a user to insert their hand into the carton. The first and second hand tabs 342A, 342B provide cushioning flaps when folded internally of the carton so as to provide a comfortable handle.

[0170] The first side end closure panel 328A comprises a first inner cut away such as a cutaway or recess R1 struck from an end edge thereof. The first recess R1 is configured such that it is in alignment or registry with the second hand tab 342B of the first handle structure H1, or the hand opening HA of the first handle structure H1.

[0171] The second side end closure panel 332A comprises a second inner opening such as a cutaway or recess R2 struck from an end edge thereof. The second recess R2 is configured such that it is in alignment or registry with the first hand tab 342A of the first handle structure H1, or the hand opening HA of the first handle structure H1.

[0172] The third side end closure panel 328B comprises a third inner opening such as a cutaway or recess R3 struck from an end edge thereof. The third recess R3 is configured such that it is in alignment or registry with the second hand tab 342B of the second handle structure H2, or the hand opening HA of the second handle structure H2.

[0173] The fourth side end closure panel 332B comprises a fourth inner opening such as a cutaway or recess R4 struck from an end edge thereof. The fourth recess R4 is configured such that it is in alignment or registry with the first hand tab 342A of the second handle structure H2, or the hand opening HA of the second handle structure H2.

[0174] In the embodiment of FIG. 12 the inner tabs, such as 52A, 52B, have been omitted from the first, second, third and fourth recesses R1, R2, R3, R4.

[0175] FIG. 13 shows an end view of a carton 490 according to a fifth embodiment. The carton 490 comprises a plurality of main panels forming a tubular structure. The tubular structure is closed at each end by end closure panels 416A, 420A, 426A, 430A. The carton 490 comprises an upper end closure panel 426A having a handle structure defined therein. The handle structure comprises a first hand tab 442A and a second hand tab 442B. The first hand tab 442A is hinged to the upper end closure panel 426A by a pair of non-linear fold lines 491A, 493A. The fold lines 491A, 493A are arcuate in shape. The fold lines 491A, 493A converge towards each other at both ends thereof to form a vertex or point of intersection at each end. The fold lines 491A, 493A together define web panel 476A which, in the

illustrated embodiment, has a pointed oval shape. The web panel 476A comprises a first vertex defined by first ends of the fold lines 491A, 493A. The web panel 476A comprises a second vertex defined by second ends of the fold lines 491A, 493A. The first and second vertices of the web panel 476A hinged to the first hand tab 442A define a first notional linear line L1.

[0176] The second hand tab 442B is hinged to the upper end closure panel 426A by a pair of non-linear fold lines 491B, 493B. The fold lines 491B, 493B are arcuate in shape. The fold lines 491B, 493B converge towards each other at both ends thereof to form a vertex or point of intersection at each end. The fold lines 491B, 493B together define web panel 476B which, in the illustrated embodiment, has a pointed oval shape. The web panel 476B comprises a first vertex defined by first ends of the fold lines 491B, 493B. The web panel 476B comprises a second vertex defined by second ends of the fold lines 491B, 493B. The first and second vertices of the web panel 476B hinged to the second hand tab 442B define a second notional linear line L2.

[0177] The first and second notional linear lines L1, L2 are arranged to form an inverted V-shape. The first and second notional linear lines L1, L2 define an obtuse angle  $\psi$  therebetween.

[0178] The first hand tab 442A is separated from the second hand tab 442B by a portion of an aperture A3, which portion has an inverted "V" shape.

[0179] A first side end closure panel 416A comprises a first inner opening such as a cutaway or recess (not shown) struck from an end edge thereof. The first recess is configured such that it is in alignment or registry with a portion of a hand opening defined by the first hand tab 442A, second hand tab 442B and the aperture A3.

[0180] A second side end closure panel 420A comprises a second inner opening such as a cutaway or recess (not shown) struck from an end edge thereof. The second recess is configured such that it is in alignment or registry with a portion of the hand opening defined by the first hand tab 442A, second hand tab 442B and the aperture A3.

[0181] FIG. 14 shows a fragmentary internal end elevation of a carton according to a sixth embodiment. The carton of the sixth embodiment shares many common features with that of the first embodiment shown in FIGS. 1-5 and therefore only the differences from the embodiment illustrated in FIGS. 1 to 5 will be described in any greater detail. In FIG. 14, like numerals, where possible, are used to denote like parts which are also present in FIGS. 1-5, albeit with the addition of the prefix "500" to indicate that these features belong to the sixth embodiment, respectively.

[0182] The carton of the sixth embodiment includes a top panel, a bottom panel, a first side panel and a second side panel forming a tubular structure. FIG. 14 shows a third side end closure panel 528B hinged to the first side panel and a fourth side end closure panel 532B hinged to the second side panel. The third and fourth side end closure panels 528B, 532B close a second end of the tubular structure in cooperation with the second top and bottom end closure panels. Stated differently, the third and fourth side end closure panels 528B, 532B and the second top and bottom end closure panels together provide an upright, composite end wall of the carton, which closes the second end of the tubular structure. In FIG. 14, which is a fragmentary internal elevation of the composite end wall, the third side end closure panel 528B is the innermost layer

of the composite end wall while the fourth side end closure panel 532B is the second innermost layer of the composite end wall wherein the respective free end portions of the third and fourth side end closure panels 528B, 532B are shown as overlapping with each other. The top end closure panel provides either the outermost or second outermost layer of the composite wall in the manner similar to what are illustrated in FIGS. 3 and 4. A handle structure is provided by a pair of adjoining hand flaps 542A, 542B which are hinged to the top end closure panel by a pair of hinged connections 541A, 541B such that the hand flaps 542A, 542B together define a single hand opening in the top end closure panel when the hand flaps 542A, 542B are folded out of the plane of the top end closure panel. Each of the hinged connections 541A, 541B in this embodiment is provided by a linear fold line. The longitudinal axis of each hinged connection is disposed at an acute angle with respect to a notional horizontal line. Such longitudinal axes of the hinged connections are coincidental with the fold lines 541A, 541B, respectively. The fold lines 541A, 541B meet at their common upper end and downwardly extend from the common upper end divergently from each other. An obtuse angle is defined between the fold lines 541A, 541B.

[0183] The first hand tab 542A is defined in part by fold line 541A and in part by a portion of a U-shaped cut line or severance line 548. The second hand tab 542B is defined in part by fold line 541B and in part by a portion of the U-shaped cut line or severance line 548. The first hand tab 542A is disposed adjacent to the second hand tab 542B. The first hand tab 542A and the second hand tab 542B share a common edge defined by a severance line or cut line 543. The severance line or cut line 543 extends from the U-shaped cut line or severance line 548 to a vertex at which fold line 541A meets fold line 541B.

[0184] The first hand tab 542A comprises a first flap fold line 545A while the second hand tab 542B comprises a second flap fold line 545B. The first and second flap fold lines 545A, 545B facilitate folding of a first portion of the respective first or second hand tab 542A, 542B with respect to a second portion of the first or second hand tab 542A, 542B. The first flap fold line 545A extends between the severance line 543 and the U-shaped outline 548. The second flap fold line 545B extends between the severance line 543 and the U-shaped outline 548. The first and second flap fold lines 545A, 545B converge on the severance line 543 and define an obtuse angle therebetween. The first and second flap fold lines 545A, 545B an apex on the severance line 543 from which the flap fold lines 545A, 545B downwardly extend divergently from each other.

[0185] The hand opening defined by the hand flaps 542A, 542B provides a carrying handle for a user to insert their hand into the carton. The first and second hand tabs 542A, 542B provide cushioning flaps when folded internally of the carton so as to provide a comfortable handle.

[0186] The third side end closure panel 528B comprises a third inner opening such as a cutaway or recess struck from an end edge thereof. The third inner opening is configured such that it is in alignment or registry with the first hand tab 542A, or the hand opening of the handle structure. The fourth side end closure panel 532B comprises a fourth inner opening such as a cutaway or recess struck from an end edge thereof. The fourth inner opening is configured such that it is in alignment or registry with the second hand tab 542B, or the hand opening of the handle structure. The third inner

opening is defined in part by a first inner tab **552A** hinged to the third side end closure panel **528B** by a fold line **551A**. The fourth inner opening is defined in part by a second inner tab **552B** hinged to the fourth side end closure panel **532B** by a fold line **551B**.

[0187] As viewed in FIG. 14, the lower end of the inner flap fold line **551A** is located below the lower end of the flap fold line **541A**. The inner flap fold line **551A** extends upward from its lower end, intersects with the flap fold line **541A** of the hand flap **542A** and extends above the flap fold line **541A**. The fold lines **551A**, **541A** are arranged to define an acute angle with respect to each other. The inner flap fold line **551A** is arranged to define an acute angle with respect to a notional horizontal line. The flap fold line **541A** is arranged to define an acute angle with respect to a notional horizontal line. The acute angle between the flap fold line **541A** and the notional horizontal line is less than that between the inner flap fold line **551A** and the notional horizontal line. The flap fold line **541A** is arranged to define an acute angle with respect to a notional vertical line.

[0188] As shown in FIG. 14, the first hand tab **542A** is arranged in a partially overlapping or overlying relationship with the first inner tab **552A**. The second hand tab **542B** is arranged in a partially overlapping or overlying relationship with the second inner tab **552B**.

[0189] The arrangement of the second hand tab **542B** with respect to the second inner tab **552B** is substantially the same as the arrangement of the first hand tab **542A** with respect to the first inner tab **552A** described above, albeit a mirror image of the arrangement of the first hand tab **542A** and the first inner tab **552A**.

[0190] FIG. 15 shows a fragmentary internal end elevation of a carton according to a seventh embodiment. The carton of the seventh embodiment shares many common features with that of the first and sixth embodiment shown in FIGS. 1 to 5 and 14 and therefore only the differences from the embodiments illustrated in FIGS. 1 to 5 and 14 will be described in any greater detail. In FIG. 15, like numerals, where possible, are used to denote like parts which are also present in FIG. 14, albeit with the addition of the prefix "600" to indicate that these features belong to the seventh embodiment, respectively.

[0191] As viewed in FIG. 15, the lower end of the inner flap fold line **651A** is located below the lower end of the flap fold line **641A**. The inner flap fold line **651A** extends upward from its lower end, passes through the lower end of the flap fold line **641A** of the hand flap **642A** and extends above the flap fold line **641A**. Stated differently, the lower end of the flap fold line **641A** is located on the inner flap fold line **651A** such that the flap fold line **641A** extends upwardly and divergently from the inner flap fold line **651A**. The fold lines **651A**, **641A** are arranged to define an acute angle with respect to each other. The inner flap fold line **651A** is arranged to define an acute angle with respect to a notional horizontal line. The flap fold line **641A** is arranged to define an acute angle with respect to a notional horizontal line. The acute angle between the flap fold line **641A** and the notional horizontal line is less than that between the inner flap fold line and the notional horizontal line. The flap fold line **641A** is arranged to define an acute angle with respect to a notional vertical line.

[0192] As shown in FIG. 15, the first hand tab **642A** is arranged in a partially overlapping or overlying relationship with the first inner tab **652A**. The second hand tab **642B** is

arranged in a partially overlapping or overlying relationship with the second inner tab **652B**.

[0193] The arrangement of the second hand tab **642B** with respect to the second inner tab **652B** is substantially the same as the arrangement of the first hand tab **642A** with respect to the first inner tab **652A** described above, albeit a mirror image of the arrangement of the first hand tab **642A** and the first inner tab **652A**.

[0194] It can be appreciated that various changes may be made within the scope of the present invention. For example, the size and shape of the panels and apertures may be adjusted to accommodate articles of differing size or shape. The handle structures disclosed herein may be used in a variety of carton styles and are not limited to use in end-loading cartons as shown in the illustrated embodiments. The handle structures may be employed in bottom or top loading cartons or any carton style including a vertical/upright handle panel in which a hand opening may be defined; the handle structure of the invention may be employed in a basket carrier, a wraparound carrier or a top engaging carrier having upright handle panels.

[0195] Each of the foregoing described and/or illustrated embodiments may be employed on a single panel wall or on a double panel wall (two at least partially overlapping panels). When employed with a double panel wall, the hand flaps are formed from the outer panel while the inner panel wall may be provided with inner hand flaps or no hand flaps. When provided with inner hand flaps at least one inner hand flap is associated with a respective one of the outer hand flaps of the outer panel.

[0196] It will be recognized that as used herein, directional references such as "top", "bottom", "front", "back", "rear", "end", "side", "inner", "outer", "upper" and "lower" do not necessarily limit the respective panels to such orientation, but may merely serve to distinguish these panels from one another.

[0197] As used herein, the term "inner opening" refers to all manner of openings including holes and apertures which may be a part of the handle structure of the invention. More particularly, the term "inner opening" may refer to one of the following: a cutaway, a recess, a notch, a hole and an aperture. A cutaway, recess or notch may be formed along the free end edge of an end closure panel while a hole or aperture may be formed within an end closure panel, such as shown at "28A", "28B", "32A" or "32B" in FIG. 1, such that the hole or aperture is surrounded entirely by the material of the end closure panel which provides an endless perimeter of the hole or aperture.

[0198] As used herein, the term "hinged connection" refers to all manner of lines that define hinge features in a substrate of sheet material, for facilitating folding portions of the substrate with respect to one another, or otherwise for indicating optimal folding locations in the substrate. For example, a hinged connection should not be construed as necessarily referring to a single fold line only: indeed a hinged connection can be formed from two or more fold lines wherein each of the two or more fold lines may be either straight/linear or curved/curvilinear in shape. When linear fold lines form a hinged connection, they may be disposed parallel with each other or slightly angled with respect to each other. When curvilinear fold lines form a hinged connection, they may intersect each other to define a shaped panel within the area surrounded by the curvilinear fold lines. A typical example of such a hinged connection

may comprise a pair of arched or arcuate fold lines intersecting at two points such that they define an elliptical panel therebetween. A hinged connection may be formed from one or more linear fold lines and one or more curvilinear fold lines. A typical example of such a hinged connection may comprise a combination of a linear fold line and an arched or arcuate fold line which intersect at two points such that they define a half moon-shaped panel therebetween.

**[0199]** As used herein, the term “fold line” may refer to one of the following: a scored line, an embossed line, a debossed line, a line of perforations, a line of short slits, a line of half-cuts, a single half-cut, an interrupted cut line, a line of aligned slits, a line of scores and any combination of the aforesaid options.

**[0200]** As used herein, the terms “severance line” refers to all manner of lines formed in a substrate of sheet material which facilitate separating portions of the substrate on the opposite sides of that line from one another, or otherwise indicate optimal separation locations on the substrate. For example, a severance line in a substrate of sheet material is predisposed to allow a tear to propagate there along. A severance line may be one of the following: a single cut, a single half-cut, a single slit, an interrupted cut, a score line, an interrupted score line, a line of perforations, a line of short cuts, a line of short slits, a line of short half cuts, and any combination of the aforementioned options.

**[0201]** Those elements of a fold line or those of a severance line, such as cuts, perforations and scores, can be dimensioned and arranged to provide the desired functionality. For example, a line of perforations can be dimensioned or designed with degrees of weakness to define a fold line or a severance line. The line of perforations can be designed to facilitate folding and resist breaking to provide a fold line, or to facilitate breaking with little effort to provide a severance line.

1. A handle structure for a carton, the handle structure comprising a pair of adjoining hand flaps hingedly connected to a handle panel by a pair of hinged connections such that the hand flaps together define a single hand opening in the handle panel when the hand flaps are folded out of a plane of the handle panel, each of the hinged connections having a longitudinal axis disposed at an acute angle with respect to a notional horizontal line, the longitudinal axes of the hinged connections defining an obtuse angle therebetween and downwardly extending divergently from each other.

2. The handle structure according to claim 1 wherein the handle panel is a unitary, substantially upright handle panel.

3. The handle structure according to claim 2 wherein a first one of the hand flaps is separated from a second one of the hand flaps by a severance line.

4. The handle structure according to claim 2 wherein each of the hinged connections comprises at least one linear fold line, and the hinged connections of the hand flaps together define an inverted V shape.

5. The handle structure according to claim 4 wherein the longitudinal axis of each of the hinged connection extends coincidentally with the at least one linear fold lines.

6. The handle structure according to claim 2 wherein each of the hinged connections comprises a pair of opposed arcuate fold lines intersecting at two points such that the arcuate fold lines define an elliptical panel therebetween,

and wherein the longitudinal axis of each of the hinged connections extends through the two points of a respective one of the elliptical panels.

7. The handle structure according to claim 2 wherein each of the hand flaps comprises a flap fold line therein for facilitating folding of a first portion of the each hand flap with respect to a second portion of the each handle flap.

8. The handle structure according to claim 7 wherein the flap fold lines in the hand flaps together define an inverted V shape.

9. The handle structure according to claim 7 wherein the first portion of one of the hand flaps is disposed adjacent to the first portion of the other of the hand flaps.

10. The handle structure according to claim 2 comprising an aperture defining at least a portion of each of the hand flaps.

11. The handle structure according to claim 2 comprising at least one inner panel disposed in a face-contacting relationship with the handle panel, the at least one inner panel comprising at least one inner opening configured and arranged to be in registry with at least a portion of the hand opening.

12. The handle structure according to claim 11 wherein the at least one inner panel comprises a pair of inner flaps hinged to the at least one inner panel by a pair of inner hinged connections respectively, the inner flaps defining at least a portion of the at least one inner opening.

13. The handle structure according to claim 12 wherein each of the inner flaps partially overlaps with a respective one of the hand flaps.

14. The handle structure according to claim 13 wherein the inner hinged connection of each of the inner flaps is disposed at least in part above the hinged connection of a respective one of the hand flaps.

15. The handle structure according to claim 14 wherein the inner hinged connection of each of the inner flaps is spaced apart from the hinged connection of the respective one of the hand flaps.

16. The handle structure according to claim 13 wherein the inner hinged connection of each of the inner flaps is divergently arranged with respect to the hinged connection of the respective one of the hand flaps so as to define an acute angle therebetween.

17. The handle structure according to claim 6 further comprising at least one inner panel disposed in a face-contacting relationship with the handle panel, and a pair of inner flaps provided by the at least one inner panel.

18. The handle structure according to claim 17 wherein each of the inner flaps has a pair of lobes configured and arranged for facilitating folding of a respective one of the elliptical panels substantially transversely with respect to the longitudinal axis of the respective one of the elliptical panels.

19. The handle structure according to claim 18 wherein each of the elliptical panels comprises a fold line for facilitating folding thereof substantially transversely with respect to the longitudinal axis.

20. The handle structure according to claim 14 wherein the lower end of the inner hinged connection of each of the inner flaps, as viewed in an elevation of the at least one inner panel, is positioned below the lower end of the hinged connection of the respective one of the hand flaps

21. The handle structure according to claim 20 wherein the inner hinged connection of each of the inner flaps, as

viewed in the elevation of the at least one inner panel, intersects with the hinged connection of the respective one of the hand flaps.

**22.** The handle structure according to claim **20** wherein the lower end of the hinged connection of each of the hand flaps, as viewed in the elevation of the at least one inner panel, is located on the inner hinged connection of the respective one of the inner flaps such that the hinged connection of the each of the hand flaps extends upwardly and divergently from the inner hinged connection of the respective one of the inner flaps.

**23.** The handle structure according to claim **20** wherein the inner hinged connection of each of the inner flaps, as viewed in the elevation of the at least one inner panel, defines an acute angle with respect to the hinged connection of the respective one of the hand flaps.

**24.** A carton for packaging one or more articles, the carton comprising a plurality of panels including a top panel, a bottom panel, a first side panel and a second side panel forming a tubular structure, a first end panel for at least partially closing a first end of the tubular structure, and a second end panel for at least partially closing a second end of the tubular structure, wherein the carton comprises a handle structure comprising a pair of adjoining hand flaps hingedly connected to each of the first and second end panels by a pair of hinged connections such that the hand flaps together define a single hand opening in each of the first and second end panels when the hand flaps are folded out of a plane of each of the first and second end panels, each of the hinged connections having a longitudinal axis disposed at an acute angle with respect to a notional horizontal line, the longitudinal axes of the hinged connections defining an obtuse angle therebetween and downwardly extending divergently from each other.

**25.** The carton according to claim **24** wherein each of the first and second panels is a unitary, substantially upright handle panel.

**26.** The carton according to claim **24** wherein each hinged connection comprises at least one linear fold line.

**27.** The carton according to claim **26** wherein the longitudinal axis of each of the hinged connections extends coincidentally with the at least one linear fold lines.

**28.** The carton according to claim **24** wherein each of the hinged connections comprises a pair of opposed arcuate fold lines intersecting at two points such that the arcuate fold lines define an elliptical panel therebetween.

**29.** The carton according to claim **28** wherein the longitudinal axis of each of the hinged connections extends through the two points of a respective one of the elliptical panels.

**30.** A blank for forming a carton, the blank comprising a plurality of panels including a top panel, a bottom panel, a first side panel and a second side panel for forming a tubular structure, a first end panel for at least partially closing a first end of the tubular structure, and a second end panel for at least partially closing a second end of the tubular structure, wherein the blank comprises a handle structure comprising a handle panel formed by one of said first and second end panels, the handle structure comprising a pair of adjoining hand flaps hingedly connected to the handle panel by a pair of hinged connections such that the hand flaps together define a single hand opening in the handle panel when the hand flaps are folded out of a plane of the handle panel, each of the hinged connections having a longitudinal axis disposed at an acute angle with respect to a severance line which separates the hand flaps from each other, the longitudinal axes of the hinged connections defining an obtuse angle therebetween such that the obtuse angle is divided by the severance line generally into halves.

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