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(54) **ARTICLE CARRIER AND BLANK THEREFOR**

(57) Aspects of the disclosure relate to an article carrier (90; 190) for packaging one or more articles (B) and a blank for forming the carrier (90; 190). The carrier (90; 190) comprising a tubular body formed in part from opposing front and rear panels (14, 16; 116, 122) and an end closure structure comprising a pair of primary end closure panels (18, 20; 130, 134) and at least one pyramidal structure associated with the primary end closure panels (18, 20; 130, 134). The pyramidal structure comprises a plurality of hinged panels (22A/26A/30B/34B, 22B/26B/30A/34A; 142/144/118/120).

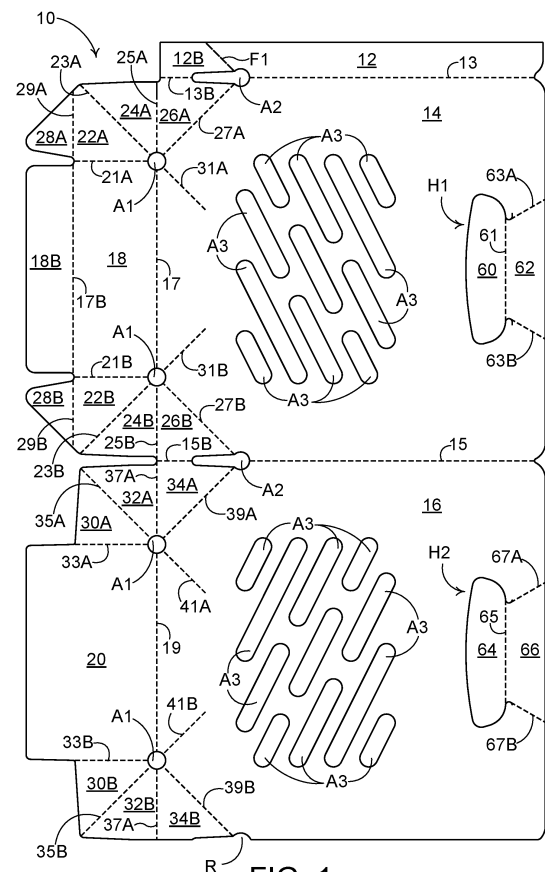


FIG. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to article carriers, and blanks for forming the same. More specifically, but not exclusively, the invention relates to flexible carriers for fresh produce and baked goods.

BACKGROUND

[0002] In the field of packaging, it is known to provide cartons for carrying multiple articles. Cartons are well known in the art and are useful for enabling consumers to transport, store, and access a group of articles for consumption. 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. Further considerations are the strength of the carton and its suitability for holding and transporting large weights of articles. It is desirable that the contents of the carton are secure within the carton.

[0003] It is desirable to provide a flexible carrier without employing plastic material or minimizing use of plastic. It is also desirable to provide a flexible carrier from a paperboard material that appears to be like a paper bag.

[0004] The present invention seeks to provide an improvement in the field of cartons, typically formed from paperboard or the like.

SUMMARY

[0005] A first aspect of the invention provides an article carrier which may be suitable for packaging at least one article. The article carrier comprises a tubular body formed in part from opposing front and rear panels and an end closure structure comprising a pair of primary end closure panels and at least one pyramidal structure associated with the primary end closure panels. The pyramidal structure comprises a plurality of hinged panels.

[0006] Optionally, the article carrier is collapsible into a flat collapsed form, and is erectable from the flat collapsed form into a tubular form. The end closure structure is configured to be automatically erectable to close the end of the tubular body when the article carrier is erected into the tubular form.

[0007] Optionally, the at least one pyramidal structure comprises a pair of pyramidal structures at each end of the pair of primary end closure panels.

[0008] Optionally, the pyramidal structure is automatically erectable when the article carrier is erected into the tubular form.

[0009] Optionally, the pyramidal structure employs an over-center or toggle mechanism and thereby maintains the end closure structure in an expanded, end-closing position. d

[0010] Optionally, the plurality of hinged panels of the

at least one pyramidal structure comprises a pair of inner corner panels disposed adjacent to each other.

[0011] Optionally, the plurality of hinged panels comprises a pair of outer corner panels disposed adjacent to each other.

[0012] Optionally, a first one of the outer corner panels is hingedly connected to a second one of the outer corner panels by a hinged connection.

[0013] Optionally, the hinged connection may be interrupted by a relief aperture.

[0014] Optionally, a corner securing flap is hingedly connected to one of the inner corner panels and is secured in face contacting relationship with the other one of the inner corner panels.

[0015] Optionally, the plurality of hinged panels is hingedly connected to each of the front and rear panels and to each of the primary end closure panels.

[0016] Optionally, each inner corner panel is hingedly connected to a respective one of the outer corner panels by a web panel.

[0017] Optionally, each inner corner panel defines a common vertex with respective ones of the outer corner panels and web panels.

[0018] Optionally, the vertex is interrupted by a relief aperture.

[0019] Optionally, each outer corner panel is hingedly connected to one of the front and rear panels.

[0020] Optionally, each inner corner panel is hingedly connected to one of the primary end closure panels.

[0021] A second aspect of the invention provides an article carrier comprising a spout structure. The spout structure comprises a plurality of hinged panels for defining a spout pathway. The hinged panels are defined at least in part by hinge lines. The hinged panels are hingedly connected to an end closure panel by at least two of said hinge lines. The hinge lines extend from an expansion element. The expansion element is provided in the end closure panel such that inner ends of the hinged panels are movable to a location over the expansion element when the spout structure is erected.

[0022] Optionally, the expansion element is provided by one selected from the group consisting of a cutaway, an opening, an aperture, a slot, a slit, a cut and a perforation.

[0023] Optionally, inner ends of the hinged panels define part of the expansion element.

[0024] Optionally, the end closure panel comprises one or more weakening elements to create a weakened area of the end closure panel.

[0025] Optionally, the one or more weakening elements comprises one or more features selected from the following group of features: additional openings, slits, fold lines.

[0026] A third aspect of the invention provides a blank for forming an article carrier. The blank comprises a first plurality of panels for forming a tubular body including front and rear panels, a pair of primary end closure panels for forming an end closure structure, and plurality of

hinged panels for forming at least one pyramidal structure associated with the primary end closure panels.

[0027] A fourth aspect of the invention provides a blank for forming an article carrier. The blank comprises a plurality of panels for forming a tubular structure and one or more end closure panels for forming an end closure structure. The blank further comprises a plurality of hinged panels for providing a spout structure defining a spout pathway. The hinged panels are defined at least in part by hinge lines. The hinged panels are hingedly connected to one of the end closure panels by at least two of said hinge lines. The hinge lines extend from an expansion element provided in the end closure panel. In a set-up article carrier, inner ends of the hinged panels are movable to a location over the expansion element when the spout structure is erected.

[0028] Further features and advantages of the present invention will be apparent from the specific embodiments illustrated in the drawings and discussed below.

[0029] Within the scope of this application, it is envisaged or 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 considered or taken independently or in any combination thereof.

[0030] Features or elements described in connection with, or relation to, one embodiment are applicable to all embodiments unless there is an incompatibility of features. One or more features or elements from one embodiment may be incorporated into, or combined with, any of the other embodiments disclosed herein, said features or elements extracted from said one embodiment may be included in addition to, or in replacement of one or more features or elements of said other embodiment.

[0031] A feature, or combination of features, of an embodiment disclosed herein may be extracted in isolation from other features of that embodiment. Alternatively, a feature, or combination of features, of an embodiment may be omitted from that embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] Exemplary embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a plan view from above of a blank for forming an article carrier according to a first embodiment;

Figures 2A and 2B illustrate stages of construction of an article carrier from the blank of Figure 1;

Figures 3A and 3B illustrate further stage of construction of the article carrier from the blank of Figure 1;

Figure 4 is a perspective view from above of an article carrier formed from the blank of Figure 1;

Figure 5 is a perspective view from below of the

article carrier of Figure 4;

Figure 6 is a plan view from above of a blank for forming an article carrier according to a second embodiment;

Figure 7 is a perspective view from above of an article carrier formed from the blank of Figure 6;

Figure 8 is an alternative perspective view of the article carrier formed from the blank of Figure 6; and

Figure 9 is a perspective view from above of the article carrier of Figures 7 and 8 showing a dispensing feature in an open or deployed condition.

DETAILED DESCRIPTION OF EMBODIMENTS

[0033] Detailed descriptions of specific embodiments of blanks and article carriers 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 blanks and article carriers 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.

[0034] Referring to Figure 1, there is shown a plan view of a blank 10 capable of forming a carton or carrier 90, as shown in Figures 4 and 5, for containing and carrying a group of primary products such as, but not limited to, foodstuffs such as fresh fruit or baked goods, hereinafter referred to as articles B. An alternative blank 110 is shown in Figure 6 for forming an alternative carton or carrier 190 as shown in Figures 7 and 8.

[0035] 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 and carrying articles.

[0036] The blanks 10; 110 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.

[0037] The packaging structures or cartons described herein may be formed from a sheet material such as

paperboard, which may be made of or coated with materials to increase its strength or moisture resistance. An example of such a sheet material is tear-resistant NATRALOCK® paperboard made by WestRock Company. It should be noted that the tear resistant materials may be provided by more than one layer, to help improve the tear-resistance or moisture resistance of the package. Typically, one surface of the sheet material may have different characteristics to the other surface. For example, the surface of the sheet material that faces outwardly from a finished package may be particularly smooth and may have a coating such as a clay coating or other surface treatment to provide good printability. The surface of the sheet material that faces inwardly may, on the other hand, be provided with a coating, a layer, a treatment or be otherwise prepared to provide properties such as one or more of tear-resistance, moisture resistance, good glueability, heat sealability, or other desired functional properties.

[0038] Referring to Figure 1 there is shown a blank 10 comprising a first main panel 14 and a second main panel 16 for forming front and rear panels of a carrier 90, (see Figures 4 and 5) and a third panel 12 for forming a securing panel of the carrier 90. The second panel 16 is hingedly connected to the first panel 14 by a hinged connection in the form of a fold line 15. The third panel 12 is hingedly connected to the first panel 14 by a hinged connection in the form of a fold line 13. Fold lines 13 and 15 may be substantially parallel to each other. The first, second and third panels 14, 16, 12 form a collapsible tubular structure, the first main panel 14 being disposed in face-to-face relationship with the second main panel 16.

[0039] The blank 10 comprises an end closure structure for closing one end of the tubular structure and forming a base of the article carrier 90. The end closure structure comprises a first end closure panel 18 for forming a first base panel 18 hingedly connected to the first panel 14 by a hinged connection in the form of a fold line 15. The end closure structure comprises a second end closure panel 20 for forming a second base panel 20 hingedly connected to the second panel 16 by a hinged connection in the form of a fold line 19. The first and second end closure panels 18, 20 form first and second base panels 18, 20. A distal portion 18B of the first base panel 18, defined, at least in part, by a first hinged connection in the form of a fold line 17B extending across the first base panel 18 parallel to fold line 17, is configured to be disposed in face contacting relationship with the second base panel 20 to form a composite base panel 18/20.

[0040] The end closure structure comprises a plurality of panels 22A, 24A, 26A, 28A, 22B, 24B, 26B, 28B, 30A, 32A, 34A, 30B, 32B, 34B for forming corner structures at each end of the composite base panel 18/20.

[0041] A first inner corner panel 22A is hingedly connected to a first end of the first base panel 18 by a hinged connection in the form of a fold line 21A. A second inner corner panel 22B is hingedly connected to a second,

opposing, end of the first base panel 18 by a hinged connection in the form of a fold line 21B.

[0042] A third inner corner panel 30A is hingedly connected to a first end of the second base panel 20 by a hinged connection in the form of a fold line 33A. A fourth inner corner panel 30B is hingedly connected to a second, opposing, end of the second base panel 20 by a hinged connection in the form of a fold line 33B.

[0043] Each of the first, second, third, and fourth inner corner panels 22A, 22B, 30A, 30B is substantially triangular in shape.

[0044] A first web panel 24A is hingedly connected to the first inner corner panel 22A by a hinged connection in the form of a fold line 23A. A second web corner panel 24B is hingedly connected to the second inner corner panel 22B by a hinged connection in the form of a fold line 23B.

[0045] A third web panel 32A is hingedly connected to the third inner corner panel 30A by a hinged connection in the form of a fold line 35A. A fourth web panel 32B is hingedly connected to the fourth inner corner panel 30B by a hinged connection in the form of a fold line 35B.

[0046] A first outer corner panel 26A is hingedly connected to the first web panel 24A by a hinged connection in the form of a fold line 25A. Fold line 25A is substantially collinear with fold line 17. The first outer corner panel 26A is hingedly connected to the first panel 14 by a hinged connection in the form of a fold line 27A. Fold line 27A is obliquely oriented with respect to the fold lines 17, 25A. Fold lines 17, 25A, 21A, 23A, 27A define a vertex or intersection. In the illustrated embodiment, the vertex or intersection is interrupted by a first aperture A1, that is to say substrate material is removed at the location fold lines 17, 25A, 21A, 23A, 27A would intersect. In other embodiments, the first aperture A1 may be omitted and the fold lines 17, 25A, 21A, 23A, 27A are uninterrupted so as to intersect with each other.

[0047] A second outer corner panel 26B is hingedly connected to the second web panel 24B by a hinged connection in the form of a fold line 25B. Fold line 25B is substantially collinear with fold line 17. The second outer corner panel 26B is hingedly connected to the first panel 14 by a hinged connection in the form of a fold line 27B. Fold line 27B is obliquely oriented with respect to the fold lines 17, 25B. Fold lines 17, 25B, 21B, 23B, 27B define a vertex or intersection. In the illustrated embodiment, the vertex or intersection is interrupted by a first aperture A1, that is to say substrate material is removed at the location fold lines 17, 25A, 21A, 23A, 27A would intersect. In other embodiments, the first aperture A1 may be omitted and the fold lines 17, 25A, 21A, 23A, 27A are uninterrupted so as to intersect with each other.

[0048] A third outer corner panel 34A is hingedly connected to the third web panel 32A by a hinged connection in the form of a fold line 37A. Fold line 37A is substantially collinear with fold line 19. The third outer corner panel 34A is hingedly connected to the second panel 16 by a hinged connection in the form of a fold line 39A. Fold line

39A is obliquely oriented with respect to the fold lines 19, 37A. Fold lines 19, 37A, 33A, 35A, 39A define a vertex or intersection. In the illustrated embodiment, the vertex or intersection is interrupted by a first aperture A1, that is to say substrate material is removed at the location fold lines 19, 37A, 33A, 35A, 39A would intersect. In other embodiments, the first aperture A1 may be omitted and the fold lines 19, 37A, 33A, 35A, 39A are uninterrupted so as to intersect with each other.

[0049] A fourth inner corner panel 30B is hingedly connected to the fourth outer corner panel 32B by a hinged connection in the form of a fold line 37B. Fold line 37B is substantially collinear with fold line 19. The fourth outer corner panel 34B is hingedly connected to the second panel 16 by a hinged connection in the form of a fold line 39B. Fold line 39B is obliquely oriented with respect to the fold lines 19, 37B. Fold lines 19, 37B, 33B, 35B, 39B define a vertex or intersection. In the illustrated embodiment, the vertex or intersection is interrupted by a first aperture A1, that is to say substrate material is removed at the location fold lines 19, 37B, 33B, 35B, 39B would intersect. In other embodiments, the first aperture A1 may be omitted and the fold lines 19, 37B, 33B, 35B, 39B are uninterrupted so as to intersect with each other.

[0050] The third outer corner panel 34A is hingedly connected to the second outer corner panel 26B by a hinged connection in the form of a fold line 15B. Fold line 15B is collinear with fold line 15.

[0051] A portion 12B of the third panel 12 forms a corner securing flap 12B, the corner securing flap 12B is hingedly connected to the first outer corner panel 26A by a hinged connection in the form of a fold line 13B. Fold line 13B is collinear with fold line 13. The corner securing flap 12B is hingedly or severably connected to the third panel 12 by a hinged connection or frangible connection F1 in the form of a fold line or tear line, respectively.

[0052] Fold line F1 and fold line 27A define a vertex or intersection with fold line 13 and fold line 13B, the vertex or intersection is interrupted by a second aperture A2, that is to say substrate material is removed at the location fold lines F1, 27A, 13, 13B would intersect. In other embodiments, the second aperture A2 may be omitted and the fold lines F1, 27A, 13, 13B are uninterrupted so as to intersect with each other.

[0053] Fold line 27B and fold line 39A define a vertex or intersection with fold line 15 and fold line 15B, the vertex or intersection is interrupted by a second aperture A2, that is to say substrate material is removed at the location fold lines 27B, 39A, 15, 15B would intersect. In other embodiments, the second aperture A2 may be omitted and the fold lines 27B, 39A, 15, 15B are uninterrupted so as to intersect with each other.

[0054] First apertures A1 and second apertures A2 form relief apertures and reduce the stress in the substrate, they may also reduce the fold resistance at the fold line intersections, or prevent or mitigate against an increase the folding resistance due to an intersection be-

tween of a plurality of fold lines.

[0055] A recess R may be provided in a free edge of the second panel 16, the recess R is configured to be disposed in registry with a portion of the second aperture struck from the first and third panels 14, 12.

[0056] A first corner securing panel 28A is hingedly connected to the first inner corner panel 22A by a hinged connection in the form of a fold line 29A. Fold line 29A is substantially collinear with fold line 17B. A second corner securing panel 28B is hingedly connected to the second inner corner panel 22B by a hinged connection in the form of a fold line 29B. Fold line 29B is substantially collinear with fold line 17B.

[0057] The first corner securing panel 28A is configured to be disposed in face contacting relationship with the fourth inner corner panel 30B and secured thereto.

[0058] The second corner securing panel 28B is configured to be disposed in face contacting relationship with the third inner corner panel 30A and secured thereto.

[0059] The first panel 14 may comprise a first relief fold line 31A, the first relief fold line 31A may be collinear with fold line 23A and may extend from the first aperture A1 into the first panel 14. In other embodiments, the first relief fold line 31A may extend from the vertex or intersection of defined by fold lines 17, 25A, 21A, 23A, 27A.

[0060] The first panel 14 may comprise a second relief fold line 31B, the second relief fold line 31B may be collinear with fold line 23B and may extend from the first aperture A1 into the first panel 14. In other embodiments, the second relief fold line 31B may extend from the vertex or intersection of defined by fold lines 17, 25B, 21B, 23B, 27B.

[0061] The second panel 16 may comprise a third relief fold line 41A, the third relief fold line 41A may be collinear with fold line 35A and may extend from the first aperture A1 into the second panel 16. In other embodiments, the third relief fold line 41A may extend from the vertex or intersection of defined by fold lines 19, 37A, 33A, 35A, 39A.

[0062] The second panel 16 may comprise a fourth relief fold line 41B, the fourth relief fold line 41B may be collinear with fold line 35B and may extend from the first aperture A1 into the second panel 16. In other embodiments, the fourth relief fold line 41B may extend from the vertex or intersection of defined by fold lines 19, 37B, 33B, 35B, 39B.

[0063] The blank 10 may comprise a handle structure. The handle structure comprises first handle opening H1 defined in the first panel 14 and second handle opening H2 defined in the second panel 16. The second handle opening H2 is configured to be in registry with the first handle opening H1.

[0064] The first handle opening H1 is defined at least in part by a first handle tab 60. The first handle tab 60 is struck from, or defined in the first panel 14 and is hingedly connected thereto by a hinged connection in the form of a fold line 61. The handle structure comprises a first pair of fold lines 63A, 63B. A first one of the first pair of fold lines

63A, 63B extends from a first end of the fold line 61 to a free end edge of the first panel 14. A second one of the first pair of fold lines 63A, 63B extends from a second, opposing, end of the fold line 61 to the free end edge of the first panel 14. The first pair of fold lines 63A, 63B may be divergently arranged with respect to each other. The first pair of fold lines 63A, 63B may be arranged to diverge towards the free end edge of the first panel 14. The first pair of fold lines 63A, 63B define a first handle grip portion 62 therebetween. The first handle grip portion 62 is defined between the first handle opening H1 and the free end edge of the first panel 14.

[0065] The second handle opening H2 is defined at least in part by a second handle tab 64. The second handle tab 64 is struck from, or defined in the second panel 16 and is hingedly connected thereto by a hinged connection in the form of a fold line 65. The handle structure comprises a second pair of fold lines 67A, 67B. A first one of the second pair of fold lines 67A, 67B extends from a first end of the fold line 65 to a free end edge of the second panel 16. A second one of the second pair of fold lines 67A, 67B extends from a second, opposing, end of the fold line 65 to the free end edge of the second panel 16. The second pair of fold lines 67A, 67B may be divergently arranged with respect to each other. The second pair of fold lines 67A, 67B may be arranged to diverge towards the free end edge of the second panel 16. The second pair of fold lines 67A, 67B define a second handle grip portion 66 therebetween. The second handle grip portion 66 is defined between the second handle opening H2 and the free end edge of the second panel 16.

[0066] The first one of the first pair of fold lines 63A, 63B may be arranged to in registry with the second one of the second pair of fold lines 67A, 67B in the set-up article carrier 90. The second one of the first pair of fold lines 63A, 63B may be arranged to in registry with the first one of the second pair of fold lines 67A, 67B in the set-up article carrier 90.

[0067] The second handle grip portion 66 may be in registry with the first handle grip portion 62 in the set-up article carrier 90. The handle structure may serve to secure the front and rear panels 14, 16 in face-to-face contact at an upper end thereof, whereby closing the upper end of the carrier 90, see Figure 4. One of the handle tabs 60, 64 hinged to one of the front and rear panels 14, 16 passing through the opening created in the other of the front and rear panels 14, 16 created when the other handle tabs 60, 64 is folded out of the plane of the respective one of the front and rear panels 14, 16 to which it is hinged.

[0068] The first and second pairs of fold lines 63A, 63B, 67A, 67B may facilitate or allow movement, deformation or folding of the first and second grip portions 62, 66 with respect to the first and second panels 14, 16 when the carrying handle, provided by the handle structure, is in use.

[0069] Optionally the first and second panels 14, 16 may comprise one or more apertures A3, apertures A3

may provide ventilation to the interior of the article carrier 90 and or a window to allow visual inspection of the contents from the exterior without opening an upper end of the article carrier 90 by separating the first and second panels 14, 16 from each other. The apertures A3 may be useful by vendor at a point of sale to readily determine the correct tariff for the goods packaged within the article carrier 90.

[0070] Turning to the construction of the article carrier 90, the article carrier 90 can be formed by a series of sequential folding operations. The folding process is not limited to that described below and may be altered according to particular manufacturing requirements. In particular, the folding process described below results in the securing panel 12 being disposed outermost, that is to say secured to an outer surface of third panel 16. In other embodiments, the securing panel 12 may be disposed internally, that is to say disposed between the first and second panels 14, 16.

[0071] Optionally, glue or other adhesive treatment may be applied to the first, second, third, and fourth web panels 24A, 24B, 32A, 32B, as shown in Figure 2A. In other embodiments, the glue or other adhesive treatment may be applied to the first, second, third, and fourth outer corner panels 26A, 26B, 34A, 34B. In still other embodiments, no glue or no other adhesive treatment is applied either to the web panels 24A, 24B, 32A, 32B or to the outer corner panels 26A, 26B, 34A, 34B.

[0072] The first base panel 18 and the first and second web panels 24A, 24B are folded, along with the first and second inner corner panels 22A, 22B and the first and second corner securing panels 28A, 28B, about fold lines 17, 25A, 25B. The first base panel 18 and first and second inner corner panels 22A, 22B are brought into face-to-face relationship with the first panel 14. The first and second web panels 24A, 24B are brought into face-to-face relationship with the respective one of the first and second outer corner panels 26A, 26B to which they are hingedly connected. The first and second web panels 24A, 24B are optionally secured to the respective one of the first and second outer corner panels 26A, 26B to which they are hingedly connected.

[0073] The distal portion 18B of the first base panel 18 is folded with respect to a proximal portion 18, about fold line 17B, to bring the distal portion into face-to-face relationship with the proximal portion 18.

[0074] The first and second corner securing panels 28A, 28B are folded with respect to first and second inner corner panels 22A, 22B, about fold lines 29A, 29B respectively, to be brought into face-to-face relationship with the respective one of the first and second inner corner panels 22A, 22B to which they are hingedly connected.

[0075] The second base panel 20 and the third and fourth web panels 32A, 32B are folded, along with the third and fourth inner corner panels 30A, 30B, about fold lines 19, 37A, 37B. The second base panel 20 and third and fourth inner corner panels 30A, 30B are brought into

a face-to-face relationship with the second panel 16. The third and fourth web panels 32A, 32B are brought into face-to-face relationship with the respective one of the third and fourth outer corner panels 34A, 34B to which they are hingedly connected. The third and fourth web panels 32A, 32B are secured optionally to the respective one of the third and fourth outer corner panels 34A, 34B to which they are hingedly connected.

[0076] Glue or other adhesive treatment is applied to the third and fourth inner corner panels 30A, 30B and to the second base panel 20, as shown in Figure 2B. In other embodiments, the glue or other adhesive treatment may be applied to the distal portion 18B of the first base panel 18 and to the first and second corner securing panels 28A, 28B.

[0077] The second panel 16 is folded with respect to the first panel 14, about fold lines 15, 15B, as shown in Figure 3A to bring the second panel 16 into face-to-face relationship with the first panel 14. The third and fourth inner corner panels 30A, 30B are brought into face contacting relationship with respective ones of the first and second corner securing panels 28A, 28B. The third and fourth inner corner panels 30A, 30B are secured to said respective ones of the first and second corner securing panels 28A, 28B. The second base panel 20 is brought into face contacting relationship with distal portion 18B of the first base panel 18. The second base panel 20 is secured to the distal portion 18B of the first base panel 18.

[0078] Glue or other adhesive treatment is applied to the second panel 16 and to the fourth outer corner panel 34B. In other embodiments, the glue or other adhesive treatment may be applied to the securing panel 12 and the corner securing flap 12B.

[0079] The securing panel 12 and the corner securing flap 12B is folded with respect to the first panel 14, about fold lines 13, 13B, as shown in Figure 3B to bring the securing panel 12 into face contacting relationship with the second panel 16 and the corner securing flap 12B into face contacting relationship with the fourth outer corner panel 34B. The securing panel 12 is secured to the second panel 16 and the corner securing flap 12B is secured to the fourth outer corner panel 34B.

[0080] In this way a flat collapsed article carrier 90 is formed, the article carrier 90 can be erected or opened for loading with articles B, see Figure 4, and the end closure structure is automatically erected as a result.

[0081] The inner and outer corner panels 22A, 26A, 22B, 26B, 30A, 34A, 30B, 34B form a pyramidal structure at each end of the composite panel 18/20, best shown in Figure 5.

[0082] Referring now to Figures 6 to 8, there is shown an additional embodiment of the present disclosure.

[0083] Figure 6 illustrates a blank 110 comprising a plurality of main panels 112, 114, 116, 118, 120, 122, 124, hinged one to the next in series by a plurality of fold lines 113, 115, 117, 119, 121, 123, for forming a tubular structure.

[0084] A first main panel 114 for forming a securing

panel 112 of an article carrier 190 is hingedly connected to a second main panel 114 by a hinged connection in the form of a fold line 113. The second main panel 114 forms a first part of a first side wall 114/124 of the article carrier 190. A third main panel 116 for forming a front panel 116 of the article carrier 190 is hingedly connected to a second main panel 114 by a hinged connection in the form of a fold line 115. A fourth main panel 118 for forming a first part of a second side wall 118/120 of the article carrier 190 is hingedly connected to the third main panel 116 by a hinged connection in the form of a fold line 117. A fifth main panel 120 for forming a second part of the second side wall 118/120 of the article carrier 190 is hingedly connected to the fourth main panel 118 by a hinged connection in the form of a fold line 119. A sixth main panel 122 for forming a rear panel 122 of the article carrier 190 is hingedly connected to the fifth main panel 120 by a hinged connection in the form of a fold line 121. A seventh main panel 124 for forming a second part of the first side wall 114/124 of the article carrier 190 is hingedly connected to the sixth main panel 122 by a hinged connection in the form of a fold line 123. A glue region GR on the first main panel 114 is shown in Figure 6, for securing the seventh main panel 124 to the first main panel 114.

[0085] Fold lines 115 and 117 may be divergently arranged with respect to each other, fold lines 121 and 123 may be divergently arranged with respect to each other; in this way the front and rear panels 116, 122 may be generally trapezoidal in shape.

[0086] The blank 110 comprises end closure structures for closing each end of the tubular structure formed by the plurality of main panels 112, 114, 116, 118, 120, 122, 124. A first end closure structure forms a base of the article carrier 190, a second end closure structure forms a top or lid of the article carrier 190.

[0087] The first end closure structure comprises a first end closure panel 126 for forming a first base panel 126 hingedly connected, along a first side thereof, to the third main panel 116 (front panel 116) by a hinged connection in the form of a fold line 125. The end closure structure comprises a second end closure panel 128 for forming a second base panel 128 hingedly connected to the sixth main panel 122 (rear panel 126) by a hinged connection in the form of a fold line 127. The first and second end closure panels 126, 128 form first and second base panels 126, 128. A distal portion 128B of the second base panel 128, defined, at least in part, by a first hinged connection in the form of a fold line 131 extending across the second base panel 128 parallel to fold line 127, is configured to be disposed in face contacting relationship with the first base panel 126 to form a composite base panel 126/128. Glue regions GR are shown in Figure 6 on the distal portion 128B of the second base panel 128 for securing the first and second base panels 126, 128 together.

[0088] The distal portion 128B of the second base panel 128 comprises a free end edge opposing the fold line 131. The free end edge of the distal portion 128B of

the second base panel 128 may be non-parallel with the fold line 131 and/or with the fold line 127. The free end edge of the distal portion 128B of the second base panel 128 may be divergently arranged with respect to fold line 131 and/or fold line 127.

[0089] The first base panel 126 may be substantially hexagonal in shape. A plurality of flaps 136, 138A, 138B, 140A, 140B may be hingedly connected to edges of the first base panel 126 by respective hinged connections in the form of fold lines 135, 137A, 137B, 139A, 139B. A first flap 136 is hingedly connected to the first base panel 126 by a hinged connection in the form of a fold line 135. The first flap 136 is hinged to a second side of the first base panel 126, the second side opposes the first side along which the first base panel 126 is hinged to the front panel 116.

[0090] A second flap 138A is hingedly connected to the first base panel 126 by a hinged connection in the form of a fold line 137A. The second flap 138A is disposed adjacent to the first flap 136. A third flap 138B is hingedly connected to the first base panel 126 by a hinged connection in the form of a fold line 137B. The third flap 138B is disposed adjacent to the first flap 136 such that the first flap 136 is disposed between the second and third flaps 138A, 138B.

[0091] A fourth flap 140A is hingedly connected to the first base panel 126 by a hinged connection in the form of a fold line 139A. The fourth flap 140A is disposed adjacent to the second flap 138A such that the second flap 138A is disposed between the first and fourth flaps 136, 140A.

[0092] A fifth flap 140B is hingedly connected to the first base panel 126 by a hinged connection in the form of a fold line 139B. The fifth flap 140B is disposed adjacent to the third flap 138B such that the third flap 138B is disposed between the first and fifth flaps 136, 140A.

[0093] The fourth flap 140A and the fifth flap 140B may be substantially triangular in shape. The first, second and third flaps 136, 138A, 138B may be substantially rectangular in shape.

[0094] The second end closure structure comprises a top end closure panel 130 hingedly connected to the rear panel 122 by a hinged connection in the form of a fold line 129. Fold line 129 may be non-linear in shape and may be arcuate or curvilinear in shape. Fold line 129 may be shaped such that rear panel 122 appears convex when viewed from an external vantage point.

[0095] The top end closure panel 130 may comprise a first spout panel 142 struck therefrom and defined at least in part by a first pair of fold lines 141, 143. The first pair of fold lines 141, 143 extend inwardly from an edge of the top end closure panel 130 and are divergently arranged with respect to each other. The top end closure panel 130 may comprise a second spout panel 144 struck therefrom and hinged to the first spout panel 142. The second spout panel 144 is defined at least in part by a second pair of fold lines 143, 145. The first and second spout panels 142, 144 share a common fold line 143. The second pair of fold

lines 143, 145 extend inwardly from an edge of the top end closure panel 130 and are divergently arranged with respect to each other. Each of the first and second spout panels 142, 144 may be generally trapezoidal in shape. Each of the fold lines 141, 143, 145 may terminate at an aperture A3 struck from the top end closure panel 130. The top end closure panel 130 comprises a plurality of apertures A3, specifically, but not limited to three apertures A3. In other embodiments, the fold lines 141, 143, 145 may be arranged to intersect and define a vertex in the top end closure panel 130, in such embodiments the first and second spout panels 142, 144 may be generally triangular in shape.

[0096] The first spout panel 142 may comprise a first tab T1 hingedly connected to an edge of the first spout panel 142 extending between the first pair of fold lines 141, 143, by a hinged connection in the form of a fold line 147.

[0097] The second spout panel 144 may comprise a second tab T2 hingedly connected to an edge of the second spout panel 144 extending between the second pair of fold lines 143, 145, by a hinged connection in the form of a fold line 149. Fold lines 149 is divergently arranged with respect to fold line 147.

[0098] The rear panel 122 may comprise a plurality of apertures A3, specifically, but not limited to six apertures A3.

[0099] The front panel 116 may comprise at least one front aperture A4, in the illustrated embodiment the front aperture A4 extends across the width of the front panel 116 separating the front panel 116 into separate and spaced apart upper and lower portions. The front aperture A4 forms a window through which the interior of the article carrier 190 is visible or exposed to view. The front aperture A4 may be covered or closed with a transparent or translucent material to retain articles within the article carrier 190 whilst remaining visible.

[0100] The second end closure structure comprises a locking or securing device for securing the top end closure panel 130 in a closed position.

[0101] A first part of the locking device is provided by the top end closure panel 130, a second part of the locking device is provided by the front panel 116.

[0102] The first part of the locking device comprises a locking tab LT2 extending from the top end closure panel 130 and disposed in opposition to the hinged connection, fold line 129, between the top end closure panel 130 and the rear panel 122. The locking tab LT2 comprises a pair of lobes L3, L4 at opposed ends thereof. Each lobe L3, L4 is defined in part by a respective cutaway or recess R3, R4. Each lobe L3, L4 defines a shoulder or engaging edge portion for engaging with the front panel 116. The lobes L3, L4 define a waist locking tab LT2.

[0103] The second part of the locking device comprises a receiver, the receiver comprises a recess in the upper end of the front panel 116. The recess is defined, at least in part by a receiver tab 134 struck, at least in part, from the front panel 116 and hingedly con-

nected thereto by at least one fold line 135A, 135B. In the illustrated embodiment, a pair of fold lines 135A, 135B are spaced apart from each other by a cutline. The cutline may be generally "U" shaped to define a tab LT1 extending from the receiver tab 134.

[0104] The pair of fold lines 135A, 135B may be non-linear. The pair of fold lines 135A, 135B may be divergently arranged with respect to each other.

[0105] A non-linear cutline extends from each of the pair of fold lines 135A, 135B to a free upper edge of the front panel 116. The non-linear cutlines define opposed recesses R1, R2 and lobes L1, L2 on opposed side of the receiver recess defined by the receiver tab 134. The lobes L1, L2 define a waist or restriction in the receiver recess defined by the receiver tab 134. The lobes L1, L2 each provide an engaging edge for engaging an upper or outer surface of the top end closure panel 130 or locking tab LT2.

[0106] The receiver tab 134 when folded with respect to the front panel 116, about fold line 135A, 135B creates the receiver opening or recess into which the top end closure panel 130 or locking tab LT2 is inserted. The receiver tab 134 and tab LT1 are disposed in face-to-face relationship with the top end closure panel 130 or locking tab LT2.

[0107] Tab LT1 restricts or limits the extent of movement within which the receiver tab 134 is folded, and prevents or mitigates against the receiver tab 134 being folded through more than 90°.

[0108] The pair of fold lines 135A, 135B provide a support edge upon which the top end closure panel 130 or locking tab LT2 may rest.

[0109] The locking or securing device prevents or at least inhibits the top end closure panel 130 from unfolding and also prevents or at least inhibits movement of the front panel 116 towards or away from the rear panel 122.

[0110] The blank 110 is formed into a flat collapsed structure in which the first and second base panels 126, 128 are secured together and folded internally of the flat collapsed structure. The securing panel 112 is glued or adhesively secured to the seventh main panel 124.

[0111] When the flat collapsed tubular structure is erected the composite bottom panel 126/128 is automatically erected or folded into position closing the lower end of the tubular structure. The article carrier 190 can be loaded with articles through the open upper end.

[0112] The top end closure panel 130 can be folded with respect to the rear panel 122 to close the upper end, as shown in Figure 7. The receiver tab 134, which projects beyond the upper edge of the front panel 116 contacts the inner or lower surface top end closure panel 130 or locking tab LT2, the receiver tab 134 is folded internally and the tab LT1 is folded externally of the front panel 116, best shown in Figure 8. The locking tab LT2 is received in the receiver opening created when receiver tab 134 is folded. The top end closure panel 130 and/or locking tab LT2 pass the waist in the receiver opening, the receiver lobes L1, L2 engage an upper surface of top end closure

panel 130 or locking tab LT2 preventing or inhibiting inadvertent disengagement of the locking tab LT2 from the receiver.

[0113] The first and second spout panels 142, 144 can be folded upwardly, outwardly of the top end closure panel 130, to form an inverted "V" shape, as shown in Figure 9.

[0114] The front and rear panels 116, 122 can be squeezed or pressed towards each other, in doing so the second side wall 118/120 folds about fold line 119 to form a "V" shape opposing the inverted "V" shape of the first and second spout panels 142, 144. In this way the article carrier 190 forms a dispenser or pouring spout for dispensing the content of the article carrier 190. Tabs T1, T2 may facilitate access to the spout panels 142, 144 to pull the spout panels 142, 144 upwardly.

[0115] Figure 9 shows a spout structure in an expanded or erected form, the spout structure defines a pathway or conduit between the interior of the carrier 190 and the exterior of the carrier 190. The inner ends of the spout wall panels 142, 144 are brought to a position above the aperture A3 from which fold lines 141, 143, 145 extend which aperture forms an expansion device or element facilitating opening or expansion of the spout structure.

[0116] The present disclosure provides a carrier 90; 190 having a tubular structure and an end closure structure at at least one end for supporting articles B.

[0117] The present disclosure also provides a container or carrier 90; 190 comprising a tubular body formed in part from opposing front and rear panels 14, 16; 116, 122 and an end closure structure comprising a pair of primary end closure panels 18, 20; 130, 134 and at least one pyramidal structure associated with the primary end closure panels 18, 20; 130, 134. The pyramidal structure comprises a plurality of hinged panels 22A/26A/30B/34B, 22B/26B/30A/34A; 142/144/118/120.

[0118] The container or carrier 90; 190 may be collapsible into flat collapsed tubular condition, and may be erectable from the flat collapsed tubular condition to form the tubular body, the end closure structure may be configured to be automatically erectable to close the end of the tubular body when the container or carrier 90; 190 is erected to form the tubular body.

[0119] The container or carrier 90 may comprise a pair of pyramidal structures at each end of the primary end closure panels 18, 20. The pyramidal structure may be automatically erectable when the container or carrier 90; 190 is erected to form the tubular body.

[0120] The two pyramidal structures may maintain the end closure structure, composite bottom panel 18/20 in the closed or expanded position by an over-center or toggle-like action.

[0121] Each plurality of hinged panels 22A/26A/30B/34B, 22B/26B/30A/34A may comprise a pair of inner corner panels 22A/30B, 22B/30A disposed adjacent to each other. Each plurality of hinged panels

22A/26A/30B/34B, 22B/26B/30A/34A may comprise a pair of outer corner panels 26A/34B, 26B/34A disposed adjacent to each other.

[0122] A corner securing panel 28A, 28B may be provided hingedly connected to one of the panels of pair of inner corner panels 22A/30B, 22B/30A and secured in face contacting relationship with the other one of the panels of pair of inner corner panels 22A/30B, 22B/30A.

[0123] A first one of the panels of each pair of outer corner panels 26A/34B, 26B/34A is hingedly connected to a second one of the panels of said pair of outer corner panels 26A/34B, 26B/34A by a hinged connection. The hinged connection may be interrupted by a relief aperture A2

[0124] A corner securing flap 12B may be hingedly connected to one of the panels of pair of outer corner panels 26A/34B, 26B/34A and secured in face contacting relationship with the other one of the panels of pair of outer corner panels 26A/34B, 26B/34A.

[0125] Each plurality of hinged panels 22A/26A/30B/34B, 22B/26B/30A/34A is hingedly connected to one of the front and rear panels 14, 16 and to each of the pair of primary end closure panels 18, 20.

[0126] Each inner corner panel 22A, 30B, 22B, 30A may be hingedly connected to a respective one of the outer corner panels 26A, 34B, 26B, 34A by a web panel 24A, 32A, 24B, 32A.

[0127] Each inner corner panel 22A, 30B, 22B, 30A may share or define a common vertex with respective ones of the outer corner panels 26A, 34B, 26B, 34A and web panels 24A, 32A, 24B, 32A. The vertex may be interrupted by a relief aperture A1.

[0128] Each outer corner panel 26A, 34B, 26B, 34A may be hingedly connected to one of the front and rear panels 14, 16.

[0129] Each inner corner panel 22A, 30B, 22B, 30A may be hingedly connected to one of the pair of primary end closure panels 18, 20.

[0130] The present disclosure also provides a container or carrier 190 comprising a spout or dispenser structure comprising a plurality of hinged panels 142, 144 for defining a spout pathway. The hinged panels 142, 144 are defined at least in part by hinged connections or fold lines 141, 143, 145. The hinged panels 142, 144 are hingedly connected to an end closure panel 130 of the carrier 190 by two of said hinged connections 141, 143, 145. The hinged connections 141, 143, 145 extend from an expansion element A3. The expansion element A3 may be provided by any one of a cutaway, an opening, an aperture, a slot, a slit, a cut, and a perforation. The expansion element A3 is provided in the end closure panel 130 such that inner ends of the hinged panels 142, 144 are movable to a location over the expansion element when the spout is erected.

[0131] Inner ends of the spout wall panels (hinged panels 142, 144) define part of the expansion element.

[0132] The end closure panel 130 may comprise one or more weakening elements such as additional openings

A3, one or more slits, one or more fold lines, or combinations of said features to create a weakened area of the end closure panel 130. The weakened area may facilitate erection of the spout structure.

[0133] 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 shoulder panels may be omitted.

[0134] It will be recognized that as used herein, directional references such as "top", "bottom", "base", "front", "back", "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.

[0135] As used herein, the terms "hinged connection" and "fold line" refer to all manner of lines that define hinge features of the blank, facilitate folding portions of the blank with respect to one another, or otherwise indicate optimal panel folding locations for the blank. Any reference to "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 be 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.

[0136] 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 cutline, a line of aligned slits, a line of scores and any combination of the aforesaid options.

[0137] It should be understood that hinged connections and fold lines can each include elements that are formed in the substrate of the blank including perforations, a line of perforations, a line of short slits, a line of half-cuts, a single half-cut, a cutline, an interrupted cutline, slits, scores, embossed lines, debossed lines, any combination thereof, and the like. The elements 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 and/or a severance line. The line of perforations can be designed to facilitate folding and

resist breaking, to facilitate folding and facilitate breaking with more effort, or to facilitate breaking with little effort.

[0138] The phrase "in registry with" as used herein refers to the alignment of two or more elements in an erected carton, such as an aperture formed in a first of two overlapping panels and a second aperture formed in a second of two overlapping panels. Those elements in registry with each other may be aligned with each other in the direction of the thickness of the overlapping panels. For example, when an aperture in a first panel is "in registry with" a second aperture in a second panel that is placed in an overlapping arrangement with the first panel, an edge of the aperture may extend along at least a portion of an edge of the second aperture and may be aligned, in the direction of the thickness of the first and second panels, with the second aperture.

Claims

1. An article carrier comprising a tubular body formed in part from opposing front and rear panels and an end closure structure comprising a pair of primary end closure panels and at least one pyramidal structure associated with the primary end closure panels, wherein the at least one pyramidal structure comprises a plurality of hinged panels.
2. An article carrier according to claim 1, wherein the article carrier is collapsible into a flat collapsed form, and is erectable from the flat collapsed form into an expanded tubular form, the end closure structure is configured to be automatically erectable to close an end of the tubular body when the article carrier is erected into the expanded tubular form.
3. An article carrier according to claim 1, wherein the at least one pyramidal structure comprises a pair of pyramidal structures at opposite ends of the pair of primary end closure panels.
4. An article carrier according to claim 2, wherein the at least one pyramidal structure is automatically erectable when the article carrier is erected into the expanded tubular form.
5. An article carrier according to claim 1, wherein the at least one pyramidal structure employs an over-center mechanism whereby maintains the end closure structure, in an expanded, closing position.
6. An article carrier according to claim 1, wherein the plurality of hinged panels of the at least one pyramidal structure comprises a pair of inner corner panels disposed adjacent to each other.
7. An article carrier according to claim 6, wherein the plurality of hinged panels comprises a pair of outer

corner panels disposed adjacent to each other.

8. An article carrier according to claim 7, wherein a first one of the outer corner panels is hingedly connected to a second one of the outer corner panels by a hinged connection.
9. An article carrier according to claim 8, wherein the hinged connection may be interrupted by a relief aperture.
10. An article carrier according to claim 8, wherein a corner securing flap is hingedly connected to one of the inner corner panels and is secured in face contacting relationship with the other one of the inner corner panels.
11. An article carrier according to claim 1, wherein the plurality of hinged panels of the at least one pyramidal structure is hingedly connected to each of the front and rear panels and to each of the pair of primary end closure panels.
12. An article carrier according to claim 7, wherein each of the inner corner panels is hingedly connected to a respective one of the outer corner panels by a web panel.
13. An article carrier according to claim 12, wherein each of the inner corner panels defines a common vertex with respective ones of the outer corner panels and web panels.
14. An article carrier according to claim 13, wherein the vertex is interrupted by a relief aperture.
15. An article carrier comprising a spout structure comprising a plurality of hinged panels for defining a spout pathway, the hinged panels being defined at least in part by hinge lines, the hinged panels being hingedly connected to an end closure panel by at least two of said hinge lines, wherein the hinge lines extend from an expansion element, the expansion element provided in the end closure panel such that inner ends of the hinged panels are movable to a location over the expansion element when the spout structure is erected.
16. An article carrier according to claim 17, wherein the expansion element is provided by one selected from the group consisting of a cutaway, an opening, an aperture, a slot, a slit, a cut and a perforation.
17. An article carrier according to claim 17, wherein inner ends of the hinged panels define part of the expansion element.
18. An article carrier according to claim 17, wherein the

end closure panel comprises one or more weakening elements to create a weakened area of the end closure panel, wherein the one or more weakening elements comprises one or more features selected from the following group of features: additional openings, slits, fold lines. 5

19. A blank for forming an article carrier, the blank comprising a plurality of panels for forming a tubular body including front and rear panels, a pair of end closure panels for forming an end closure structure, and plurality of hinged panels for forming at least one pyramidal structure associated with the end closure panels. 10

20. A blank according to claim 19, wherein the plurality of hinged panels for provide a spout structure defining a spout pathway, the hinged panels being defined at least in part by hinge lines, the hinged panels being hingedly connected to one of the pair of end closure panels by at least two of said hinge lines, wherein the hinge lines extend from an expansion element provided in the one of the pair of end closure panels, wherein in a set-up article carrier, inner ends of the hinged panels are movable to a location over the expansion element when the spout structure is erected. 15 20 25

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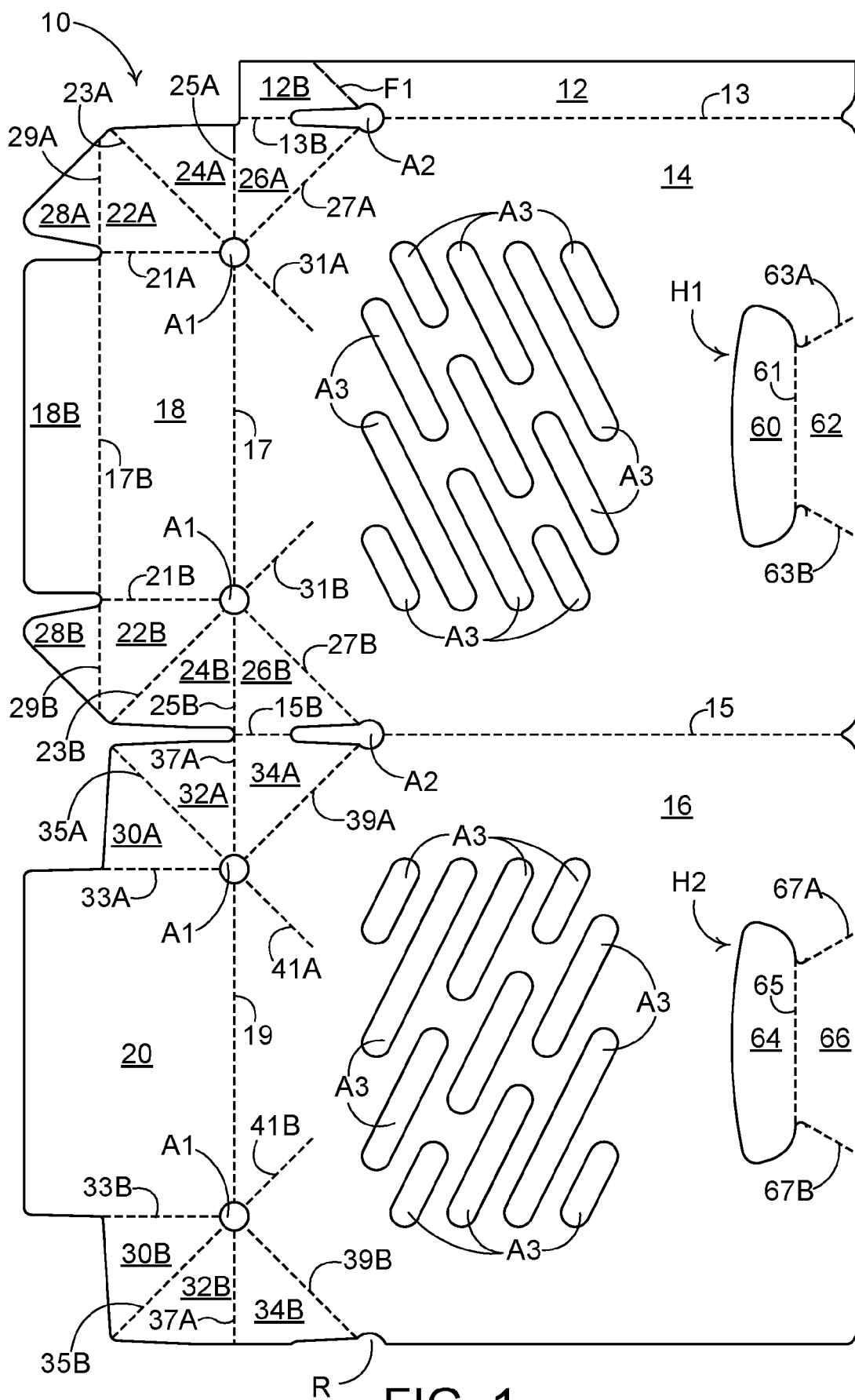


FIG. 1

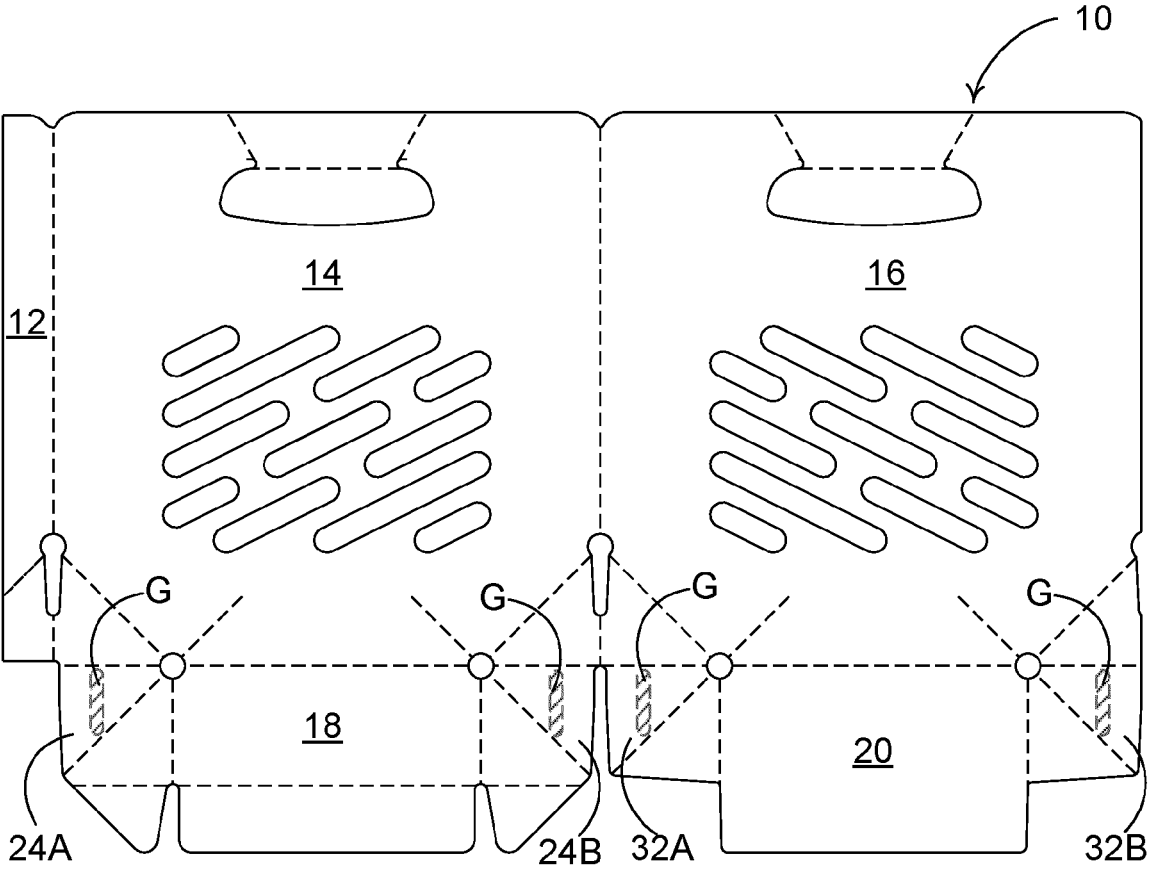


FIG. 2A

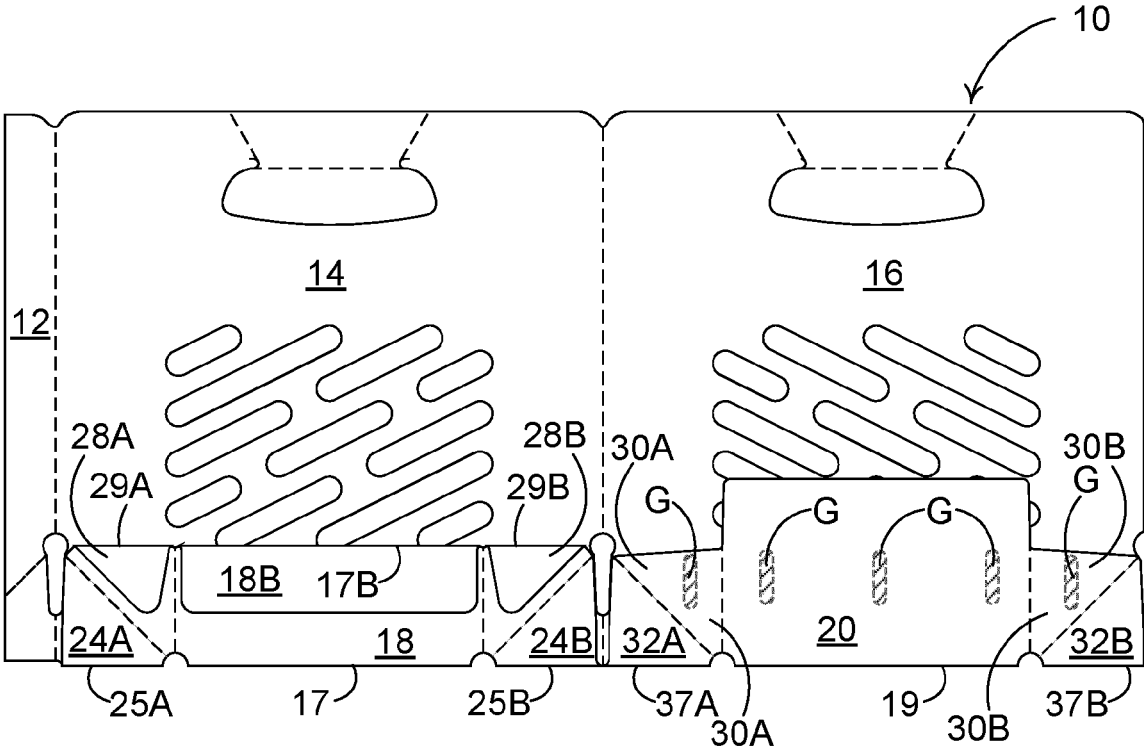


FIG. 2B

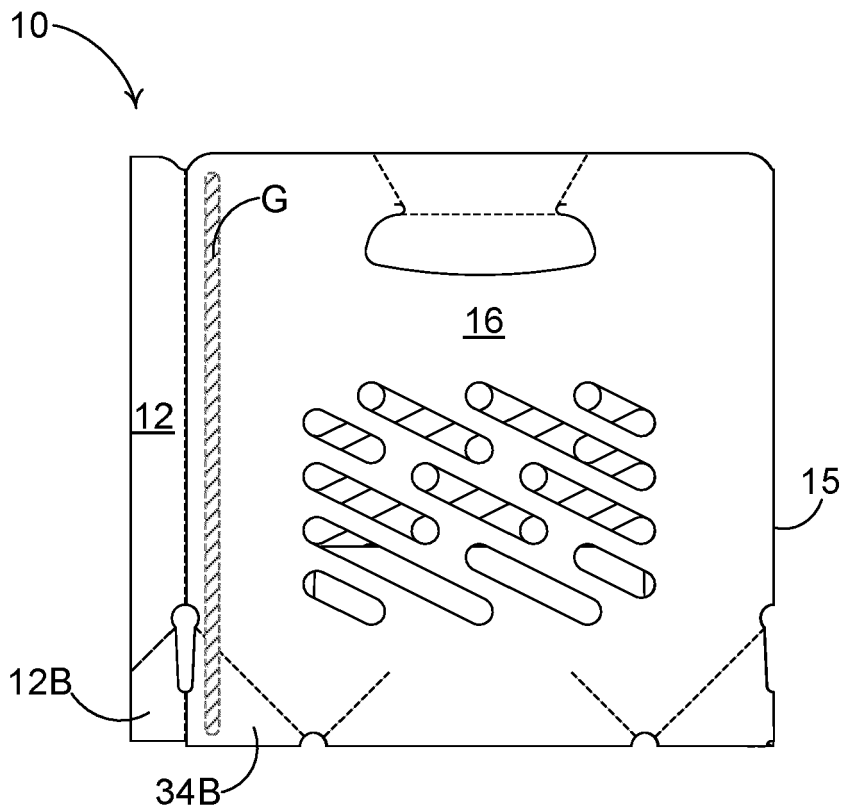


FIG. 3A

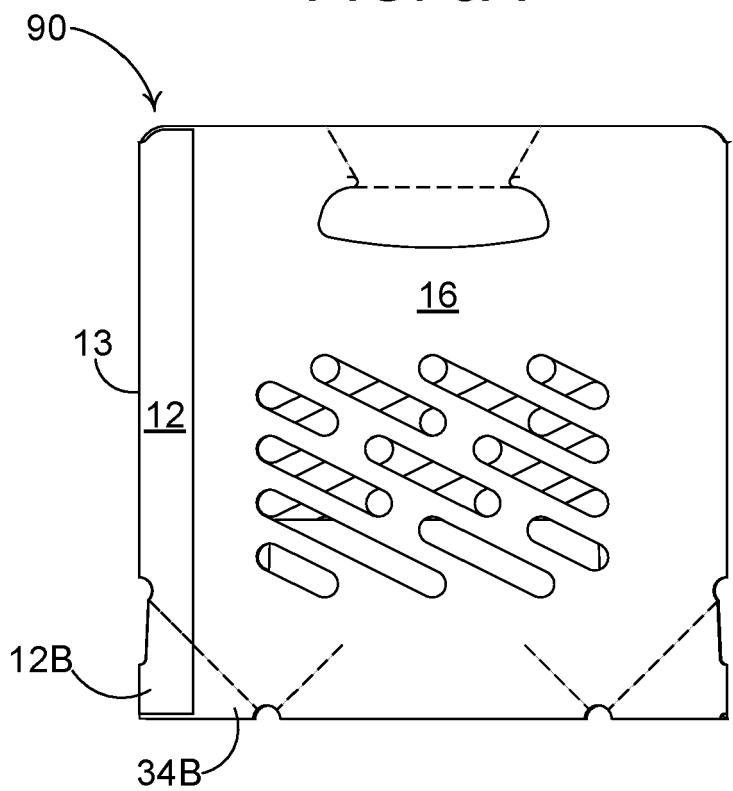


FIG. 3B

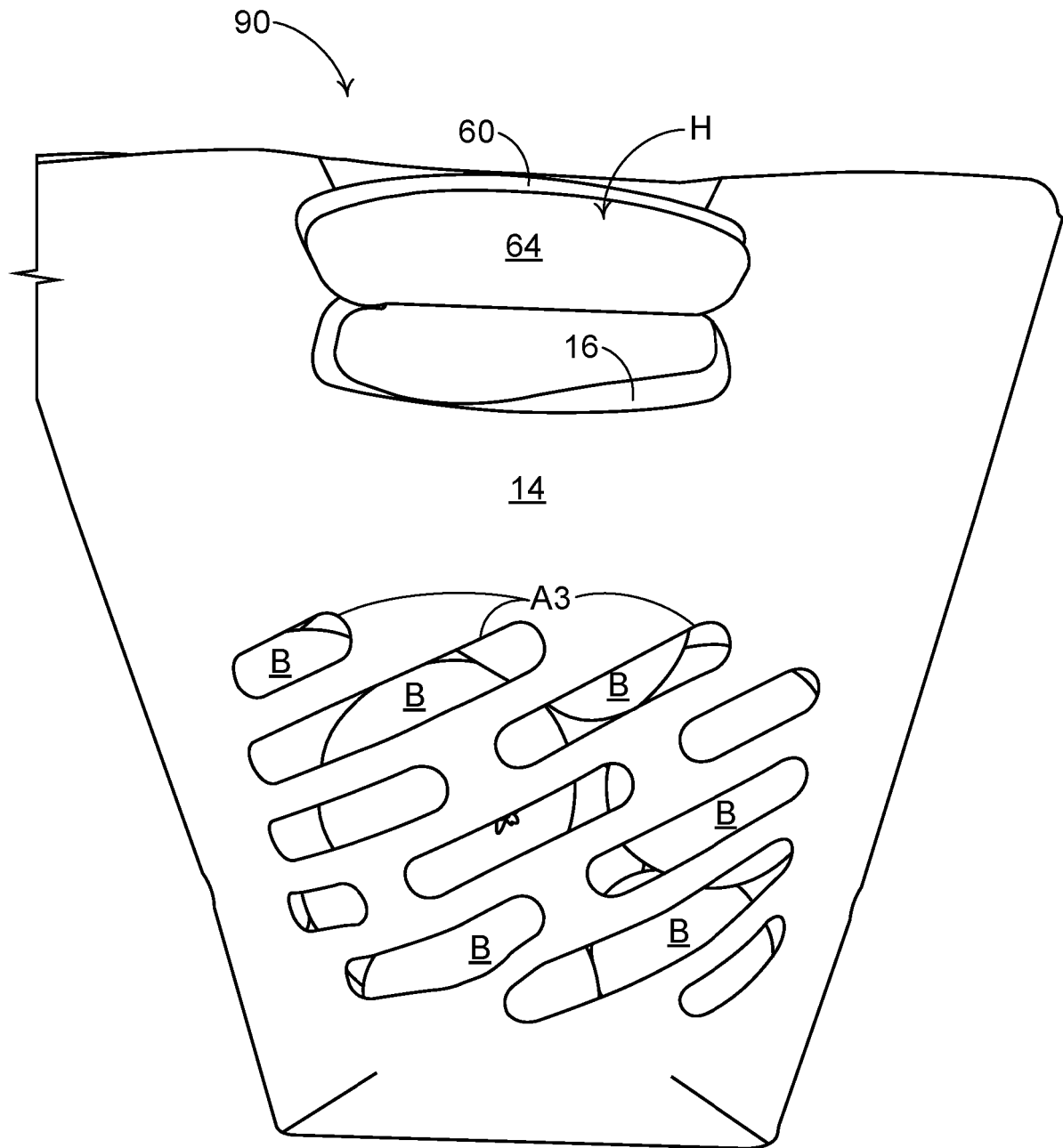


FIG. 4

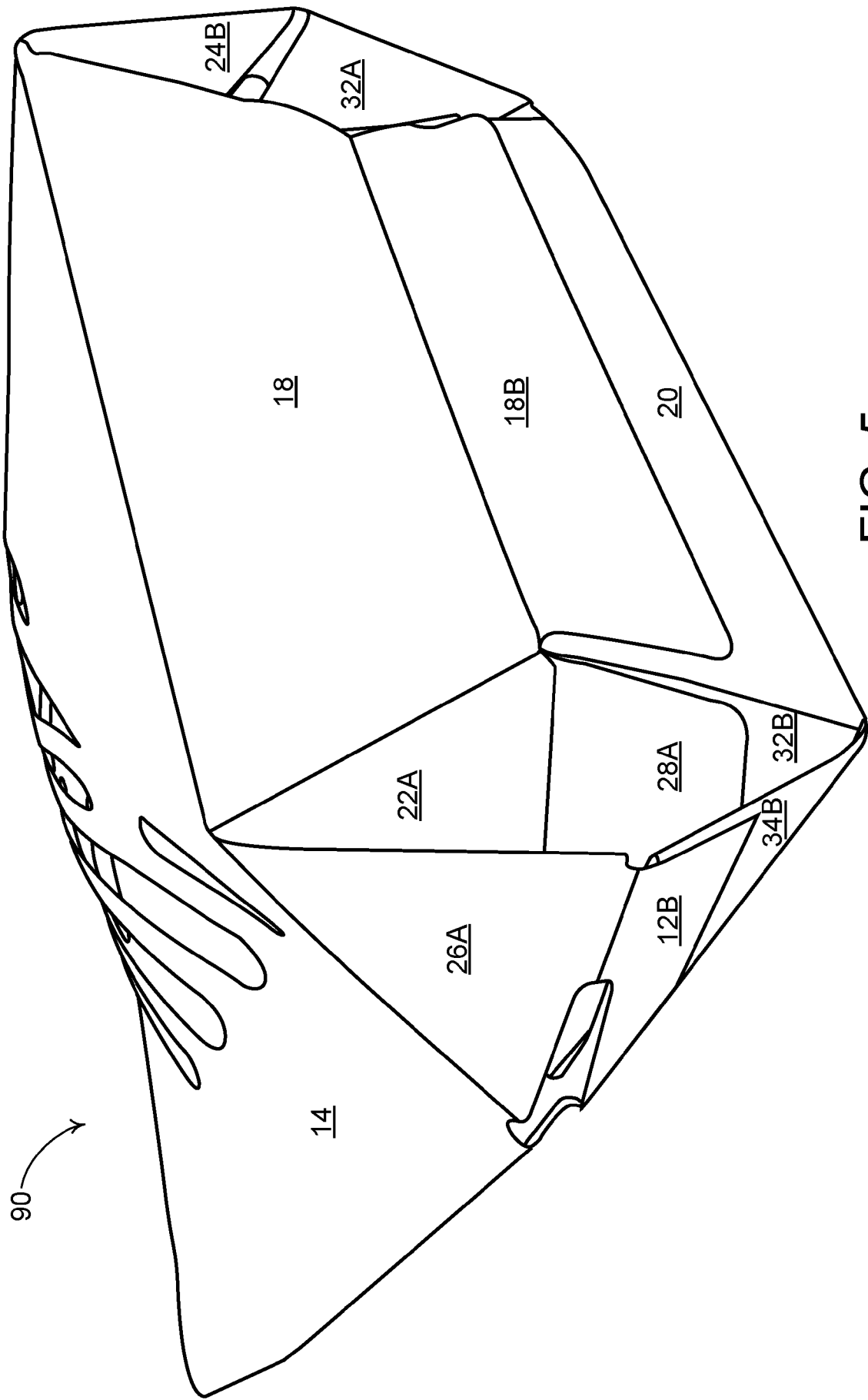


FIG. 5

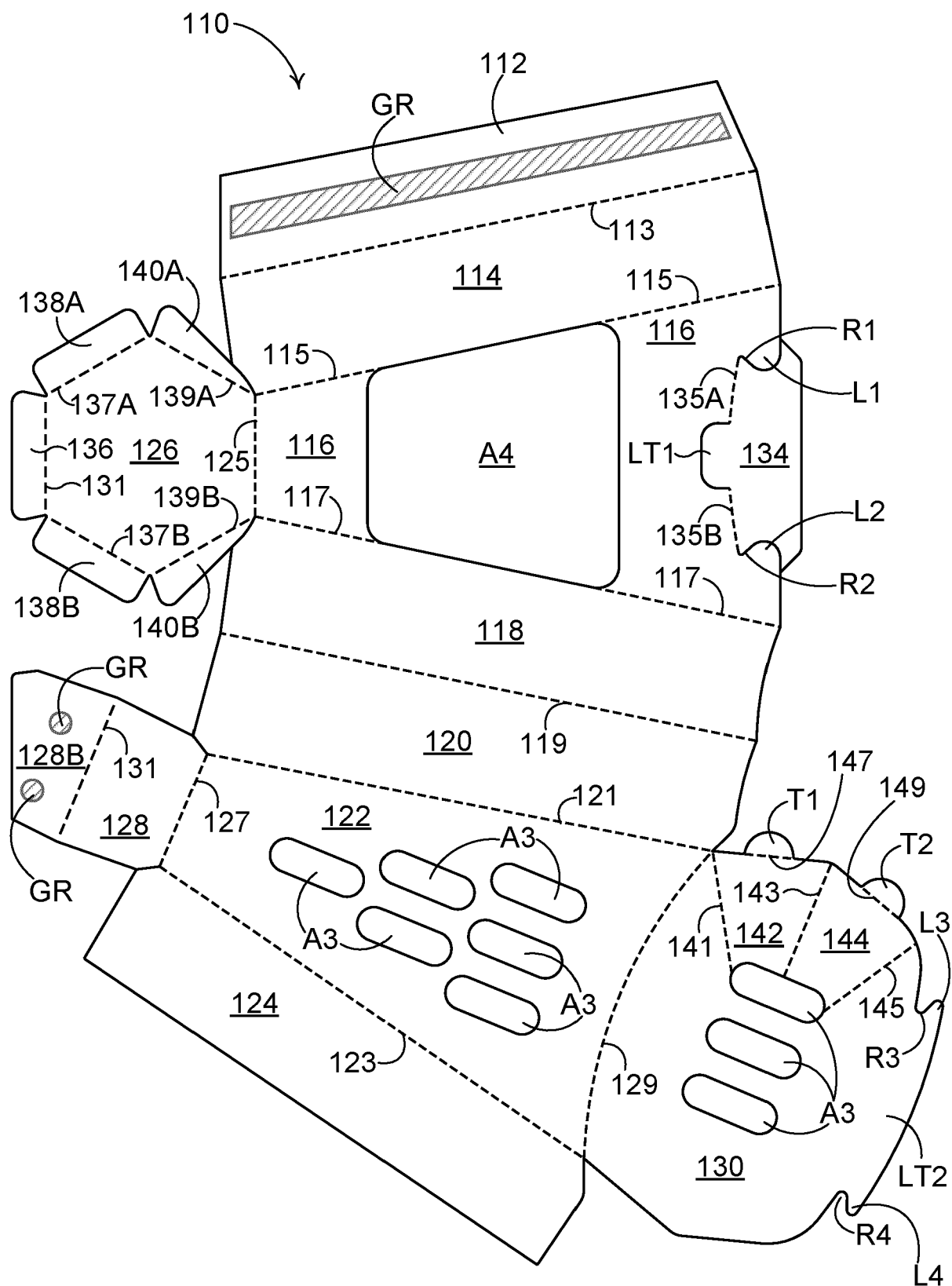


FIG. 6

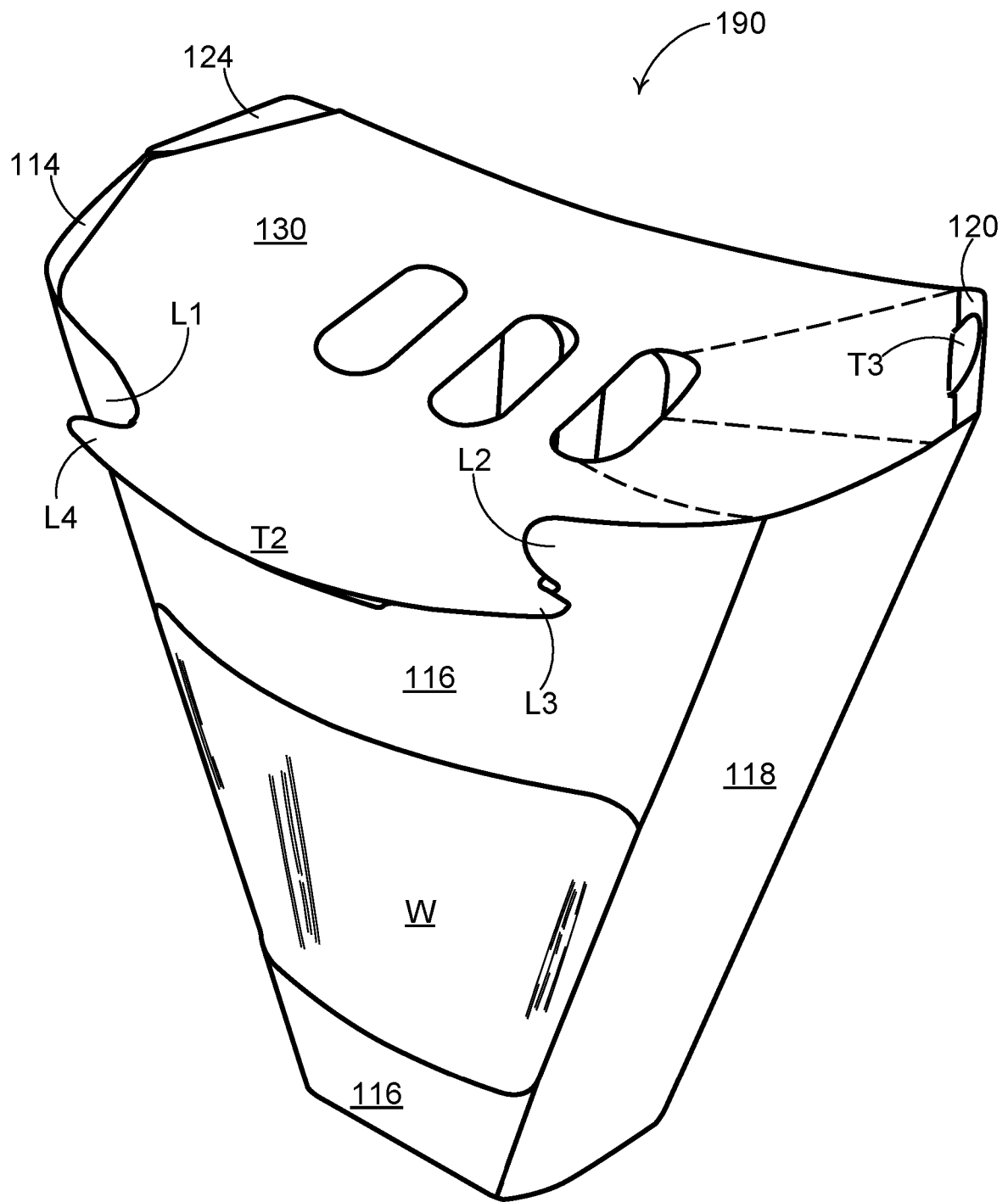


FIG. 7

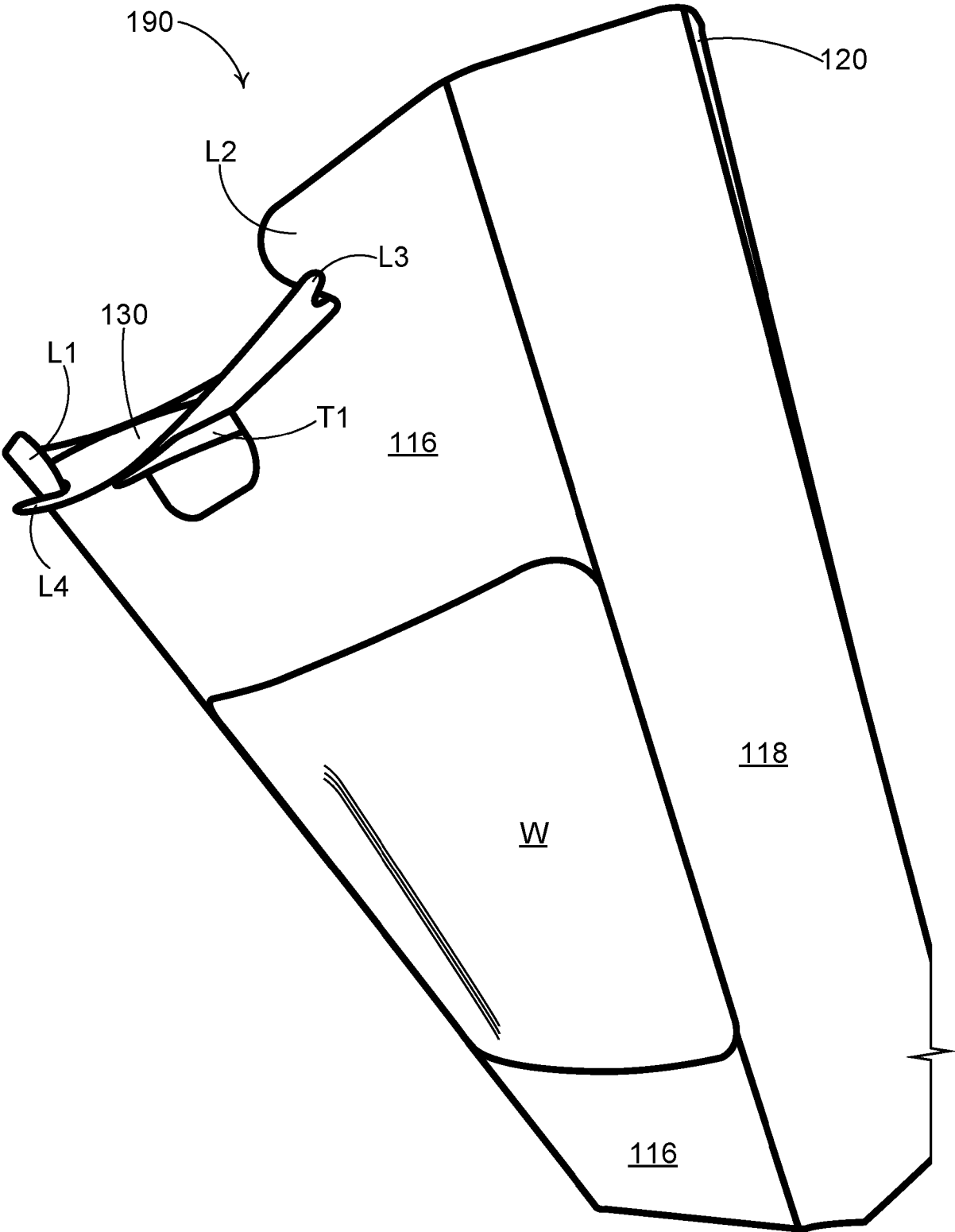


FIG. 8

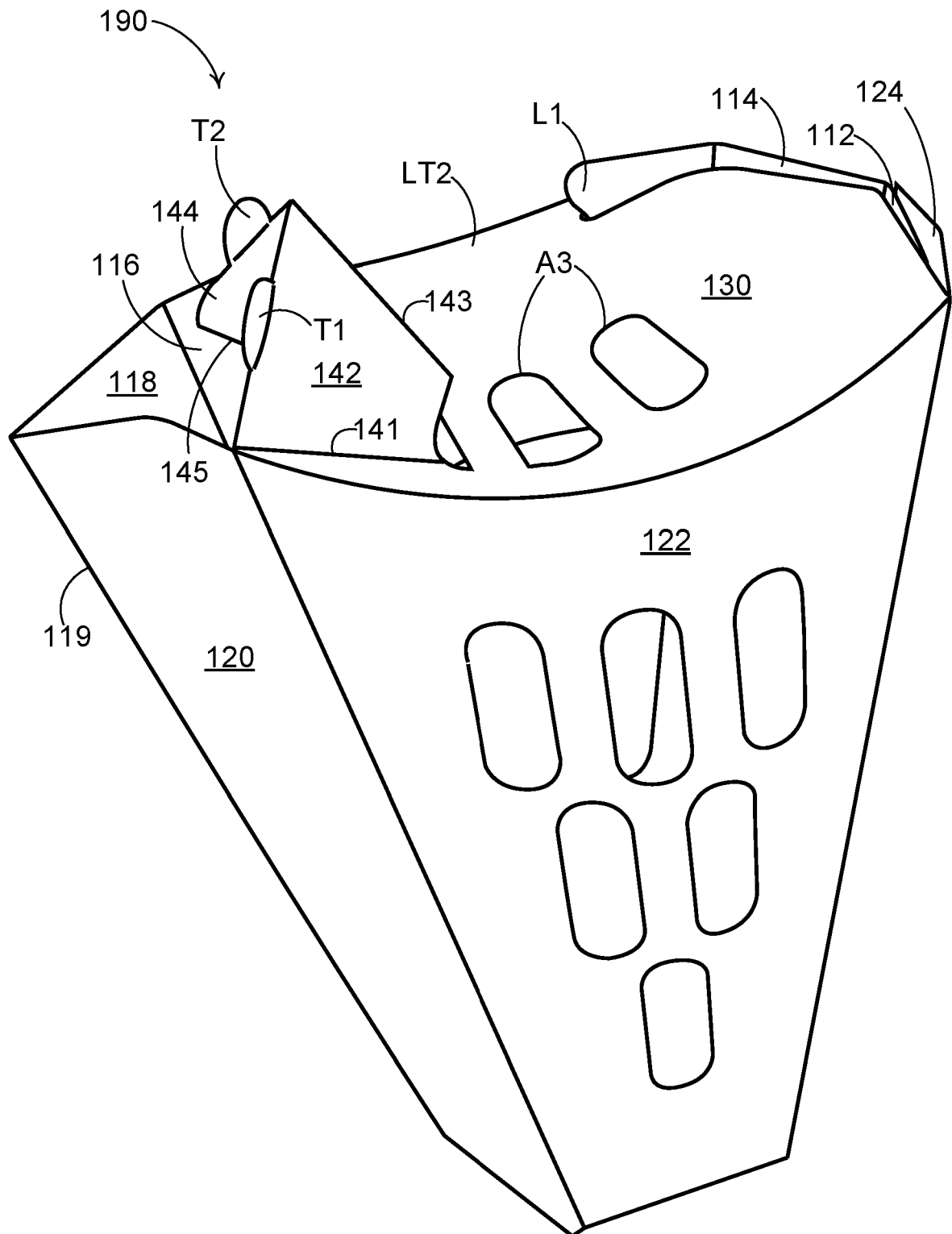


FIG. 9