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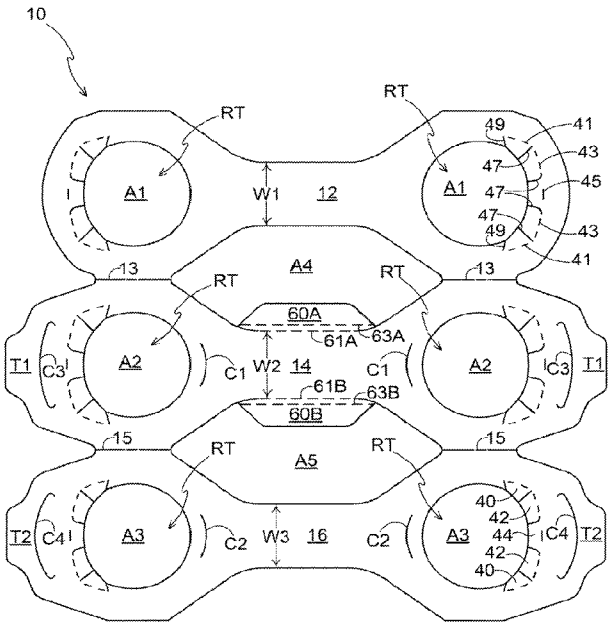


FIG. 1

(57) Abstract: Aspects of the disclosure relate to a packaging system, method of packaging, apparatus, handle structure, an article carrier (90) for packaging a plurality of articles (B), and to a blank (10; 110; 210; 410; 510; 610; 710) for forming the handle structure or article carrier (90). The packaging system provides an apparatus (1000) for applying the handle structure or article carrier (90) to one of more articles (B). The apparatus (1000) provides component (1020; 1120) adapted to engage the handle structure or article carrier (90) so as to displace a first side of the handle structure or article carrier (90), disposed on a first side of an article retention structure RT to a greater extent than a second side of the handle structure or article carrier (90), disposed on a second, opposing, side of an article retention structure RT.

[Continued on next page]

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PACKAGING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to and the benefit of U.S. Provisional Application No. 63/289,191, filed December 14, 2021, the entire contents of which is herein incorporated by reference in its entirety.

TECHNICAL FIELD

The present invention relates to a packaging system, to an apparatus, to a method for forming handle structures, to article carriers and to blanks for forming the same. More specifically, but not exclusively, the invention relates to an apparatus for applying a carrier of the top gripping style to one, two or more articles to provide a carrying handle for transportation of the articles.

BACKGROUND

In the field of packaging, it is known to provide article carriers or 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.

It is an object of the present invention to provide a carrier having a carrying handle to enable two or more articles to be transported; in particular for large, or heavy articles.

It is another object of the present invention to provide a system and apparatus for automatically applying a carrier to at least one article.

The present invention seeks to provide an improvement in the field of packaging apparatus and cartons, typically formed from paperboard or the like.

SUMMARY

An aspect of the invention provides a method of packaging at least one article comprising;

applying an article carrier to at least one article with an applicator comprising:

displacing a first side of a primary panel from a planar condition by a first distance;

displacing a second opposing side of a primary panel from the planar condition by a second distance, wherein the second distance is less than the first distance;

engaging the article carrier with at least one article;

receiving the at least one article in an opening in the primary panel.

Another aspect of the invention provides a method of packaging at least one article comprising:

engaging an article carrier with an applicator;

bringing a first limb of the applicator into contact with a first side of a primary panel of the article carrier and applying a force to the first side of a primary panel of the article carrier, adjacent to an article retention structure comprising an opening for receiving the at least one article, so as to displace the first side of a primary panel from a planar condition by a first distance;

bringing a second limb of the applicator into contact with a second, opposing, side of a primary panel of the article carrier and applying a force to the second side of a primary panel of the article carrier, adjacent to an article retention structure comprising an opening for receiving the at least one article, so as to displace the second side of a primary panel from a planar condition by a second distance, wherein the second distance is less than the first distance.

bringing the article carrier into contact with at least one article;

receiving the at least one article in the opening in the primary panel.

Optionally, the method of packaging further comprises folding one or more engaging teeth outwardly of the primary panel to engage a flange of the at least one article.

Optionally, the one or more engaging teeth are disposed about an end edge of the opening adjacent to the first and second sides.

Optionally, the one or more engaging teeth are folded between a pair of spaced apart limbs each of which is in contact with one of the first and second sides of the primary panel.

A further aspect of the invention provides a method of packaging at least one article comprising;

bringing an article carrier into contact with at least one article;

applying a force to a first side of a primary panel of the article carrier, adjacent to an article retention structure comprising an opening for receiving the at least one article;

receiving a first side of the at least one article in the opening adjacent to the first side of the primary panel;

applying a force to a second, opposing, side of the primary panel of the article carrier, adjacent to an article retention structure comprising an opening for receiving the at least one article;

receiving a second, opposing, side of the at least one article in the opening adjacent to the second side of the primary panel.

Optionally, the method of packaging further comprises folding one or more engaging teeth outwardly of the primary panel to engage a flange of the at least one article.

Optionally, the one or more engaging teeth are disposed about an end edge of the opening adjacent to the first and second sides.

Optionally, the one or more engaging teeth are folded between a pair of spaced apart limbs each of which is in contact with one of the first and second sides of the primary panel.

Still another aspect of the invention provides a component for an applicator device. The component comprises a first limb having a first end and a second, opposing, end disposed a first distance from the first end. The first end provides a first abutment surface. The component comprises a second limb having a first end and a second, opposing, end disposed a second distance from the first end. The first end provides a second abutment surface. The first limb is spaced apart from the second limb and the second distance is less than the first distance.

Yet another aspect of the invention provides an apparatus for forming a package. The apparatus includes an applicator comprising an applicator plate for engaging an article carrier. The applicator plate has a component mounted thereto that comprises a first limb having a first end and a second, opposing, end disposed a first distance from the first end. The first end provides a first abutment surface. The component comprises a second limb having a first end and a second, opposing, end disposed a second distance from the first end. The first end provides a second abutment surface. The first limb is spaced apart from the second limb and the second distance is less than the first distance.

Still yet another aspect of the invention provides a bushing for mounting in an opening of an applicator device. The bushing comprises an annular wall having opposed ends. A first end provides a pair of spaced apart abutment regions diametrically opposed to each other. A first one of the abutment regions is disposed a first distance from the second end of the annular wall. The second end of the annular wall opposes the first end. A second one of the abutment regions is disposed a second distance from the second end of the annular wall. The second distance is less than the first distance.

An aspect of the invention provides an apparatus for forming a package. The apparatus comprises an applicator including an applicator plate for engaging an article carrier. The applicator plate has at least one aperture and a bushing mounted in the at least one aperture. The bushing comprises an annular wall having opposed ends. A first end provides a pair of spaced apart abutment regions diametrically opposed to each other. A first one of the abutment regions is disposed a first distance from the second end of the annular wall. The second end of the annular wall opposes the first end. A second one of the abutment regions is disposed a second distance from the second end of the annular wall. The second distance is less than the first distance.

Optionally, the bushing comprises a saddle disposed between the pair of abutment regions comprising a recess defining at least in part void for receiving a portion of an article carrier.

Optionally, the apparatus further comprises an engagement device for holding at least one article carrier in engagement with the applicator plate.

Optionally, the engagement device comprises a vacuum system.

Optionally, the saddle is defined by portions of the annular wall disposed between the pair of abutment regions and wherein said portions of the of the annular wall are chamfered.

Optionally, the saddle is defined by portions of the annular wall disposed between the pair of abutment regions and wherein said portions of the of the annular wall are filleted.

Optionally, the saddle is defined by portions of the annular wall disposed between the pair of abutment regions and wherein said portions of the of the annular wall are inclined with respect to surfaces of the pair of abutment regions.

An aspect of the invention provides an article carrier for packaging a plurality of articles. The article carrier comprises at least one primary panel forming a handle structure. The at least one primary panel comprises a handle portion and at least one article retention structure for engaging an article so as to provide a top gripping article carrier. The at least one article retention structure comprises a receiving opening having a boundary including a first edge and second opposing edge. The second edge is defined by a series of distal ends of the engaging teeth providing engaging edges thereof. The first edge is arranged to be closer to the handle portion than the second edge. The first edge is curved such that the centre of curvature of the first edge is located closer to the second edge than to the first edge. The boundary further includes a pair of third and fourth opposing edges which continuously connect the first and second edges such that each of the third and fourth edges provides a smooth transition between the first and second edges.

Optionally, the radius of curvature of the first edge is less than the radius of curvature of the second edge.

Optionally, the article carrier comprises a release device, the release device may comprise a pull tab.

Optionally, the release device comprises a cut disposed between the pull tab and the receiving opening of the at least one article retention structure.

Optionally, the release device comprises a cut disposed on an outer side of the top-receiving opening.

Optionally, the cut is arcuate.

Optionally, the article carrier comprises a relief device, the relief device includes a relief cut, the relief cut being arcuate, the relief cut is disposed between the handle portion and the receiving opening of the at least one article retention structure.

Optionally, the relief cut is disposed on an inner side of the receiving opening, the inner side of the receiving opening opposes the outer side.

Optionally, the article carrier is formed from at least two layers of sheet material in face contacting arrangement, the at least two layers of sheet material includes a first layer and a second layer, the first

layer is greater in a longitudinal dimension than the second layer to provide an accessing tab at an end of the first layer projecting outwards beyond the adjacent end of the second layer.

Another aspect of the invention provides an article carrier for packaging a plurality of articles. The article carrier comprises at least one primary panel forming a handle structure. The at least one primary panel comprises a handle portion and at least one article retention structure for engaging an article so as to provide a top gripping article carrier. The at least one article retention structure comprises a top-receiving opening. The article carrier comprises a release device including a pull tab and cut. The cut is disposed between the pull tab and the top-receiving opening of the at least one article retention structure.

Optionally, the cut is disposed on an outer side of the top-receiving opening.

Optionally, the cut is curvilinear.

Yet another aspect of the invention provides an article carrier for packaging a plurality of articles. The article carrier comprises at least one primary panel forming a handle structure. The at least one primary panel comprises a handle portion and at least one article retention structure for engaging an article so as to provide a top gripping article carrier. The at least one article retention structure comprises a top-receiving opening. The article carrier comprises a relief device, the relief device comprising a relief cut. The relief cut is disposed between the handle portion and the top-receiving opening of the at least one article retention structure.

Optionally, the relief cut is disposed on an inner side of the top-receiving opening.

Optionally, the relief cut is curved.

Still yet another aspect of the invention provides an article carrier for packaging a plurality of articles. The article carrier comprises at least one primary panel and a top engaging feature, including a top-receiving opening, in the at least one primary panel. The top engaging feature comprises a series of engaging tabs disposed along an outer section of the perimeter of the top-receiving opening. The outer section generally opposes an inner section adjacent to the handle portion of the at least one primary panel. The radius of curvature of the inner section of the top-receiving opening perimeter is less than the radius of the curvature of the outer section defined by distal ends of the engaging tabs. The distal ends of the engaging tabs provide engaging edges for engaging with an article.

A further aspect of the invention provides a top engaging article carrier for packaging a plurality of articles. The article carrier comprises a pair of engaging portions and a handle portion bridging between the engaging portions. The article carrier is formed from at least two layers of sheet material in face contacting arrangement. The at least two layers of sheet material includes a first layer and a second layer. The first layer is greater in a longitudinal dimension than the second layer to provide an accessing tab at an end of the first layer projecting outwards beyond the adjacent end of the second layer.

Optionally, the at least two layers of sheet material are secured together.

Optionally, the at least two layers of sheet material are secured together by glue or other adhesive treatment.

Optionally, the at least two layers of sheet material are secured together by mechanical fasteners.

Optionally, the mechanical fasteners are provided by article retention structures in each of the at least two layers of sheet material and disposed in vertical registry with each other, the at least two layers of sheet material being secured together when an article is received in the article retention structure in each of the at least two layers of sheet material.

Yet a further aspect of the invention provides an article carrier comprising a primary panel having top engaging feature including a top-receiving opening and a series of engaging tabs disposed along an outer section of the top-receiving opening perimeter. The series of engaging tabs includes a pair of end tabs at each end of the series. Each of the end tabs is defined in part by a tear stopper.

Optionally, the tear stopper takes the form of cutaway selected from the following group of cutaways: a recess and a "J" shaped cut line.

Still yet a further aspect of the invention provides an article carrier comprising a primary panel having a top engaging feature comprising a top-receiving opening and a series of engaging tabs disposed along an outer section of the opening perimeter. At least one medial tab is adjoined at its proximal end by an accessing feature which may be employed by a user to disengage the top engaging feature from the associated article.

Another aspect of the invention provides an article carrier comprising a primary panel having a top engaging feature comprising a top-receiving opening and a series of engaging tabs. A first one of the series of engaging tabs is hinged to the primary panel by a first fold line. A second one of the series of engaging tabs is hinged to the primary panel by a second fold line. The first and second fold lines define an obtuse angle therebetween.

Optionally, the obtuse angle is in the range 115° to 135°.

Optionally, the obtuse angle about 125°.

Optionally, the first fold line defines an angle of about 20° with respect to a first notional line, the first notional line is parallel to the longitudinal axis of the primary panel.

Optionally, the second fold line defines an angle of about 15° with respect to a second notional line, second notional line is perpendicular to the first notional line.

A further aspect of the invention provides a blank for forming an article carrier. The blank comprises at least one primary panel for forming a handle structure. The at least one primary panel comprises a handle portion and at least one article retention structure for engaging an article so as to provide a top gripping article carrier. The at least one article retention structure comprises a receiving opening having a boundary including a first edge and second opposing edge. The second edge is defined by a series of

distal ends of the engaging teeth providing engaging edges thereof. The first edge is arranged to be closer to the handle portion than the second edge. The first edge is curved such that the centre of curvature of the first edge is located closer to the second edge than to the first edge. The boundary further includes a pair of third and fourth opposing edges which continuously connect the first and second edges such that each of the third and fourth edges provides a smooth transition between the first and second edges.

Still another aspect of the invention provides a blank for forming an article carrier, the blank comprises at least one primary panel forming a handle structure. The at least one primary panel comprises a handle portion and at least one article retention structure for engaging an article so as to provide a top gripping article carrier. The at least one article retention structure comprises a top-receiving opening. The blank comprises a release device including a pull tab and cut. The cut is disposed between the pull tab and the top-receiving opening of the at least one article retention structure.

Still a further aspect of the invention provides a blank for forming an article carrier. The blank comprises at least one primary panel forming a handle structure. The at least one primary panel comprises a handle portion and at least one article retention structure for engaging an article so as to provide a top gripping article carrier. The at least one article retention structure comprises a top-receiving opening. The blank comprises a relief device. The relief device comprises a relief cut. The relief cut is disposed between the handle portion and the top-receiving opening of the at least one article retention structure.

Yet still a further aspect of the invention provides a blank for forming an article carrier. The blank comprises at least one primary panel and a top engaging feature, including a top-receiving opening, in the at least one primary panel. The top engaging feature comprises a series of engaging tabs disposed along an outer section of the perimeter of the top-receiving opening. The outer section generally opposes an inner section adjacent to the handle portion of the at least one primary panel. The radius of curvature of the inner section of the top-receiving opening perimeter is less than the radius of the curvature of the outer section defined by distal ends of the engaging tabs. The distal ends of the engaging tabs providing engaging edges for engaging with an article.

Another aspect of the invention provides a blank for forming a top engaging article carrier. The blank comprises at least two panels for providing respective layers of sheet material disposed in face contacting arrangement in a setup carrier. The at least two panels provides a first layer and a second layer. Each of the at least two panels comprises a pair of engaging portions and a handle portion bridging between the engaging portions. The panel providing the first layer is greater in a longitudinal dimension than the panel providing second layer so as to provide an accessing tab at an end of the first layer projecting outwards beyond the adjacent end of the second layer.

Still another aspect of the invention provides a blank for forming an article carrier. The blank comprises a primary panel having a top engaging feature comprising a top-receiving opening and a series of engaging tabs disposed along an outer section of the top-receiving opening perimeter. The series of engaging tabs includes a pair of end tabs at each end of the series. Each of the end tabs is defined in part by a tear stopper.

A further aspect of the invention provides a blank for forming an article carrier. The blank comprises a primary panel having a top engaging feature including a top-receiving opening and a series of engaging tabs disposed along an outer section of the opening perimeter. At least one medial tab is adjoined at its proximal end by an accessing feature which may be employed by a user in a setup carrier to disengage the top engaging feature from the associated article.

Yet still a further aspect of the invention provides a blank for forming an article carrier. The blank comprises a primary panel having a top engaging feature comprising a top-receiving opening and a series of engaging tabs. A first one of the series of engaging tabs is hinged to the primary panel by a first fold line. A second one of the series of engaging tabs is hinged to the primary panel by a second fold line. The first and second fold lines define an obtuse angle therebetween.

Yet further aspect of the invention provides a package. The package comprises at least one article and an article carrier. The article carrier comprises at least one primary panel forming a handle structure. The at least one primary panel comprises a handle portion and at least one article retention structure in engagement with the at least one article. The at least one article retention structure comprises a receiving opening having a boundary including a first edge and second opposing edge. The second edge is defined by a series of distal ends of engaging teeth providing engaging edges which are in engagement with the at least one article below a radially protruding portion of the at least one article. The first edge is arranged to be closer to the handle portion than the second edge. The boundary further includes a pair of third and fourth opposing edges which continuously connect the first and second edges. The third and fourth edges are spaced apart such that the maximum distance therebetween is less than the lateral dimension of the radially protruding portion of the at least one article.

In the package of the above aspect, each of the first, second, third and fourth edges may be curved such that each of the third and fourth edges provides a smooth transition between the first and second edges. Optionally, the first edge may be curved such that the centre of curvature of the first edge is located closer to the second edge than to the first edge. In the same optional arrangement, the radius of curvature of the first edge may be less than the radius of curvature of the second edge. The at least one article may be at least one bottle having a neck flange, the radially protruding portion may be the neck flange of the at least one bottle, and the lateral dimension may be the diameter of the neck flange.

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

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.

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.

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

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 a carrier according to certain embodiments of the invention;

Figure 1B is an enlarged view of a portion of the blank of Figure 1;

Figure 1C is a plan view from above of the blank of Figure 1 in a folded condition showing the position of the panels relative to each other;

Figure 1D is a schematic side view of a portion of the carrier showing engagement tabs in an engaging position;

Figure 2 is a perspective view of a carton formed from the blank of Figure 1;

Figures 3, 4, and 5 are alternative perspective views of the carton of Figure 2;

Figure 6 is a plan view from above of a blank for forming a carrier according to certain embodiments of the invention;

Figure 7 is a plan view from above of a blank for forming a carrier according to certain embodiments of the invention;

Figure 8 is an enlarged plan view of a portion of a blank for forming a carrier according to certain embodiments of the invention;

Figure 9 is a plan view from above of a blank for forming a carrier according to certain embodiments of the invention;

Figure 10 is a plan view from above of a blank for forming a carrier according to certain embodiments of the invention;

Figure 11 is a plan view from above of a blank for forming a carrier according to certain embodiments of the invention;

Figures 12 and 13 illustrate an apparatus for applying the blanks according to various embodiments to a group of articles;

Figure 14 is an isometric view from below illustrating a component forming part of the apparatus of Figures 12 and 13;

Figure 15 is an enlarged view of a portion of the apparatus shown in Figure 13;

Figure 16 schematically illustrates application of a blank according to embodiments of the present disclosure to a group of articles;

Figure 16B schematically illustrates an alternative component for application of a blank according to embodiments of the present disclosure; and

Figure 17 is a plan view from below illustrating a component for forming part of an apparatus according to embodiments of the present disclosure.

DETAILED DESCRIPTION

Detailed descriptions of specific examples of a packaging system, method and apparatus, handle structures, packages, 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 packaging system, method and apparatus, handle structures, 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 minimised 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.

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 2 to 5, for carrying a group of primary products such as, but not limited to, bottles, hereinafter referred to as articles. The blank 10 forms a secondary package or handle structure for packaging at least one primary product container or package. Alternative blanks 110, 210, 410, 510, 610, 710 are shown in Figures 6 to 11 for forming alternative carriers (not shown).

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 90 for engaging and carrying articles, such as primary 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. Other exemplary containers include bottles (for example metallic, glass or plastics bottles), cans (for example aluminium cans), tins, pouches, packets and the like.

The blanks 10; 110; 210; 410; 510; 610; 710 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 recognised that one or other numbers of blanks may be employed, where suitable, for example, to provide the carrier structure described in more detail below.

The packaging structure or carton 90 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. 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 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, good glue-ability, heat sealability, or other desired functional properties.

In the illustrated examples, the blanks 10; 110; 210; 410; 510; 610; 710 are configured to form a carton or carrier 90 for packaging an exemplary arrangement of exemplary articles. In the illustrated examples the arrangement is an m × n matrix or array, having one rows (m=1) and two columns (n=2); in the illustrated example one rows of two articles are provided, and the articles are 2.84L bottles, the bottles may be formed from a suitable material such as, but not limited to, glass, Aluminium or PET (polyester - polyethylene terephthalate). Alternatively, the blanks 10; 110; 210; 410; 510; 610; 710 can be configured to form a carrier for packaging other types, number and size of articles and/or for packaging

articles in a different arrangement or configuration for example, but not limited to, fully enclosed cartons or wrap-around carriers, the articles may be cups, pouches, pots or cans.

Turning to Figure 1, there is illustrated a blank 10 for forming a carton 90 (see Figures 2 to 4). The blank 10 comprises a plurality of panels 12, 14, 16 arranged in a linear series hinged one to the next by fold lines 13, 15 respectively.

The plurality of main panels 12, 14, 16 form a top engaging carrier or handle structure. The plurality of panels 12, 14, 16 comprises a first panel 12, a second panel 14, and a third panel 16. The second panel 14 is hingedly connected to the first panel 12 by a hinged connection in the form of a fold line 13. The third panel 16 is hingedly connected to the second panel 14 by a hinged connection in the form of a fold line 15.

The second panel 14 forms an upper or outer panel 14, the third panel 16 forms a lower or inner panel 16 and the first panel 12 forms an intermediate panel 12 disposed between the second panel 14 and the third panel 16.

Each of the main panels 12, 14, 16 may be generally bow-tie shaped, that is to say the main panels 12, 14, 16 comprises a waisted intermediate portion disposed or bridging between opposed flared, widened, or bulbous end portions.

Intermediate portions of each of the main panels 12, 14, 16 provide or define a handle portion.

The intermediate portion of the first panel 12 comprises a first width or lateral dimension W1. The intermediate portion of the second panel 14 comprises a second width or lateral dimension W2. The intermediate portion of the third panel 16 comprises a third width or lateral dimension W3.

The intermediate portion of the first panel 12 is separated from the intermediate portion of the second panel 14 by an aperture A4. The intermediate portion of the second panel 14 is separated from the intermediate portion of the third panel 16 by an aperture A5.

The first and third width dimensions W1, W3 may be equal to or less than the second width dimension W2. The first and third width dimensions W1, W3 may be equal to each other. In some embodiments, the third width dimension W3 may be less than the first width dimension W1.

The second or upper panel 14 may comprise a pair of opposed handle flaps 60A, 60B hinged to opposing side edges of the intermediate portion of the second or upper panel 14 by respective hinged connections in the form of fold lines 61A, 61B.

Each of the handle flaps 60A, 60B may comprise a second fold line 63A, 63B, the second fold lines 63A, 63B may facilitate folding of the handle flaps 60A, 60B about the intermediate and lower panels 12, 16 to be in face-to-face relationship with the lower panel 16.

Each of the main panels 12, 14, 16 comprises at least one at least one article retention structure RT. The main panels 12, 14, 16 comprises a plurality of article retention structures RT, specifically two article

retention structures RT arranged in 1 × 2 matrix or array. Each of the article retention structures RT comprises an opening or aperture A1, A2, A3.

The article retention structures RT comprises a toothed region defined by a plurality of teeth or tabs 40, 42, 44 and a tooth free or toothless region. The toothed region is disposed in closer proximity to end edges of the main panels 12, 14, 16 than the toothless region.

The toothed region comprises five teeth or engaging tabs 40, 42, 44. A central engaging tab 44 lies on a notional line extending longitudinally of the main panel 12, 14, 16 and passing through the centre of the aperture A1, A2, A3. The toothed region comprises a pair of outer engaging tabs 40 defining a boundary between the toothed and toothless regions. The toothed region comprises an intermediate engaging tab 42 disposed between the central engaging tab 44 and a respective one of the outer engaging tabs 40.

The central engaging tab 44 is hinged to the main panel 12, 14, 16 by a hinged connection defined in part by a cut line 45, the hinged connection and/or cut line 45 lie on a notional transverse line y-y.

The intermediate engaging tabs 42 are hinged to the main panel 12, 14, 16 by a hinged connection defined in part by a pair of cut lines 43, the hinged connection and/or cut lines 43 lie on a first notional line n1.

The outer engaging tabs 40 are hinged to the main panel 12, 14, 16 by a hinged connection defined in part by a pair of cut lines 41, the hinged connection and/or cut lines 41 lie on a second notional line n2.

The second notional line n2 is oriented at a non-zero angle with respect to the first notional line n1. The second notional line n2 may be obliquely oriented with respect to the first notional line n1. The second notional line n2 is oriented at an angle θ with respect to the first notional line n1, the angle θ may be obtuse and may be in the range 115° to 135° and optionally may be about 125°.

The hinged connection and/or cut lines 41 may be oriented at an angle of about 20° with respect to a notional longitudinal line x-x. The notional longitudinal line x-x is oriented perpendicularly with respect to the notional transverse line y-y. The notional longitudinal line x-x is parallel with a longitudinal axis of the main panel 12, 14, 16.

The hinged connection and/or cut lines 43 may be oriented at an angle of about 15° with respect to the notional transverse line y-y.

The toothless region may be defined by a cutline 53, cut line 53 may define a portion of a circle having a first centre C_e1 and a first radius r1.

The plurality of teeth 40, 42, 44 each comprise a free engaging edge substantially defining a portion of a notional circle NC. The notional circle NC comprises a second centre C_e2 and a second radius r2.

The second radius r2 is greater than the first radius r1. The second centre C_e2 is offset longitudinally from the first centre C_e1. The second centre C_e2 is disposed in closer proximity to the intermediate portion than the first centre C_e1.

The central engaging tab 44 may be defined, at least in part, by a pair of first cut lines 47. Each of the pair of first cut lines 47, or at least a portion thereof, may lie upon a radial line passing through the second centre C_e2 of the notional circle NC. The pair of first cut lines 47 may be substantially "J" shaped.

The outer engaging tabs 40 are defined, at least in part, by a second cut line 51 and a third cut line 49. The second cut line 51 and a third cut line 49 are divergently arranged with respect to each other such that the outer engaging tabs 40 taper or narrow towards their free engaging edge. The third cut line 49 is shorter in length than the second cut line 51. In some embodiments, the third cut line 49 may comprise a tear stopper, the third cut line 49 may terminate with a non-linear portion such as but not limited to a "J" or "C" shaped cutline portion. This is best shown in Figure 8 wherein the third cut line 449 comprises a tear stopper, wherein the third cut line 449 terminates with a "J" shaped cutline portion. In other embodiments, the tear stopper may take the form of a recess or cutaway providing a transition between the aperture A1, A2, A3 and a respective one of the outer engaging tabs 40.

The second cut line 51 is divergently arranged with respect to a radial line passing through the second centre C_e2 of the notional circle NC and the vertex or intersection between the second cut line 51 and the cutline defining the free engaging edges of the plurality of teeth 40, 42, 44.

The third cut line 53 is divergently arranged with respect to a radial line passing through the second centre C_e2 of the notional circle NC and the vertex or intersection between the third cut line 53 and the cutline defining the free engaging edges of the plurality of teeth 40, 42, 44.

Figure 1C shows the blank 10 in a folded condition, the position of the first panel 12 and third panel 16 has been superimposed on the second panel 14. An article retention structure RT in the second or upper panel 14 is in vertical alignment with article retention structures RT in the first and third panels 12, 16. The engaging tabs 40, 42, 44 of the article retention structure RT in the second panel 14 are longer or greater in height than the engaging tabs 40, 42, 44 of the article retention structure RT in the first or intermediate panel 12. The engaging tabs 40, 42, 44 of the article retention structure RT in the first panel 12 are longer or greater in height than the engaging tabs 40, 42, 44 of the article retention structure RT in the third or lower panel 16.

Figure 1D schematically illustrates the engaging tab 44 of the article retention structure RT in the first, second, and third panels 12, 14, 16 in a folded condition. The set of teeth or tabs 40, 42, 44 in each layer is shorter than set of teeth or tabs 40, 42, 44 in the layer above.

The hinged connections F1 of the set of teeth or tabs 40, 42, 44 in the upper layer 14 is offset with respect to the hinged connections F2 of the set of teeth or tabs 40, 42, 44 in the intermediate layer 12

below. The hinged connections F2 of the set of teeth or tabs 40, 42, 44 in the intermediate layer 12 is offset with respect to the hinged connections F3 of the set of teeth or tabs 40, 42, 44 in the lower layer 16 below.

The offset relationship between the hinged connections or fold line of the tabs 40, 42, 44 in subsequent layers may facilitate easier engagement of the article retention structure RT or carrier 90 with an article B. The first or uppermost layer of tabs 40, 42, 44 engages the article B while the subsequent layers reinforce the first or uppermost layer of tabs 40, 42, 44.

The hinged connections F1 of the engaging tabs 40, 42, 44 of the article retention structure RT in the second or upper panel 14 are offset with respect to the hinged connections F2 of the engaging tabs 40, 42, 44 of the article retention structure RT in the first or intermediate panel 12.

The hinged connections F2 of the engaging tabs 40, 42, 44 of the article retention structure RT in the first or intermediate panel 12 are offset with respect to the hinged connections F3 of the engaging tabs 40, 42, 44 of the article retention structure RT in the third or lower panel 16.

The article retention structures RT in the second panel 14 may comprise a first relief cut C1. The first relief cut C1 may comprise a circumferential cut line about a portion of the toothless region and spaced apart from the cut line 53 defining the toothless region about the aperture A2.

The second panel 14 may comprise at least one first relief cut C1, the second panel 14 may comprise a pair of first relief cuts C1. The second panel 14 may comprise a first relief cut C1 arranged to extend partially about the aperture A2 or each article retention structure RT provided therein.

The first relief cuts C1 may be non-linear in shape and may be arcuate in shape. The first relief cuts C1 are spaced apart from the cut line 53 defining the aperture A2. The first relief cuts C1, when circular in shape, may have a radius of curvature greater than the radius of curvature of the cut line 53, and may be concentrically arranged with respect to the cut line 53.

Each of the first relief cuts C1 may be disposed between the aperture A2 and the intermediate or waisted portion of the second panel 14.

The article retention structures RT in the third panel 16 may comprise a second relief cut C2. The second relief cut C2 may comprise a circumferential cut line about a portion of the toothless region and spaced apart from the cut line 53 defining the toothless region about the aperture A3.

The third panel 16 may comprise at least one second relief cut C2, the third panel 16 may comprise a pair of second relief cuts C2. The third panel 16 may comprise a second relief cut C2 arranged to extend partially about the aperture A3 or each article retention structure RT provided therein.

The second relief cuts C2 may be non-linear in shape and may be arcuate in shape. The second relief cuts C2 are spaced apart from the cut line 53 defining the aperture A3. The second relief cuts C2,

when circular in shape, may have a radius of curvature greater than the radius of curvature of the cut line 53, and may be concentrically arranged with respect to the cut line 53.

Each of the second relief cuts C2 may be disposed between the aperture A3 and the intermediate or waisted portion of the third panel 16.

The relief cuts C1, C2 may improve or increase the flexibility of the article carrier 90 when using the handle H to remove the package from a shelf or storage device. The relief cuts C1, C2 may allow the article carrier 90 to flex, deform, or bend whilst preventing or inhibiting disengagement of the article retention structures RT from the article B, particularly the inner or toothless edge E1.

The second panel 14 and/or the third panel 16 may comprise a pull tab T1, T2 at each end thereof. The pull tab T1, T2 may be defined by a tapered tongue portion integral with respective one of the second and third panels 14, 16. The pull tab T1, T2 forms a release feature to enable a consumer or user to release the article B being packaged from the article carrier 90.

Each release feature may comprise a control cut C3, C4 defined in the second panel 14 and/or the third panel 16. A first control cut C3 in the second panel 14 may define, at least in part, a first or upper pull tab T1. A second control cut C4 in the third panel 16 may define, at least in part, a second or lower pull tab T2.

The first control cuts C3 may be non-linear in shaped and may comprise an arcuate cut line terminated at each end with a “C” shaped cut.

The second control cuts C4 may be non-linear in shaped and may comprise an arcuate cut line terminated at each end with a “C” shaped cut. The arcuate cut line of the first control cuts C3 may comprise a larger radius of curvature than the arcuate cut line of the second control cuts C4.

The first and second control cuts C3, C4 may facilitate release of the article carrier 90 from the articles B. The first and second control cuts C3, C4 may direct or distribute pull forces towards the sides or marginal regions of the main panel 14, 16 about the article retention structures RT.

The second panel 12 comprises an end edge which terminates in closer proximity to the article retention structures RT than the first and second control cuts C3, C4. In some embodiments, the second panel 12 may be increased in length and may comprise additional control cuts in the region of the first and second control cuts C3, C4.

The blank 10 is foldable to form a package 90 as illustrated in Figures 4 and 5.

Turning to the construction of the article carrier 90 as illustrated in Figures 2, 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.

The first panel 12 is folded, with respect to the second panel 14 about fold line 13, to be brought into face contacting relationship therewith.

The third panel 16 is folded, with respect to the second panel 14 about fold line 15, to be brought into face contacting relationship with the first panel 12.

Once the carrier 90 is erected, the carrier 90 may be loaded with a group of articles B; in the example illustrated in Figures 2, 3 and 4, two articles B are arranged in a 1 × 2 matrix or array.

The group of articles B may be loaded through the third panel 16, and subsequently through the first and second panels 12, 14. Upper portions of the articles B, the upper portion may include a cap or end closure C, are inserted into the carrier 90, each article retention structure RT receives a portion of a respective article B. The teeth 40, 42, 44 are displaced upwardly. The teeth 40, 42, 44 engage an article below a flange F (see Figures 3 and 4), projection, under cut or other suitable feature of the article B or its end closure C.

Referring now to Figures 6, 7 and 9 to 11, there are shown additional examples according to the present disclosure. In the second and third illustrated examples, like numerals have, where possible, been used to denote like parts, albeit with the addition of the prefix “100”, “400”, “500”, “600”, “700” to indicate that these features belong to the different examples described, respectively. The additional examples share many common features with the first example and therefore only the differences from the example illustrated in Figures 1 to 5 will be described in detail.

Turning to Figure 6, there is illustrated a blank 110 for forming a carrier (not shown). The blank 110 comprises a main panel 112.

The main panel 112 forms a top engaging carrier or handle structure.

The main panel 112 comprises at least one at least one article retention structure RT. The main panel 112 comprises a plurality of article retention structures RT, specifically two article retention structures RT arranged in 1 × 2 matrix or array. Each of the article retention structures RT comprises an opening or aperture A1. The article retention structures RT of Figure 6 are substantially similar in construction to the article retention structures RT of Figure 1 and will not be described in further detail.

The main panel 112 comprises a pair of opposed handle flaps 160A, 160B hinged to opposing side edges of an intermediate portion of the main panel 112 by respective hinged connections in the form of fold lines 161A, 161B.

The handle flaps 160A, 160B may be substantially trapezoidal in shape.

Each of the handle flaps 160A, 160B defines, at least in part, a recess in a side edge of the main panel 112. When the handle flaps 160A, 160B are in a folded condition the main panel may adopt a generally bow-tied shape. That is to say the main panel 112 comprises a waisted intermediate portion disposed the pair of opposed handle flaps 160A, 160B and the main panel 112 comprises opposed flared, widened, or bulbous end portions in which an article retention structure RT is provided.

The intermediate portion of the main panel 112 provides or defines a handle portion.

In the example illustrated in Figure 6, the pull tabs T1, T2 of the previous example have been omitted as have the control cuts C3, C4. In alternative embodiments, the main panel 112 may comprise pull tabs and/or control cuts C3, C4 substantially similar to those of described above and/or shown in Figure 1.

Turning to Figure 7, there is illustrated a blank 210 for forming a carrier (not shown). The blank 210 comprises a first main panel 212 and a second main panel 214.

The second main panel 214 is hingedly connected to the first main panel 212 by a hinged connection in the form of a fold line 213.

The first main panel 212 is substantially similar in construction to the main panel 112 of the example illustrated in Figure 6 and described with reference thereto.

The second main panel 214 is substantially similar in construction to the first main panel 212 albeit with the omission of the handle flaps 260A, 260B.

The intermediate portion of the first main panel 212 is separated from the intermediate portion of the second main panel 214 by an aperture A4. The aperture A4 interrupts the fold line 213. The aperture A4 is struck, at least in part, from material which would otherwise form the second main panel 214. Optionally, the aperture A4 may be struck, at least in part, from material which would otherwise form the first main panel 212.

The first main panel 212 comprises at least one at least one article retention structure RT. The first main panel 212 comprises a plurality of article retention structures RT, specifically two article retention structures RT arranged in 1 × 2 matrix or array. Each of the article retention structures RT comprises an opening or aperture A1. The article retention structures RT of Figure 6 are substantially similar in construction to the article retention structures RT of Figure 1 and will not be described in further detail.

The second main panel 214 comprises at least one at least one article retention structure RT. The second main panel 214 comprises a plurality of article retention structures RT, specifically two article retention structures RT arranged in 1 × 2 matrix or array. Each of the article retention structures RT comprises an opening or aperture A2. The article retention structures RT of Figure 6 are substantially similar in construction to the article retention structures RT of Figure 1 and will not be described in further detail.

Each article retention structure RT in the second main panel 214 is arranged to be disposed in vertical registry or alignment with a respective article retention structure RT in the first main panel 212 when the second main panel 214 is folded into face-to-face relationship with the first main panel 212. In this way the blank 210 forms a two-ply handle structure.

Referring to Figure 9 there is shown a blank 510 for forming a carrier. The blank 510 is substantially similar in construction to the blank of Figure 1 albeit with the inclusion of additional pull tabs T3, relief cuts C5, and control cuts C6.

The article retention structures RT in the first panel 512 comprise a third relief cut C5. The third relief cut C5 may comprise a circumferential cut line about a portion of the toothless region and spaced apart from the cut line 553 defining the toothless region about the aperture A1.

The first panel 512 may comprise at least one third relief cut C5, the first panel 512 may comprise a pair of third relief cuts C5. The first panel 512 may comprise a third relief cut C5 arranged to extend partially about the aperture A1 or each article retention structure RT provided therein.

The third relief cuts C5 may be non-linear in shape and may be arcuate in shape. The third relief cuts C5, when circular in shape, may have a radius of curvature greater than the radius of curvature of the cut line 553, and may be concentrically arranged with respect to the cut line 553.

Each of the third relief cuts C5 may be disposed between the aperture A1 and the intermediate or waisted portion of the first panel 512.

The relief cuts C1, C2, C5 may improve or increase the flexibility of the article carrier when using the handle H to remove the package from a shelf or storage device. The relief cuts C1, C2, C5 may allow the article carrier to flex, deform, or bend whilst preventing or inhibiting disengagement of the article retention structures RT from the article B, particularly the inner or toothless edge.

The first panel 512 may comprise a pull tab T3 at each end thereof. The pull tab T3 may be defined by a tapered tongue portion integral with the first panel 512. The pull tab T3 forms a release feature to enable a consumer or user to release the article B being packaged from the article carrier.

Each release feature may comprise a control cut C6 defined in the first panel 512. A third control cut C6 in the first panel 512 may define, at least in part, a third or intermediate pull tab T3.

The first panel 512 may comprise a cutaway N_{CH} in the form of a recess or notch struck from a portion of the waisted intermediate portion. The cutaway N_{CH} may be struck from a side edge of the waisted intermediate portion of the first panel 512 facing towards the waisted intermediate portion of the second panel 514. The cutaway N_{CH} may be employed to control the orientation of the blank 510 during assembly of the blank510 into a carrier, and may be engaged by a tool, during application of glue and folding of the blank 510. In some embodiments, the cutaway N_{CH} may facilitate gluing of the upper layer, second panel 514 directly to the lower layer, third panel 516.

Referring to Figure 10 there is shown a blank 610 for forming a carrier. The blank 610 is substantially similar in construction to the blank 510 of Figure 9 albeit with the engaging teeth 540, 542, 544 have been omitted or removed from the article retention structures RT provided in the first panel 512. The article retention structures RT in the first panel 612 of Figure 10 each comprise a receiving opening configured and arranged to allow the engaging teeth 540, 542, 544 of the lower layer, third panel 616, to pass therethrough.

The hinged connections F1 of the set of teeth or tabs 640, 642, 644 in the upper layer 614 is offset with respect to the hinged connections F3 of the set of teeth or tabs 640, 642, 644 in the lower layer 16.

An edge portion EP of the aperture A1 of the article retention structures RT in the intermediate layer 12 is configured to lie between hinged connections F1 and the hinged connections F3 when the first panel 612 is folded between the second and third panels 614, 616.

Referring to Figure 11 there is shown a blank 710 for forming a carrier. The blank 710 is substantially similar in construction to the blank 510 of Figure 9 albeit arranged to form a carrier of a two-ply construction. The third panel 516 has been omitted from the example of Figure 11, and the first panel 712 forms a lowermost layer of the carrier.

Turning now to Figure 12 there is shown an apparatus 1000 for applying a carrier 90, such as but not limited to those described herein, to a pair of articles B. The apparatus 1000 and method will be described by way of example with reference to the carrier 90 shown in Figure 1C, however the apparatus 1000 and method is not limited to application of the carrier 90 of Figure 1C.

The apparatus 1000 comprises an applicator 1010 including an applicator plate 1012. The applicator 1010 may be adapted to pick up a carrier 90 from a hopper or magazine (not shown). The applicator may comprise a vacuum system (not shown) including a vacuum cup for engaging and removing the carrier 90 from the hopper. In other embodiments, alternative gripping devices may be employed as known in the art. In other embodiments, the carrier 90 may be picked up, aligned and placed upon the group of articles B by a separate apparatus (not shown) before entering a working region of the apparatus 1000.

Figures 13 and 15 illustrate the applicator plate 1012 from below, the applicator plate 1012 comprises at least one orifice O_{R1}, O_{R2}, and the illustrated example comprises a pair of orifices O_{R1}, O_{R2}. The orifices O_{R1}, O_{R2} define an open end of a bore in the applicator plate 1012. The bore may be blind, partially blind or open. In the illustrated example, the bore is partially blind. A bushing 1020 is disposed in the bore and comprises an annular side wall 1022 and provides a saddle 1030, best shown in Figure 14, at a lower end thereof. The saddle 1030 provides a pair of opposed abutment surfaces 1024A, 1024B. A "U" shaped recess is provided between the pair of opposed abutment surfaces 1024A, 1024B. In other embodiments, it will be appreciated that a pair of opposed abutment surfaces may be provided by alternative structures mounted to or integral with the applicator plate 1012. The pair of opposed abutment surfaces are spaced apart from each other sufficient that a portion of an article B can be received therebetween. In the illustrated example, the portion of the article B received is an end closure C of a bottle.

The bushing 1020 is oriented with respect to the carrier 90 such that the pair of opposed abutment surfaces 1024A, 1024B make contact and apply force or pressure to the second panel 514 at contact points PP, as shown in Figure 1C. The carrier 90 comprises a pair of contact points PP on opposing sides of each article retention structure RT. Each saddle 1030 transversely straddles one of the article retention

structures RT. The "U" shaped recesses of the saddle 1030 extend in a longitudinal direction, and the U" shaped recess of one saddle 1030 is collinear with the U" shaped recess of the other saddle 1030.

One of the pair of opposed abutment surfaces 1024A, 1024B is disposed at a different elevation to the other one of the pair of opposed abutment surfaces 1024A, 1024B, best illustrated in Figure 16, in which the applicator plate 1012 has been omitted for illustrative purposes. In this way the applicator 1010 applies force or pressure unevenly or asynchronously to the side or longitudinal edges of the carrier 90. The applicator 1010 unevenly or unequally displaces the opposing sides of the carrier 90 from a planar condition. A first abutment surface 1024A is disposed at a first elevation and is configured to make contact with a contact point PP along a first side of the carrier 90 before a second abutment surface 1024B, which is disposed at a higher elevation, makes contact with a second contact point PP along a second side of the carrier 90.

Figure 16B illustrates an alternative bushing 1220, having an annular wall 1222, which is substantially similar to the bushing of Figures 13 to 16 albeit a pair of opposed abutment surfaces 1024A, 1024B are disposed at the same elevation. In this way the bushing 1220 applies force or pressure evenly or synchronously to the side or longitudinal edges of the blank 10 (or carrier 90). The bushing 1220 evenly or equally displaces the opposing sides of the blank 10 from a planar condition. The first abutment surface 1024A makes contact with a contact point along a first side of the blank 10 and a second abutment surface 1024B makes contact with a second contact point along a second side of the blank 10 at substantially the same time.

The annular wall 1022 of the bushing 1020 may be inclined downwardly, as viewed in Figure 14, (albeit upwardly in normal use as shown in Figure 16) from inside to outside, in the region of the "U" shaped recess between the pair of opposed abutment surfaces 1024A, 1024B.

The "U" shaped recesses in the saddles 1030 allow, or provide a void, into which the engaging tabs 40, 42, 44 may be displaced when the carrier 90 is applied to the articles B. In this way the bushing 1020 does not interfere or inhibit movement of the engaging tabs 40, 42, 44.

The carrier 90, or at least portions thereof surrounding the article retention structures R may adopt an inverted "U" shaped form in response to engagement by the saddles 1030 whilst being applied to the articles B.

Referring now to Figure 17 there is shown the applicator 1110 having an applicator plate 1112 configured to apply three carriers 90 (outline positions of the carriers 90 are indicated by dashed lines in Figure 17) simultaneously to three groups or pairs of articles B. The applicator plate 1112 comprises six bushings 1120 mounted thereto arranged in a 2 × 3 matrix or array. In other embodiments, it will be appreciated that other configurations may be employed, to apply a different number of carriers or package a different number of articles as desired.

In some embodiments, bushings 1020; 1120 may be retro fitted to an existing applicator plate to adapt an existing packaging machine to apply paperboard carriers to articles B.

The present disclosure also provides a packaging system including a packaging apparatus 1000, article carriers 90, and a method of applying blanks 10; 110; 210; 410; 510; 610; 710 to articles B to form the article carriers 90.

The method of applying blanks 10; 110; 210; 410; 510; 610; 710 comprises asynchronously applying force or pressure, first to one side or longitudinal edge and then then the other side or longitudinal edge of the article carrier 90. The apparatus 1000 is arranged to bring a first abutment surface 1024A into contact with a first side of the article carrier 90 in a region adjacent to an article retention structure RT provided by the article carrier 90, and the subsequently bring a second abutment surface 1024B into contact with a second side of the article carrier 90 in a region adjacent to an article retention structure RT provided by the article carrier 90.

Each of the first and second abutment surfaces 1024A, 1024B is provided by a limb extending from, or mounted to, an applicator plate 1012, 1112. The limbs may have unequal length or height. The limbs are spaced apart from each other sufficient that an upper portion of an article B can be disposed therebetween. The limbs may be provided by an annular wall 1022 having an internal diameter sufficiently larger to accommodate the upper portion of the article B. A gap or void is provided between the limbs such that engaging teeth 40, 42, 44 provided on the article carrier 90 can be folded or displaced outwardly without encumbrance. The gap or void may be provided by a recess in the end of the annular wall between the first and second abutment surfaces 1024A, 1024B so as to define a saddle 1030.

The present disclosure also provides a method of applying blanks 10; 110; 210; 410; 510; 610; 710 comprising displacing a first side or longitudinal edge of one or more primary panels 12, 14, 16; 112; 212, 214; 412, 414, 416; 512, 514, 516; 612, 614, 616; 712, 714 of the blank 10; 110; 210; 410; 510; 610; 710 a greater extent than the other, opposing, side or longitudinal edge of said one or more primary panels 12, 14, 16; 112; 212, 214; 412, 414, 416; 512, 514, 516; 612, 614, 616; 712, 714 whilst engaging the blank10; 110; 210; 410; 510; 610; 710 with one or more articles B.

The present disclosure also provides an article carrier 90 comprising at least one primary panel 12, 14, 16; 112; 212, 214; 412, 414, 416; 512, 514, 516; 612, 614, 616; 712, 714 forming a handle structure. The at least one primary panel 12, 14, 16; 112; 212, 214; 412, 414, 416; 512, 514, 516; 612, 614, 616; 712, 714 comprises at least one, at least two, or more article retention structures RT for engaging an article so as to provide a top gripping article carrier 90.

The at least one article retention structure RT comprises a receiving opening having or defined by a boundary including a first edge E1 and second opposing edge E2. The second edge E2 is defined by a

series of distal or engaging ends of the engaging teeth 40, 42, 44; 140, 142, 144; 240, 242, 244; 440, 442, 444; 540, 542, 544; 640, 642, 644; 740, 742, 744.

The first edge E1 may be arranged to be closer to the handle H than the second edge E2. Either one of the first and second edges E1, E2 may be curved concavely as viewed from the location of the other. The first edge E1 may be curved such that the centre of curvature C_e1 of the first edge E1 is located closer to the second edge E2 than to the first edge E1. The boundary further includes a pair of third and fourth opposing edges E3, E4 which continuously connect the first and second edges E1, E2 such that each of the third and fourth edges E3, E4 provides a smooth transition between the first and second edges E1, E2. Either one of the third and fourth edges E3, E4 may be curved concavely as viewed from the location of the other.

The radius of curvature r1 of the first edge E1 may be less than the radius of curvature r2 of the second edge E2.

The third and fourth opposing edges E3, E4 each continuously connects the first and second edges E1, E2. The third and fourth edges E3, E4 are spaced apart such that the maximum distance therebetween is less than the lateral dimension (e.g., the diameter) of the radially protruding portion (e.g., a bottle neck flange or a bottle cap) of the associated article such as a bottle.

The present disclosure also provides an article carrier 90 comprising release device, the release device may comprise a pull tab T1, T2, T3. Optionally, the release device comprises a cut C3, C4, C6; the cut C3, C4, C6 may be arcuate or curved. The cut C3, C4, C6 is disposed between the pull tab T1, T2, T3 and a top-receiving opening of the at least one article retention structure RT. The cut C3, C4, C6 is disposed is disposed on a first or outer side of the top-receiving opening.

The present disclosure also provides an article carrier 90 comprising a relief device, the relief device comprises a relief cut C1, C2, C5; the relief cut C1, C2, C5 may be arcuate or curved. The relief cut C1, C2, C5 is disposed between the handle H and a top-receiving opening of the at least one article retention structure RT. The relief cut C1, C2, C5 is disposed on a second or inner side of the top-receiving opening. The second side of the top-receiving opening opposes the first side.

The present disclosure also provides an article carrier 90 comprising a top engaging feature or article retention structure RT comprising a top-receiving opening and a series of engaging tabs 40, 42, 44; 140, 142, 144; 240, 242, 244; 440, 442, 444; 540, 542, 544; 640, 642, 644; 740, 742, 744 disposed along an outer section E2 of the perimeter of the opening. The outer section generally opposes an inner section adjacent to the handle H or intermediate portion of the primary panel 12, 14, 16; 112; 212, 214; 412, 414, 416; 512, 514, 516; 612, 614, 616; 712, 714. The radius of curvature r1 of the inner section E1 of the opening perimeter is less than the radius of the curvature r2 defined by distal ends of the engaging tabs 40, 42, 44; 140, 142, 144; 240, 242, 244; 440, 442, 444; 540, 542, 544; 640, 642, 644; 740, 742, 744.

The distal ends of the engaging tabs 40, 42, 44; 140, 142, 144; 240, 242, 244; 440, 442, 444; 540, 542, 544; 640, 642, 644; 740, 742, 744 provide engaging edges for engaging with an article B.

The present disclosure also provides a top engaging carrier 90 comprising a pair of engaging portions and a handle portion H bridging between the engaging portions. The carrier 90 is formed from at least two layers of sheet material in face contacting arrangement. The at least two layers of sheet material may be secured together for example using glue or other adhesive treatment or mechanical fasteners. The mechanical fasteners may be provided by article retention structure RT in each of the at least two layers of sheet material and disposed in vertical registry with each other; the at least two layers of sheet material being secured together when an article B is received in the article retention structure RT in each of the at least two layers of sheet material. The at least two layers of sheet material may include a first layer 14 and a second layer 12. The first layer 14 may be greater in longitudinal dimension than the second layer 12 to provide an accessing tab at an end of the first layer 14 projecting outwards beyond the adjacent end of the second layer 12.

The present disclosure also provides a top engaging feature or article retention structure RT comprising a top-receiving opening and a series of engaging tabs 40, 42, 44; 140, 142, 144; 240, 242, 244; 440, 442, 444; 540, 542, 544; 640, 642, 644; 740, 742, 744 disposed along an outer section of the opening perimeter. The series of engaging tabs 40, 42, 44; 140, 142, 144; 240, 242, 244; 440, 442, 444; 540, 542, 544; 640, 642, 644; 740, 742, 744 includes a pair of end tabs 40; 140; 240; 440; 540; 640; 740 at each end of the series. Each of the end tabs 40; 140; 240; 440; 540; 640; 740 is defined in part by a tear stopper, the tear stopper may take the form of a recess or a “J” shaped cut line.

The present disclosure also provides a top engaging feature or article retention structure RT comprising a top-receiving opening and a series of engaging tabs 40, 42, 44; 140, 142, 144; 240, 242, 244; 440, 442, 444; 540, 542, 544; 640, 642, 644; 740, 742, 744 disposed along an outer section of the opening perimeter. At least one of medial tabs 44 is adjoined at its proximal end by an accessing feature which may be accessed by a user to disengage the top engaging feature from the associated article B.

The present disclosure also provides a top engaging feature or article retention structure RT comprising a top-receiving opening and a series of engaging tabs 40, 42, 44; 140, 142, 144; 240, 242, 244; 440, 442, 444; 540, 542, 544; 640, 642, 644; 740, 742, 744. A first one of the series of engaging tabs 40, 42, 44; 140, 142, 144; 240, 242, 244; 440, 442, 444; 540, 542, 544; 640, 642, 644; 740, 742, 744 is hinged to the primary panel 12, 14, 16; 112; 212, 214; 412, 414, 416; 512, 514, 516; 612, 614, 616; 712, 714 by a first fold line 41, a second one of the series of engaging tabs 40, 42, 44; 140, 142, 144; 240, 242, 244 is hinged to the primary panel 12, 14, 16; 112; 212, 214; 412, 414, 416; 512, 514, 516; 612, 614, 616; 712, 714 by a second fold line 43. The first and second fold lines 41, 43 define therebetween an obtuse angle θ which optionally may be between 115° and 135° and further optionally

may be about 125°. The first fold line 41 optionally defines an angle of about 20° with respect to a first notional line x-x while the second fold line 43 optionally defines an angle of about 15° with respect to a second notional line y-y. First notional line x-x is parallel to the longitudinal axis of the primary panel 12, 14, 16; 112; 212, 214; 412, 414, 416; 512, 514, 516; 612, 614, 616; 712, 714, and second notional line y-y is perpendicular to first notional line x-x.

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.

It will be recognised 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.

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.

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.

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, 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 or a severance line or both. 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.

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. A method of packaging at least one article comprising;

applying an article carrier to at least one article with an applicator comprising:

displacing a first side of a primary panel from a planar condition by a first distance;

displacing a second opposing side of a primary panel from the planar condition by a second distance, wherein the second distance is less than the first distance;

engaging the article carrier with at least one article;

receiving the at least one article in an opening in the primary panel.

2. A method of packaging at least one article comprising;

engaging an article carrier with an applicator;

bringing a first limb of the applicator into contact with a first side of a primary panel of the article carrier and applying a force to the first side of a primary panel of the article carrier, adjacent to an article retention structure comprising an opening for receiving the at least one article, so as to displace the first side of a primary panel from a planar condition by a first distance;

bringing a second limb of the applicator into contact with a second, opposing, side of a primary panel of the article carrier and applying a force to the second side of a primary panel of the article carrier, adjacent to an article retention structure comprising an opening for receiving the at least one article, so as to displace the second side of a primary panel from a planar condition by a second distance, wherein the second distance is less than the first distance.

bringing the article carrier into contact with at least one article;

receiving the at least one article in the opening in the primary panel.

3. A method of packaging at least one article according to claim 2, further comprising folding one or more engaging teeth outwardly of the primary panel to engage a flange of the at least one article.

4. A method of packaging at least one article according to claim 3, wherein the one or more engaging teeth are disposed about an end edge of the opening adjacent to the first and second sides.

5. A method of packaging at least one article according to claim 3, wherein the one or more engaging teeth are folded between a pair of spaced apart limbs each of which is in contact with one of the first and second sides of the primary panel.

6. A method of packaging at least one article comprising;

bringing an article carrier into contact with at least one article;

applying a force to a first side of a primary panel of the article carrier, adjacent to an article retention structure comprising an opening for receiving the at least one article;

receiving a first side of the at least one article in the opening adjacent to the first side of the primary panel;

applying a force to a second, opposing, side of the primary panel of the article carrier, adjacent to an article retention structure comprising an opening for receiving the at least one article;

receiving a second, opposing, side of the at least one article in the opening adjacent to the second side of the primary panel.

7. A method of packaging at least one article according to claim 6, further comprising folding one or more engaging teeth outwardly of the primary panel to engage a flange of the at least one article.

8. A method of packaging at least one article according to claim 7, wherein the one or more engaging teeth are disposed about an end edge of the opening adjacent to the first and second sides.

9. A method of packaging at least one article according to claim 7, wherein the one or more engaging teeth are folded between a pair of spaced apart limbs each of which is in contact with one of the first and second sides of the primary panel.

10. A component for an applicator device comprising a first limb having a first end and a second, opposing, end disposed a first distance from the first end, the first end providing a first abutment surface, and a second limb having a first end and a second, opposing, end disposed a second distance from the first end, the first end providing a second abutment surface, wherein the first limb is spaced apart from the second limb, and wherein the second distance is less than the first distance.

11. An apparatus for forming a package, the apparatus includes an applicator comprising an applicator plate for engaging an article carrier, the applicator plate having a component mounted thereto, the component comprising a first limb having a first end and a second, opposing, end disposed a first distance from the first end, the first end providing a first abutment surface, and a second limb having a first end and a second, opposing, end disposed a second distance from the first end, the first end providing a second abutment surface, wherein the first limb is spaced apart from the second limb, and wherein the second distance is less than the first distance.

12. A bushing for mounting in an opening of an applicator device comprising an annular wall having opposed ends, a first end providing a pair of spaced apart abutment regions diametrically opposed to each other, a first one of the abutment regions being disposed a first distance from the second end of the annular wall, the second end of the annular wall opposing the first end, wherein a second one of the abutment regions is disposed a second distance from the second end of the annular wall, and wherein the second distance is less than the first distance.

13. An apparatus for forming a package, the apparatus includes an applicator comprising an applicator plate for engaging an article carrier, the applicator plate having at least one aperture and a bushing mounted in the at least one aperture, the bushing comprising an annular wall having opposed ends, a first end providing a pair of spaced apart abutment regions diametrically opposed to each other, a first one of the abutment regions being disposed a first distance from the second end of the annular wall, the second end of the annular wall opposing the first end, wherein a second one of the abutment regions is disposed a second distance from the second end of the annular wall, wherein the second distance is less than the first distance.

14. An apparatus according to claim 13, wherein the bushing comprises a saddle disposed between the pair of abutment regions providing a recess defining at least in part void for receiving a portion of an article carrier.

15. An apparatus according to claim 12, further comprising an engagement device for holding at least one article carrier in engagement with the applicator plate.

16. An apparatus according to claim 13, wherein the engagement device comprises a vacuum system.

17. An apparatus according to claim 13, wherein the saddle is defined by portions of the annular wall disposed between the pair of abutment regions and wherein said portions of the of the annular wall are chamfered.

18. An apparatus according to claim 13, wherein the saddle is defined by portions of the annular wall disposed between the pair of abutment regions and wherein said portions of the of the annular wall are filleted.

19. An apparatus according to claim 13, wherein the saddle is defined by portions of the annular wall disposed between the pair of abutment regions and wherein said portions of the of the annular wall are inclined with respect to surfaces of the pair of abutment regions.

20. An article carrier for packaging at least one article, the article carrier comprising at least one primary panel forming a handle structure, the at least one primary panel comprising a handle portion and at least one article retention structure for engaging an article so as to provide a top gripping article carrier, the at least one article retention structure comprising a receiving opening having a boundary including a first edge and second opposing edge, wherein the second edge is defined by a series of distal ends of engaging teeth providing engaging edges thereof, the first edge is arranged to be closer to the handle portion than the second edge, the first edge is curved such that the centre of curvature of the first edge is located closer to the second edge than to the first edge, the boundary further includes a pair of third and fourth opposing edges which continuously connect the first and second edges such that each of the third and fourth edges provides a smooth transition between the first and second edges.

21. An article carrier for packaging at least one article, the article carrier comprising at least one primary panel forming a handle structure, the at least one primary panel comprising a handle portion and at least one article retention structure for engaging an article so as to provide a top gripping article carrier, the at least one article retention structure comprising a top-receiving opening, the article carrier comprising a release device including a pull tab and cut, wherein the cut is disposed between the pull tab and the top-receiving opening of the at least one article retention structure.

22. A package comprising at least one article and an article carrier, the article carrier comprising at least one primary panel forming a handle structure, the at least one primary panel comprising a handle portion and at least one article retention structure in engagement with the at least one article, the at least one article retention structure comprising a receiving opening having a boundary including a first edge and second opposing edge, wherein the second edge is defined by a series of distal ends of engaging teeth providing engaging edges which are in engagement with the at least one article below an radially protruding portion of the at least one article, the first edge is arranged to be closer to the handle portion than the second edge, the boundary further includes a pair of third and fourth opposing edges which continuously connect the first and second edges, the third and fourth edges being spaced apart such that a maximum distance therebetween is less than a lateral dimension of the radially protruding portion of the at least one article.

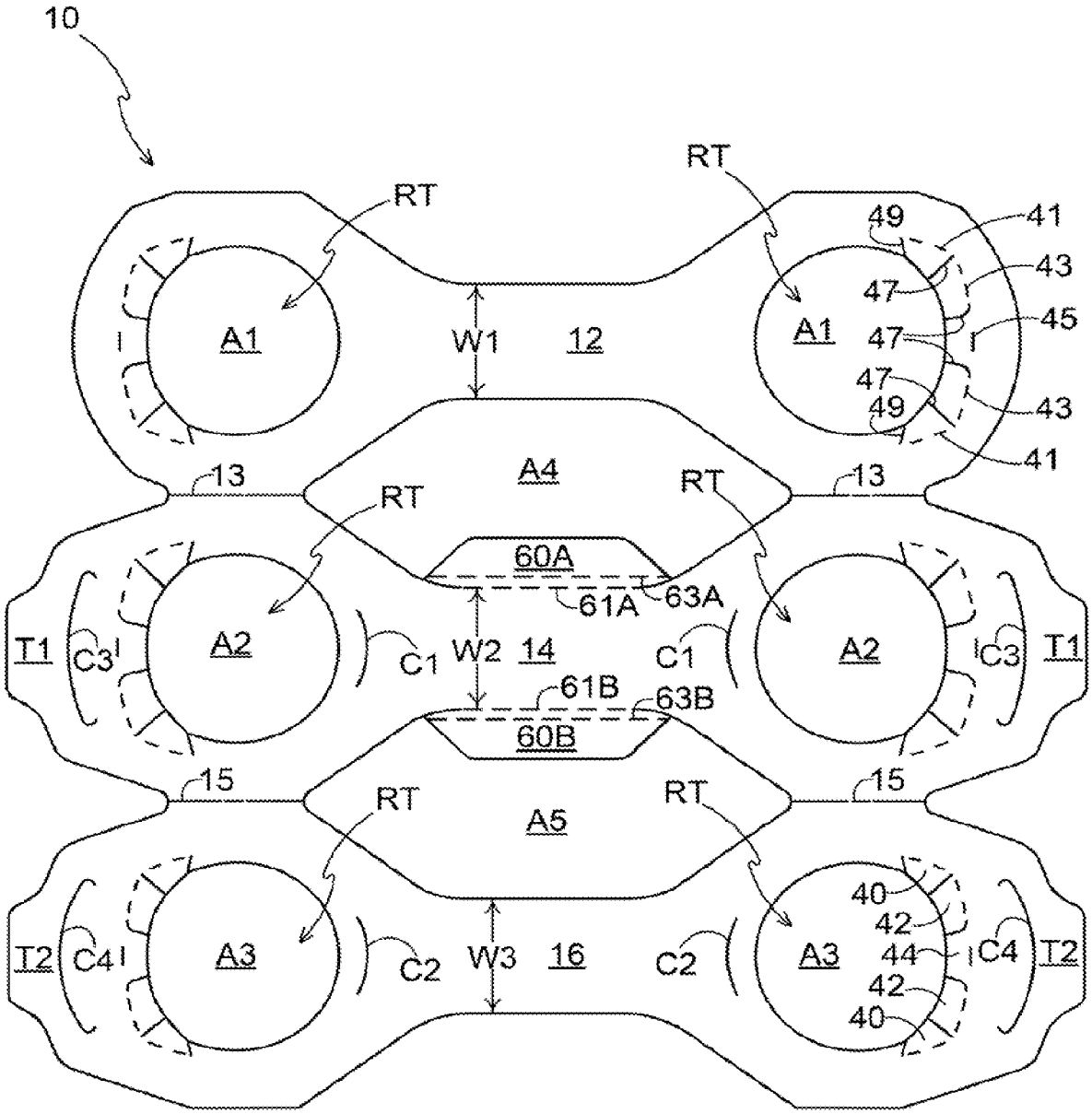

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A4
RT
RT
60A
61A
63A
T1
C3
A2
C1
W2
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C1
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C3
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40

FIG. 1

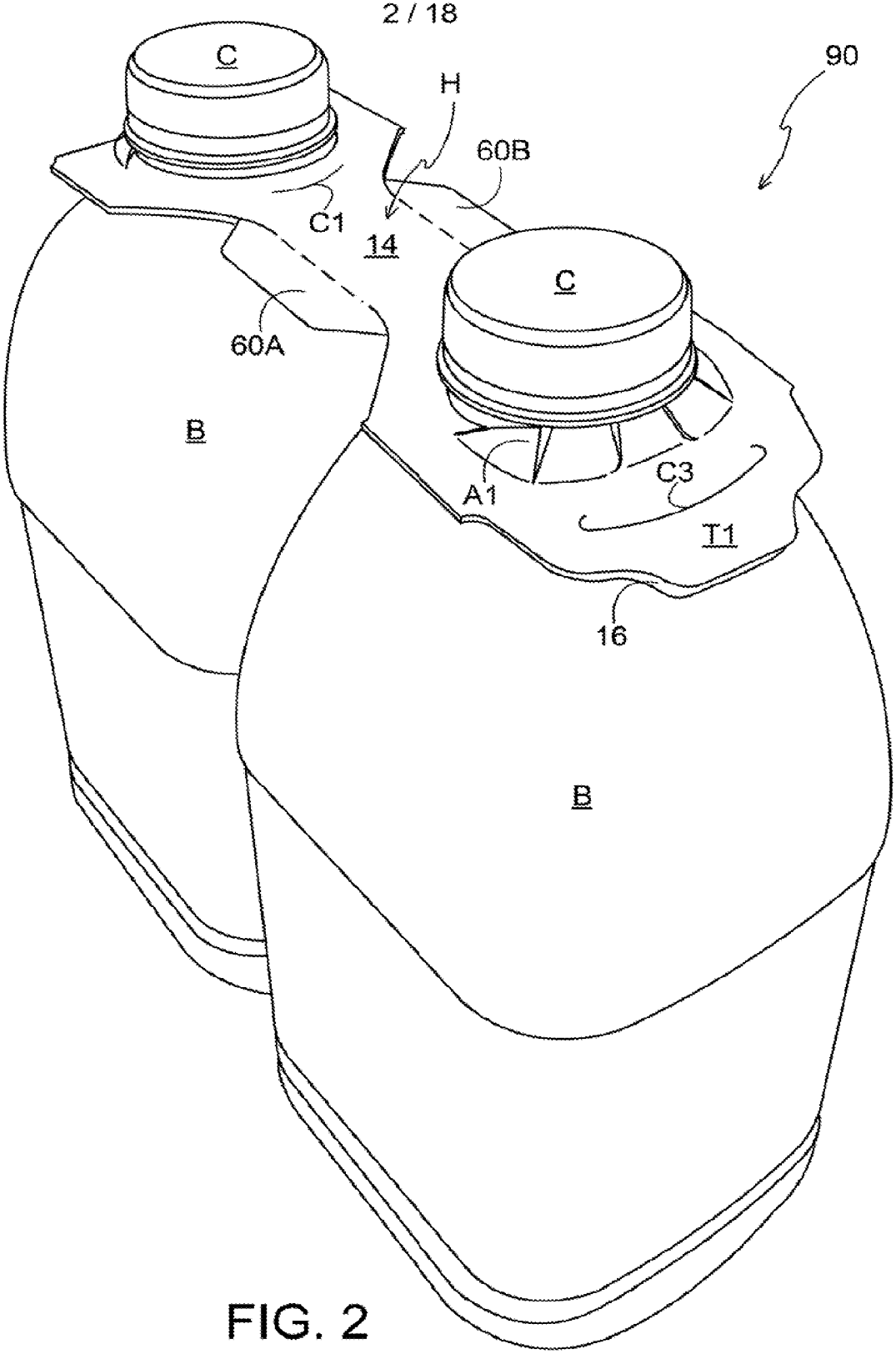


FIG. 2

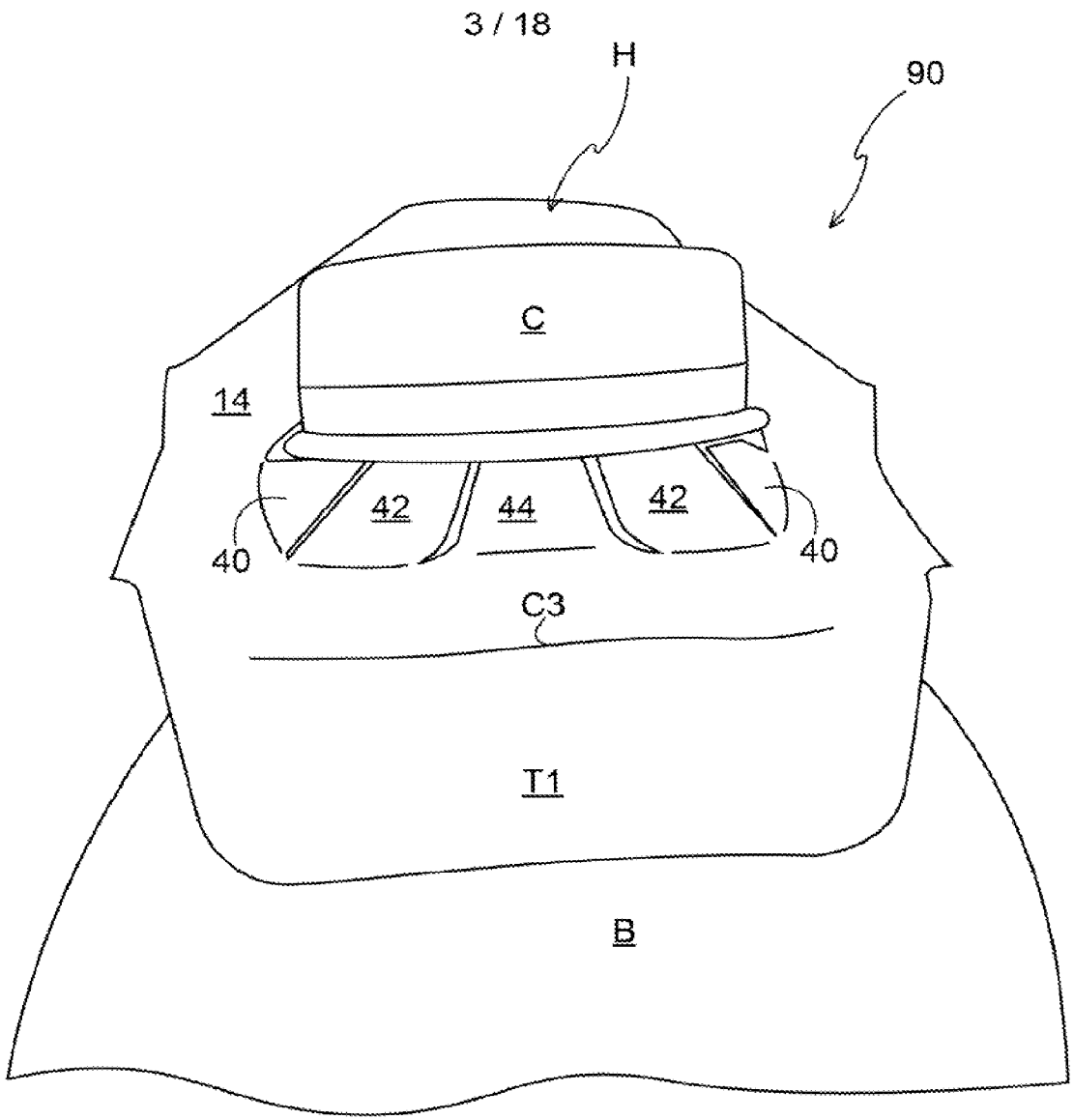


FIG. 3

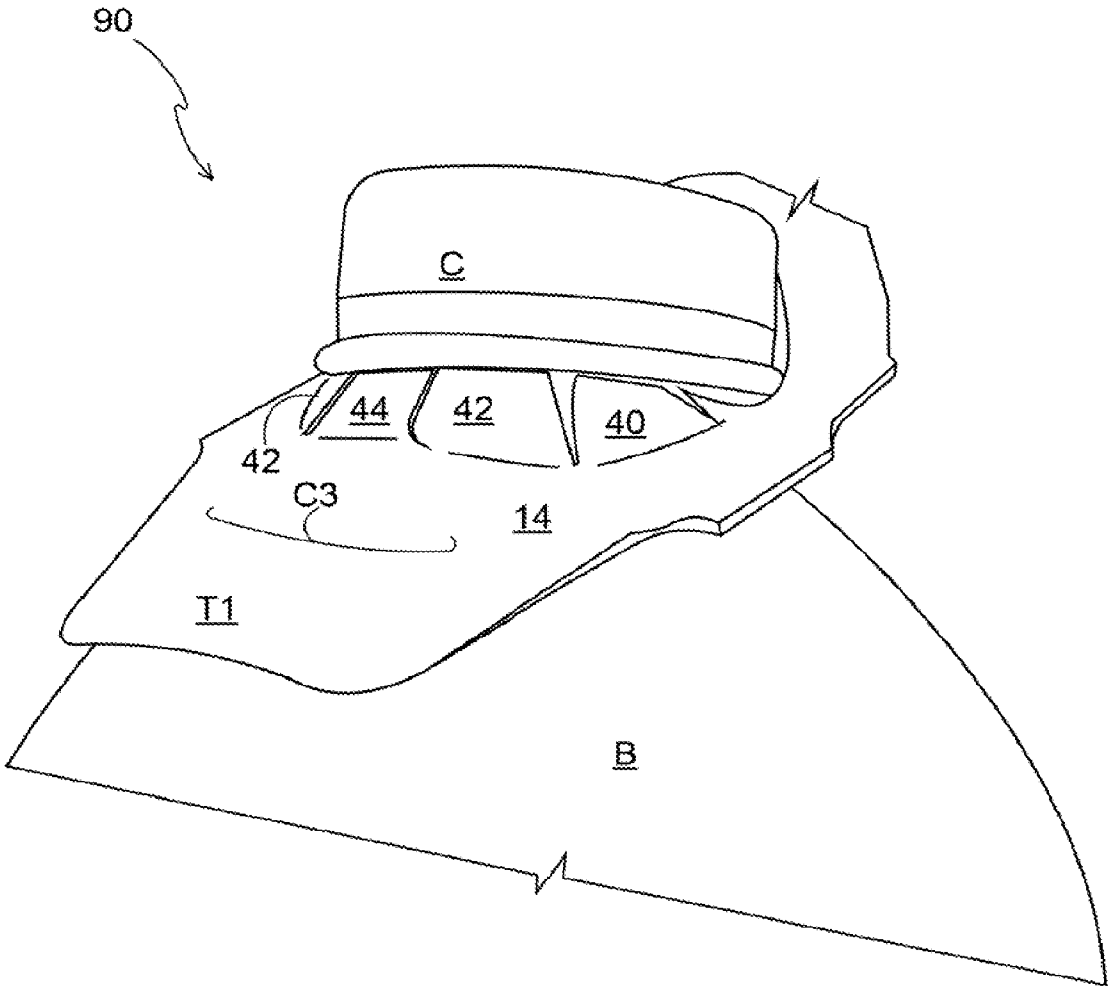


FIG. 4

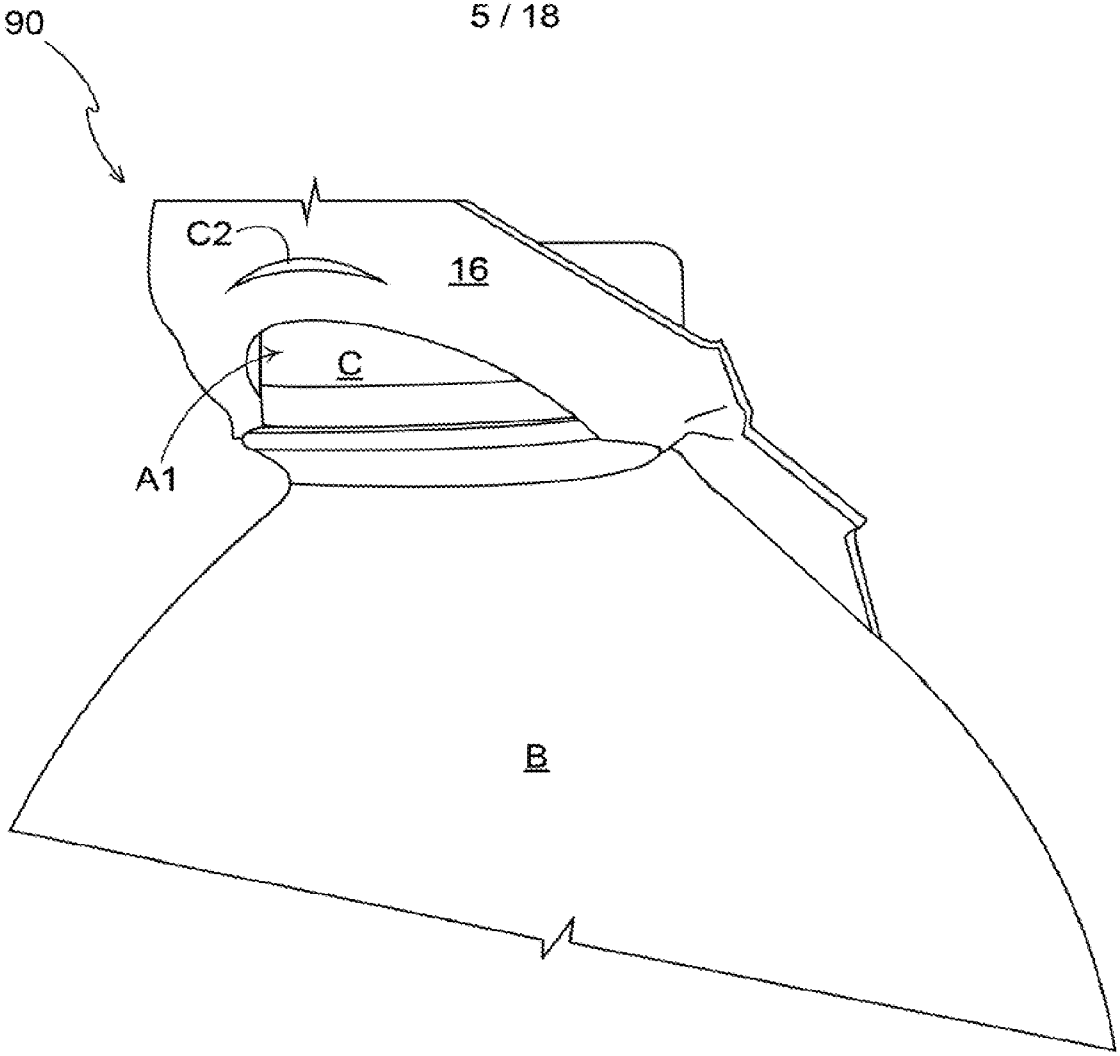


FIG. 5

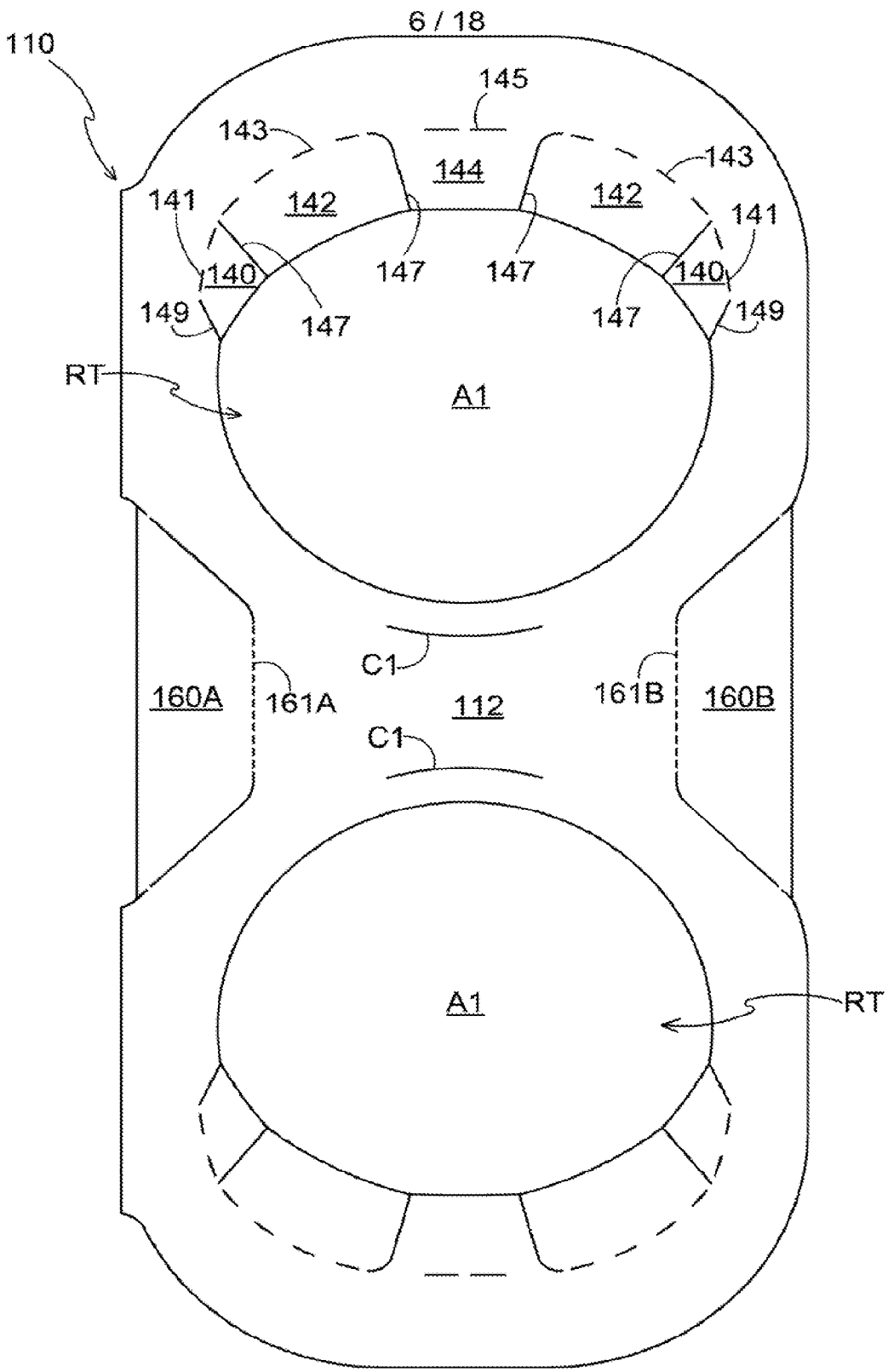

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142
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147
147
140
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RT
A1
C1
160A
161A
112
161B
160B
C1
A1
RT

FIG. 6

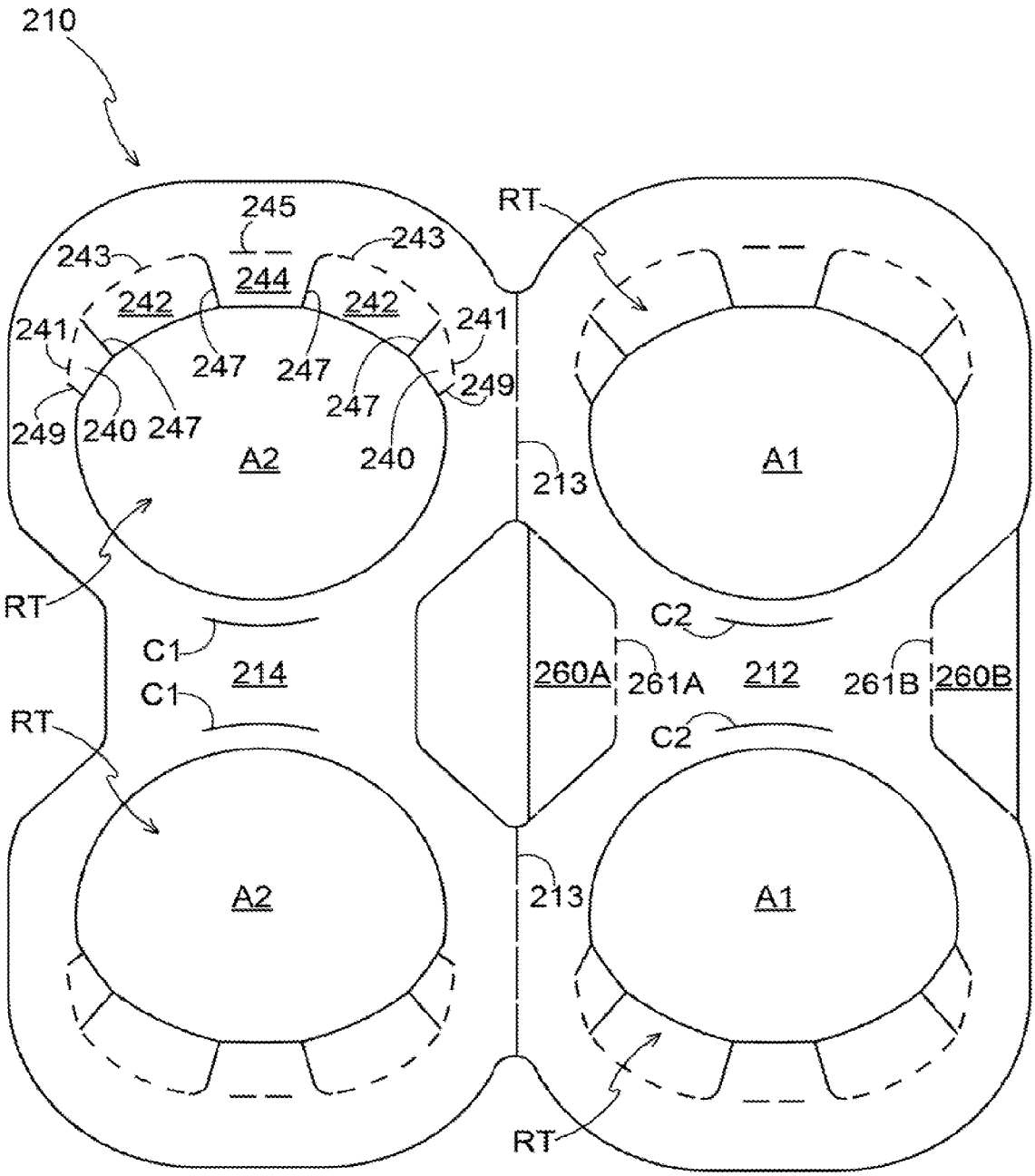

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A1
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FIG. 7

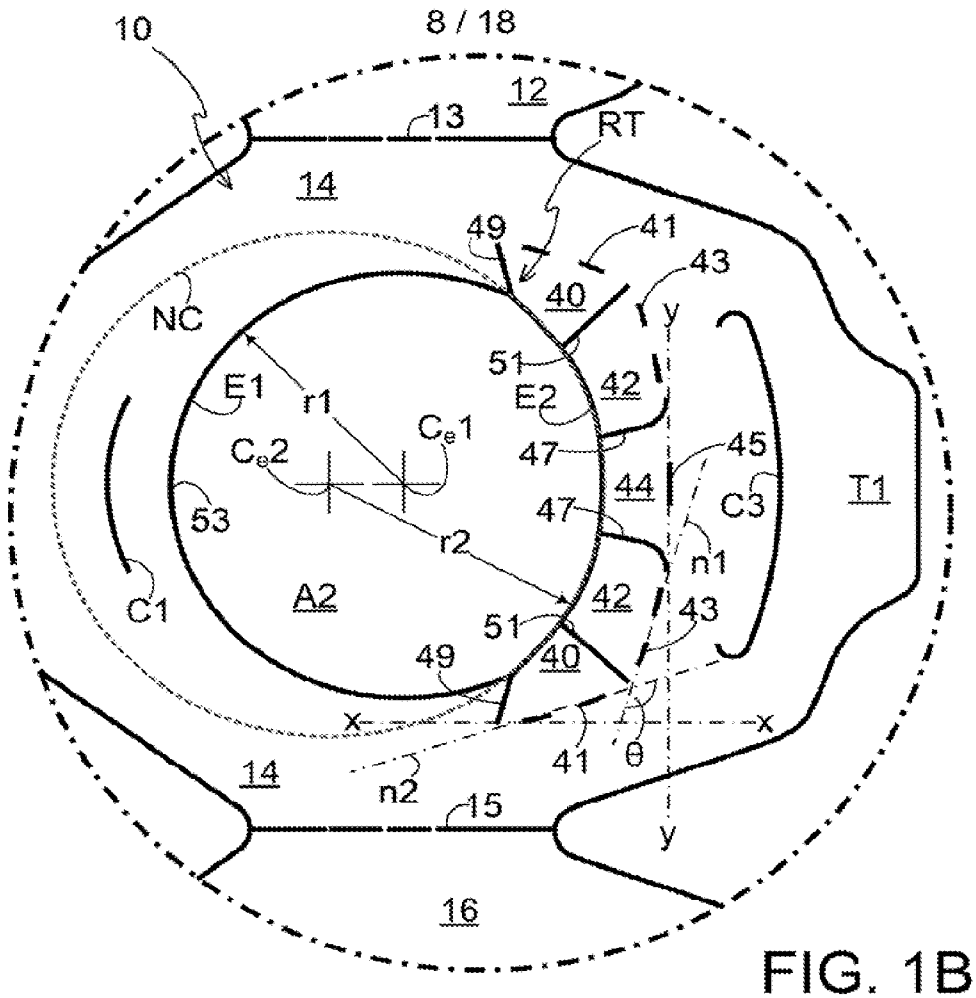


FIG. 1B

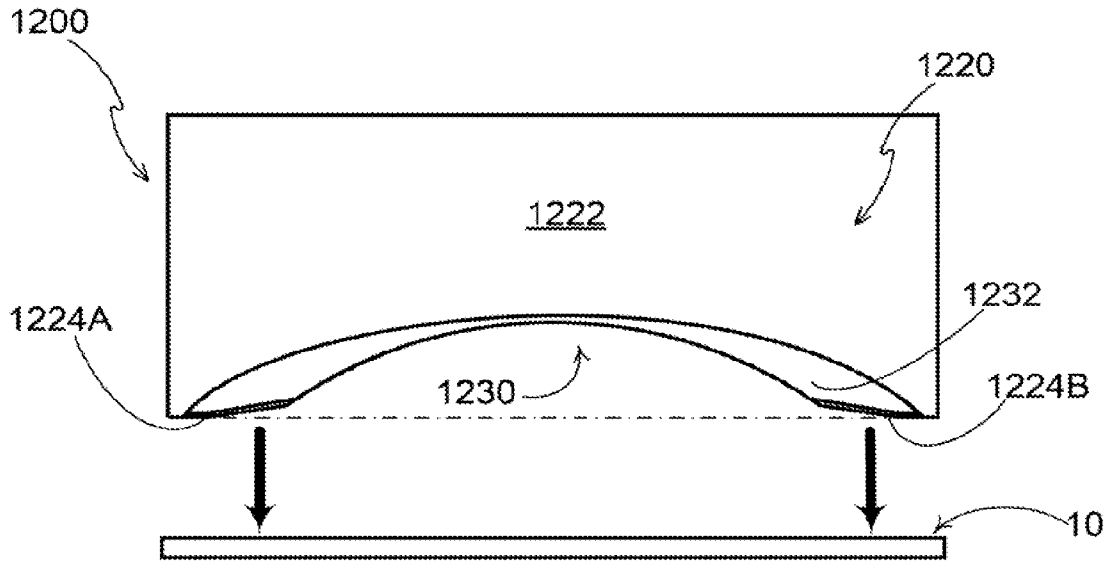


FIG. 16B

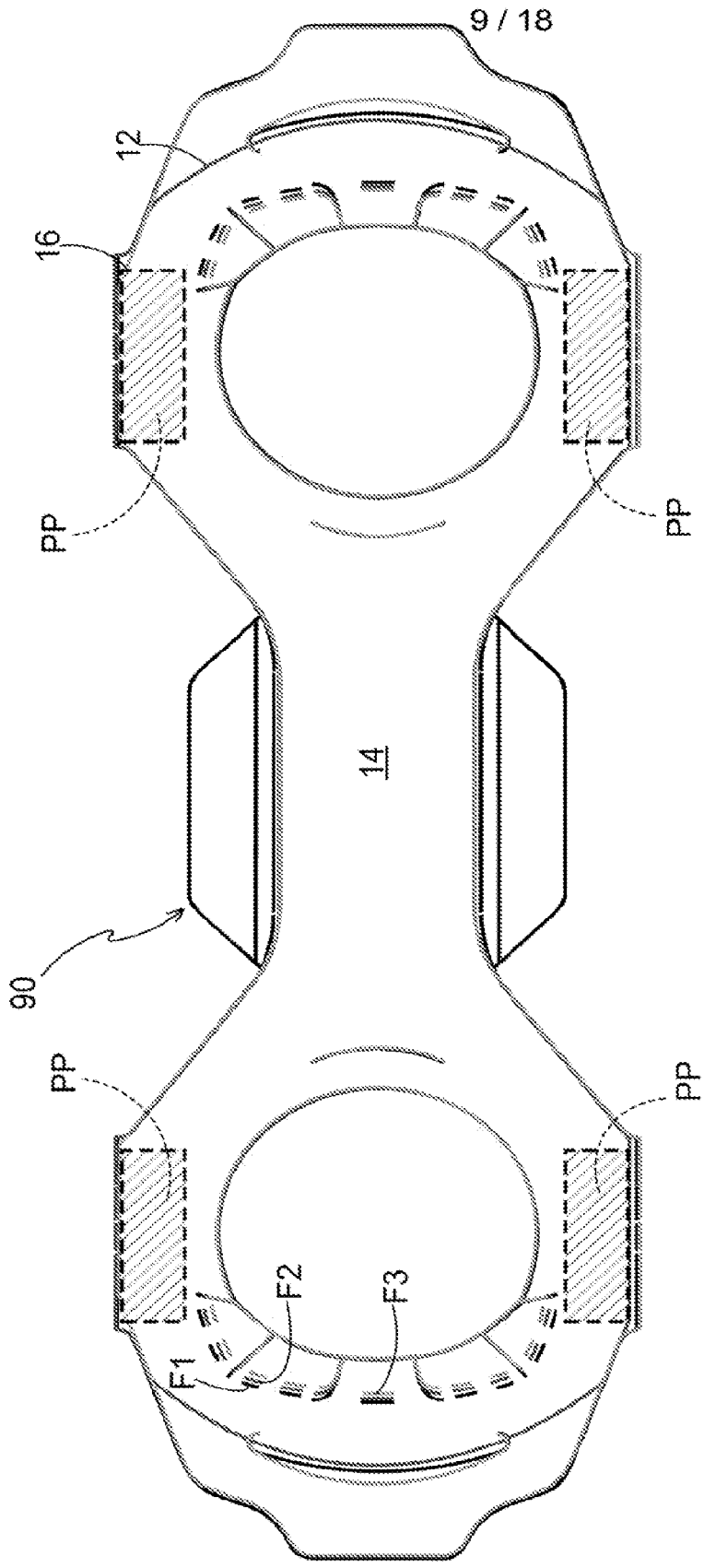


FIG. 1C

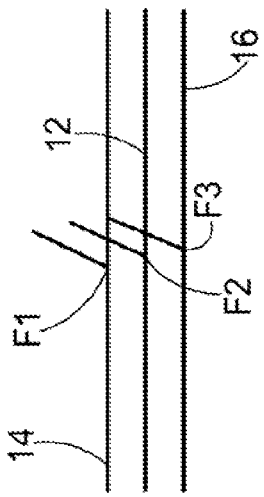


FIG. 1D

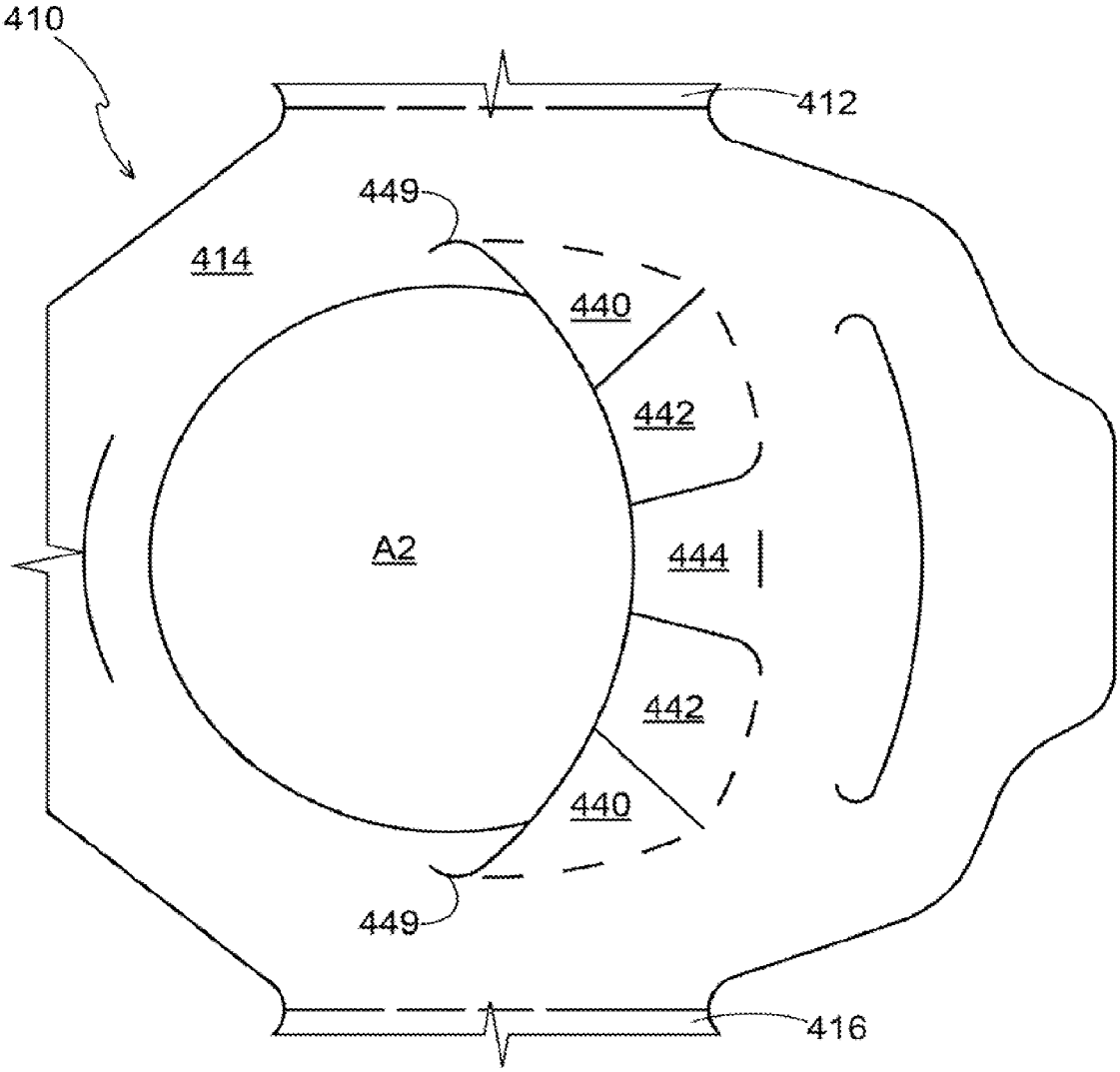


FIG. 8

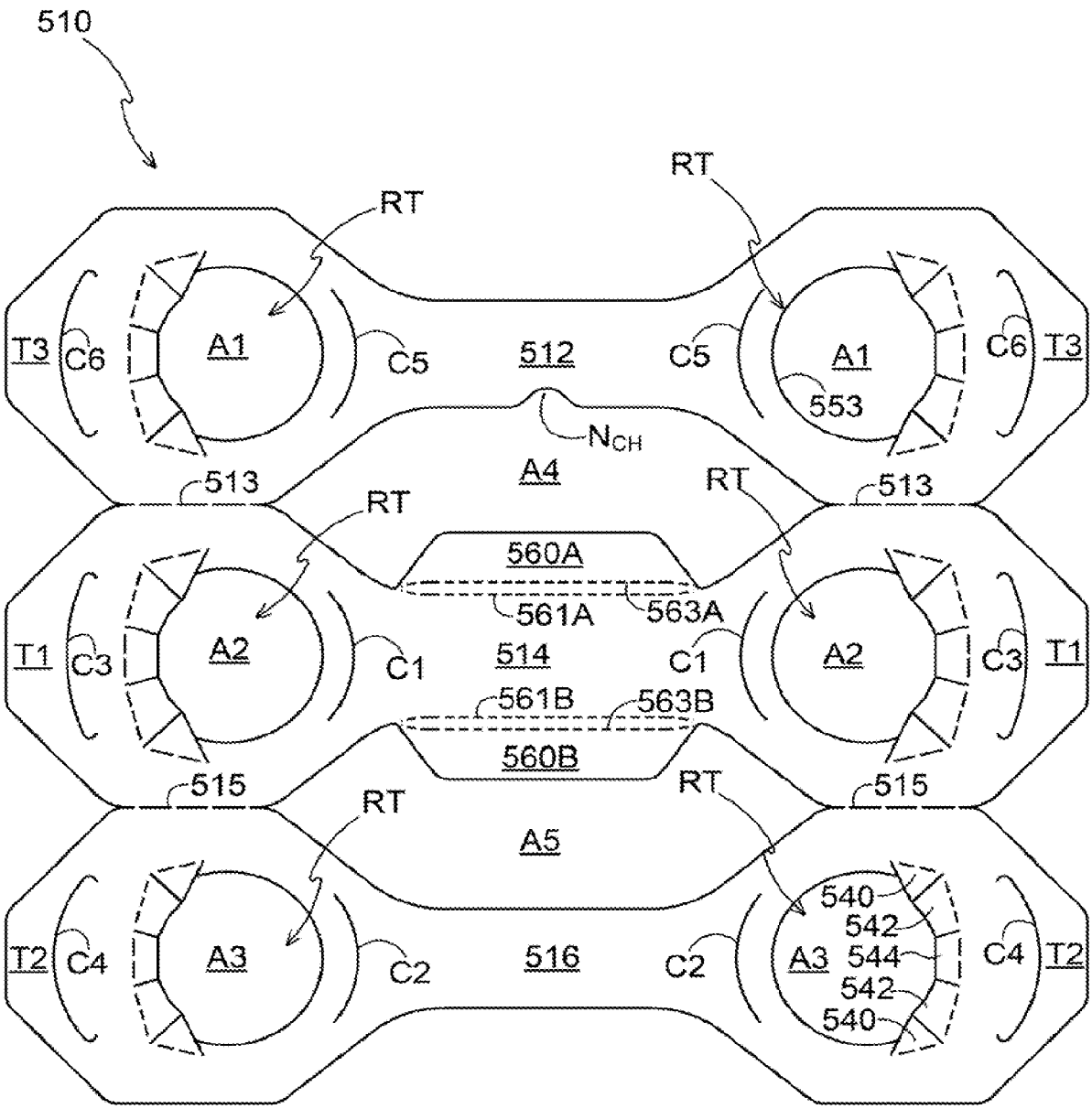

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RT
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561A
563A
T1
C3
A2
C1
514
C1
A2
C3
T1
561B
563B
560B
515
515
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FIG. 9

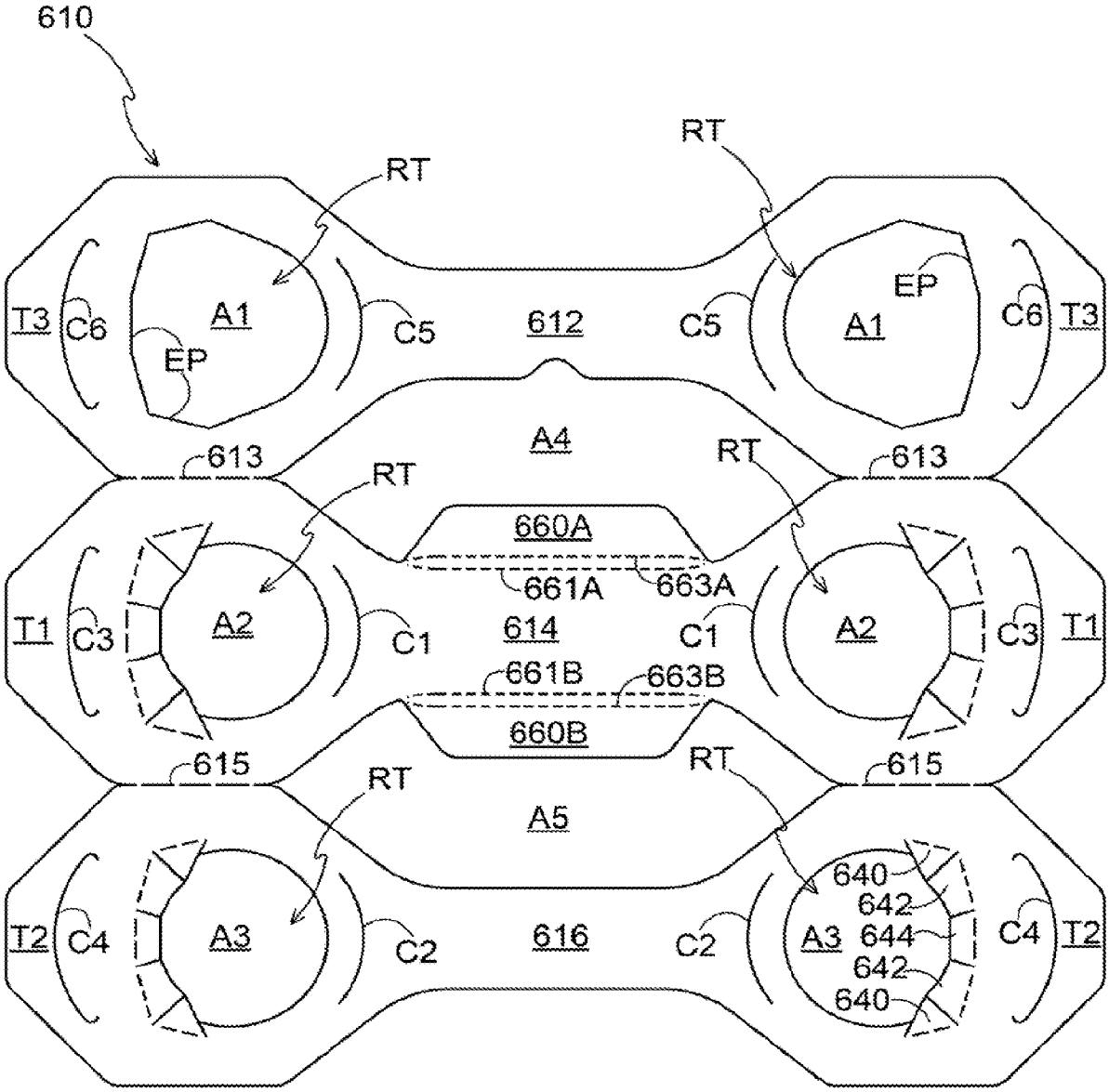

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663A
T1
C3
A2
C1
614
C1
A2
C3
T1
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663B
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RT
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FIG. 10

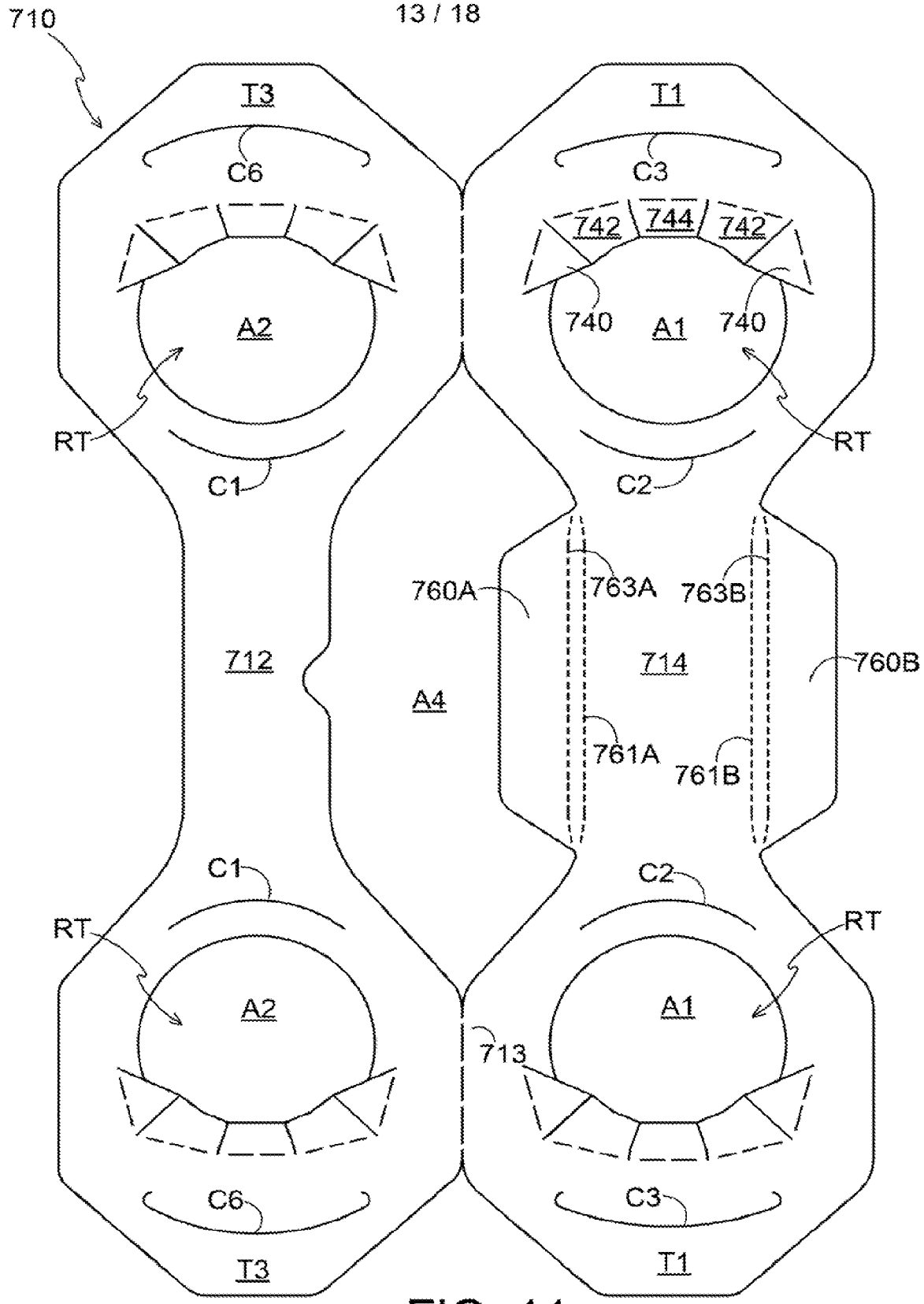

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C1
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C3
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C2
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763B
760B
712
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FIG. 11

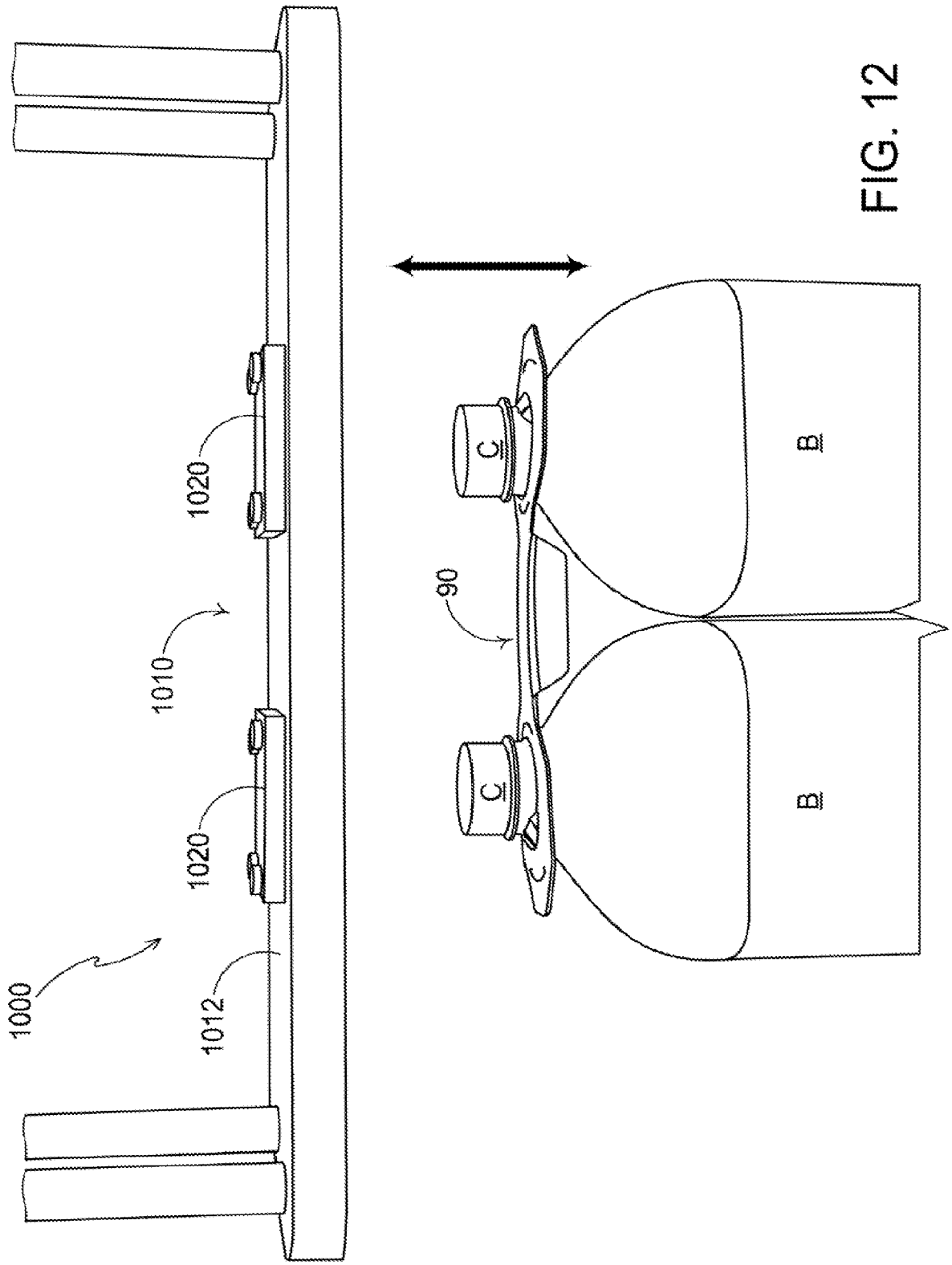


FIG. 12

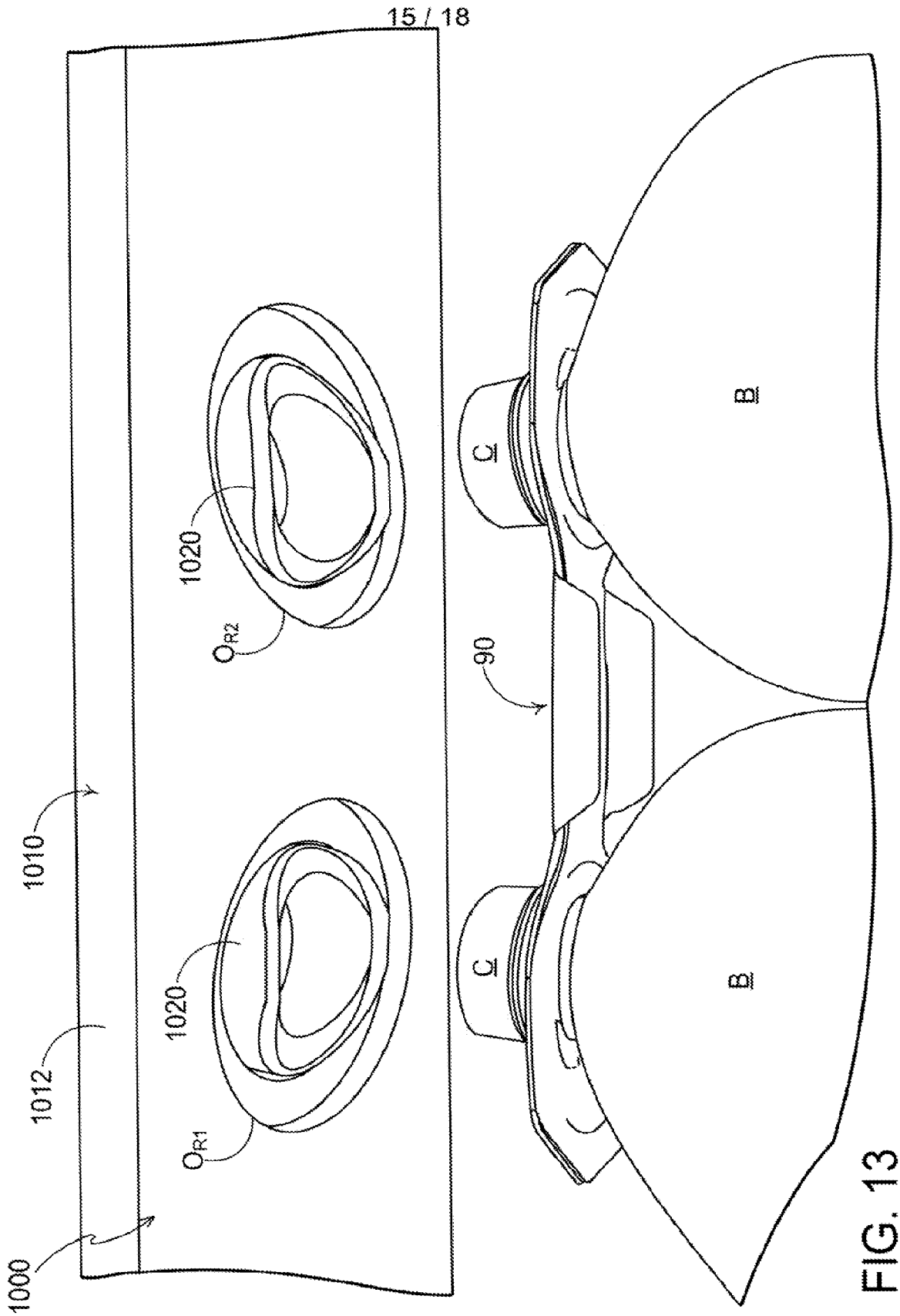


FIG. 13

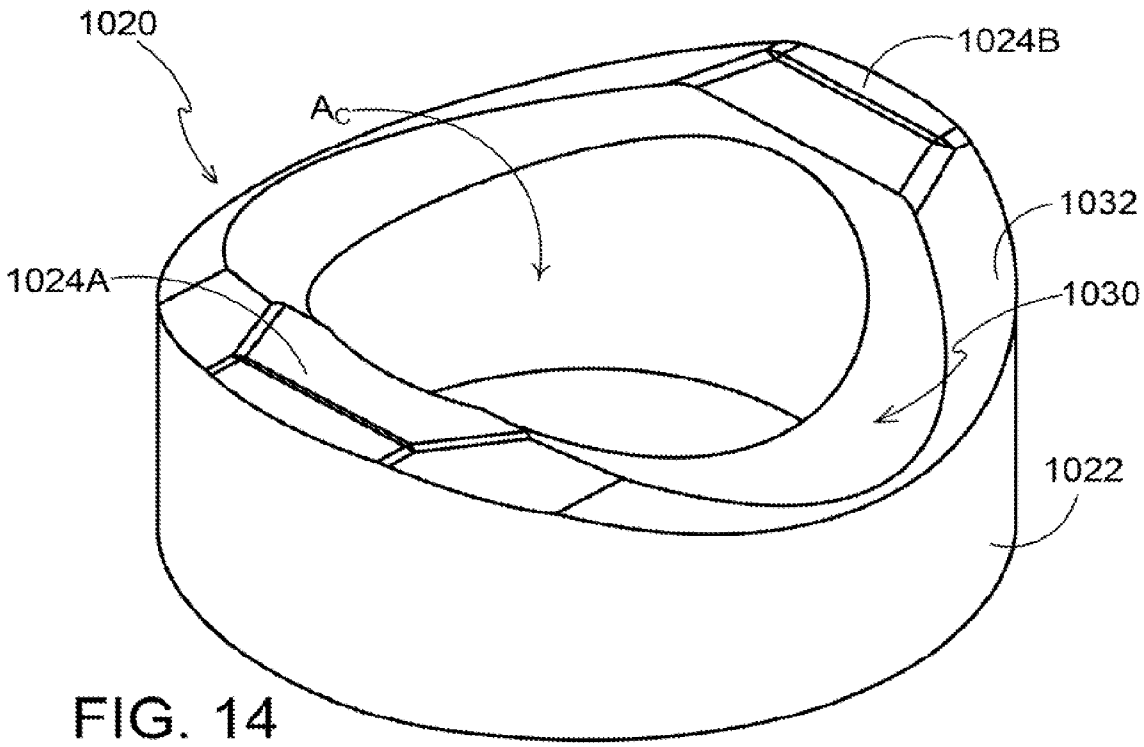


FIG. 14

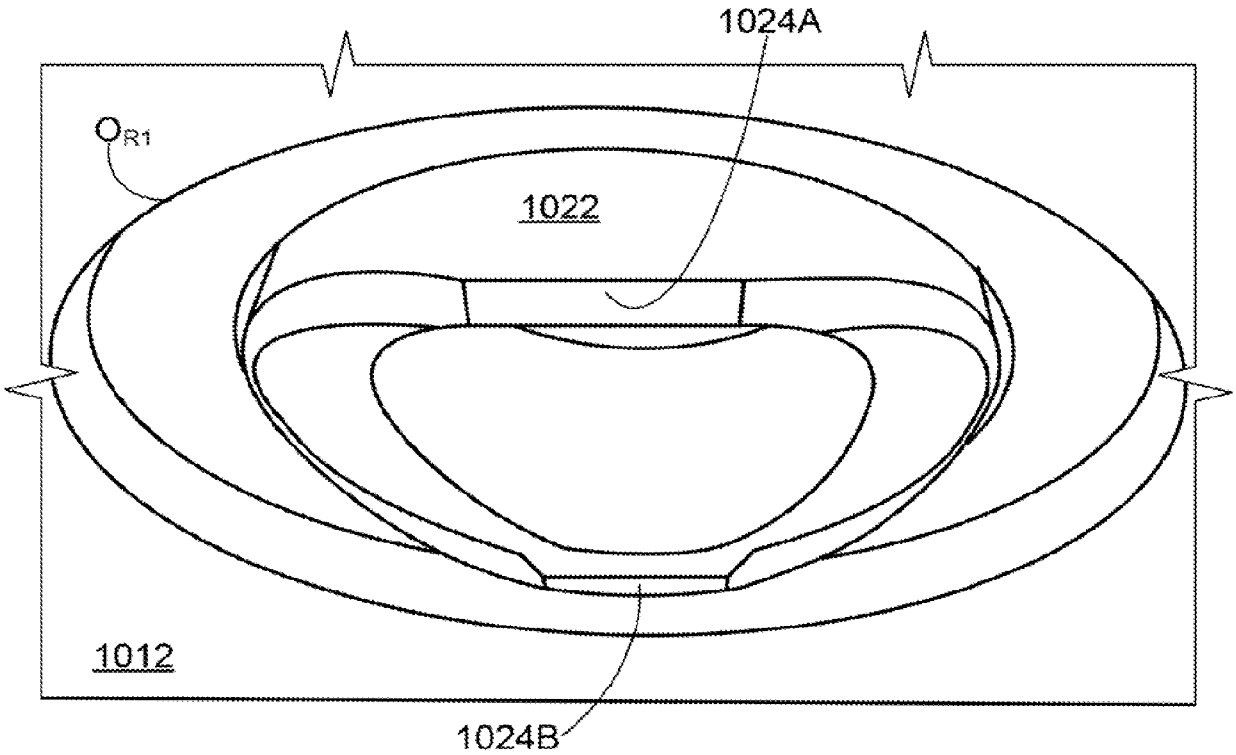


FIG. 15

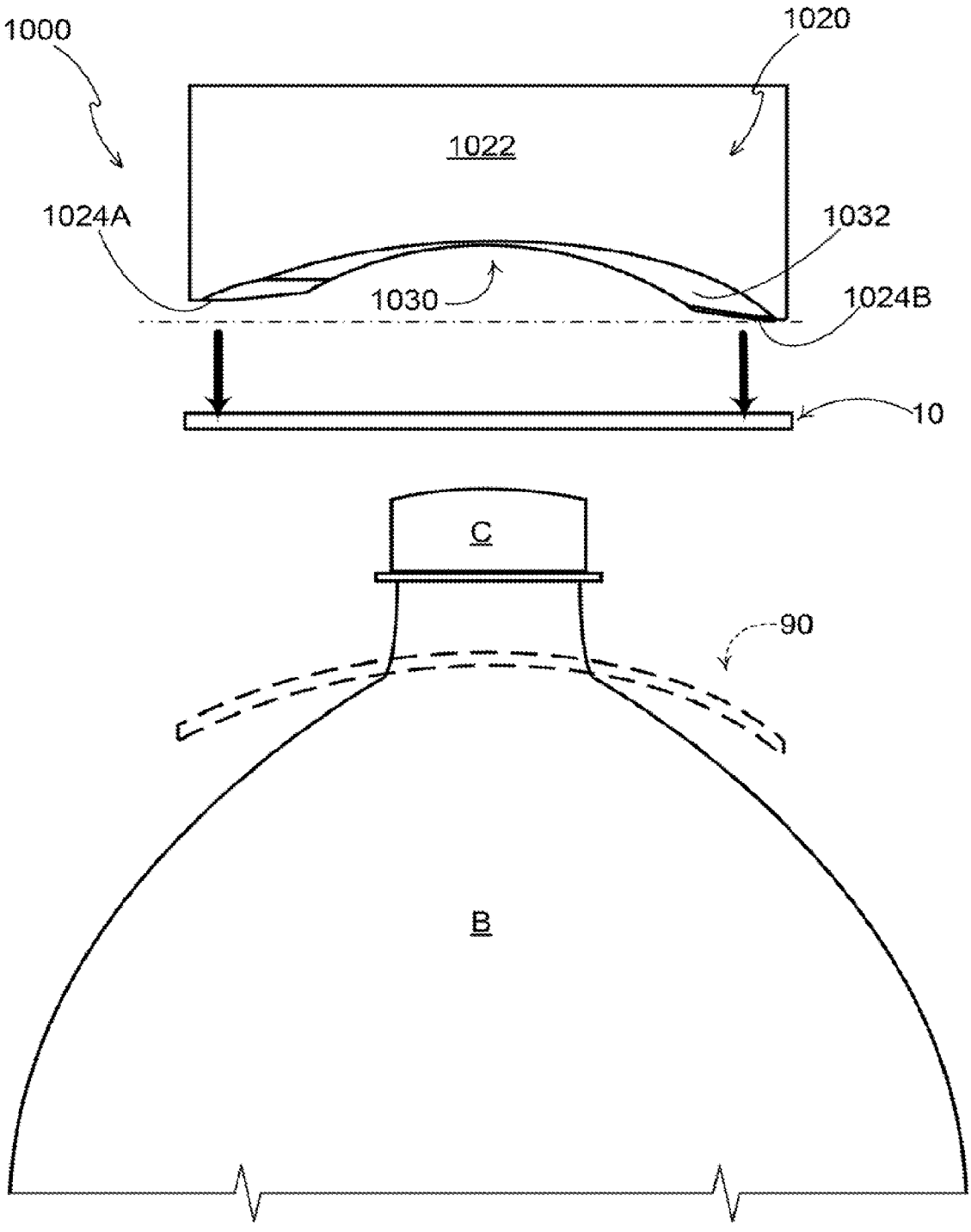


FIG. 16

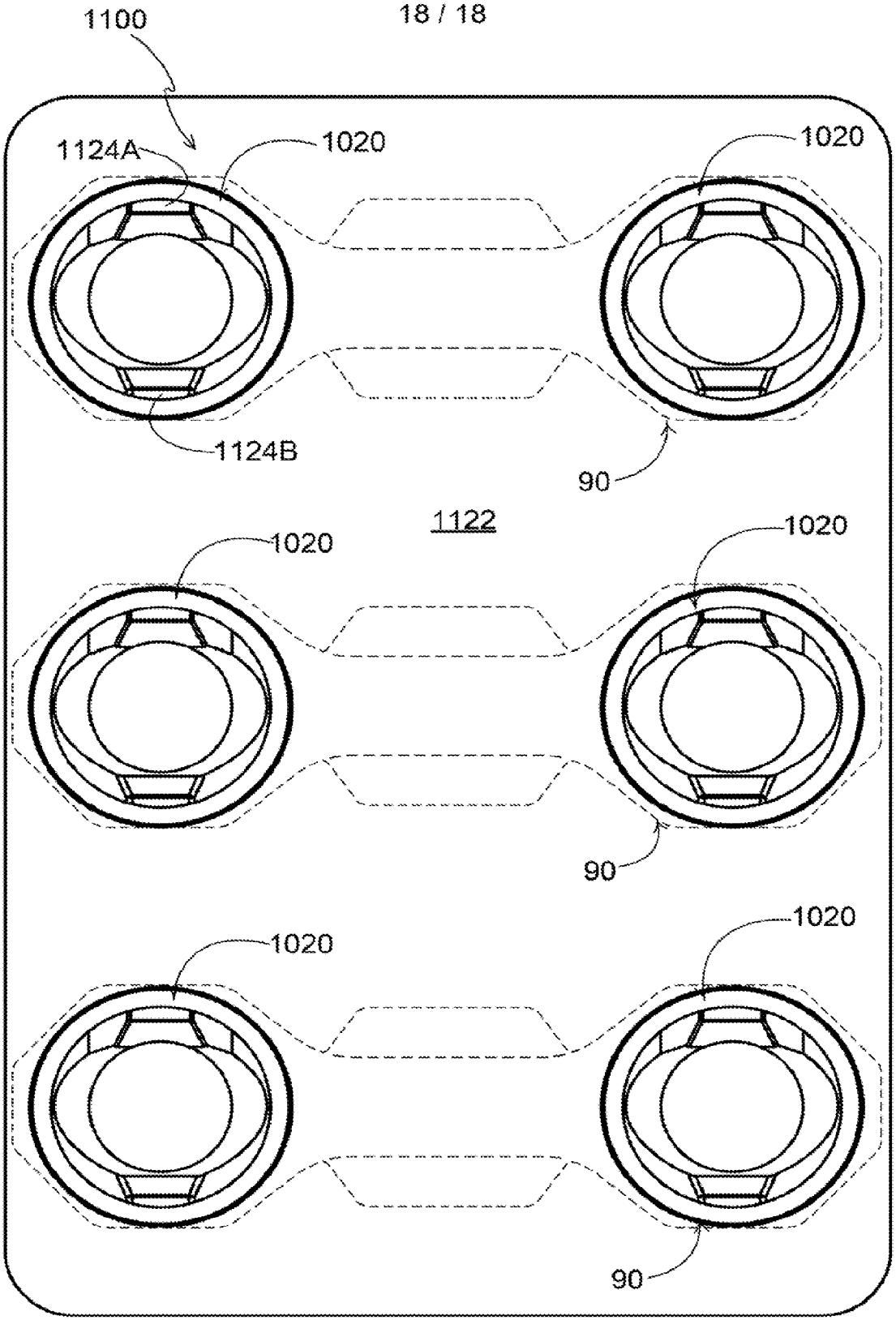


FIG. 17

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2022/052905

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65B17/02 B65D71/42
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65B B65D

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 031 992 A1 (MICHAEL F JOYCE TRADING AS INN [GB]) 15 July 1981 (1981-07-15)	6
A	figures	1-5,7-22

A	EP 3 738 895 A1 (KRONES AG [DE]) 18 November 2020 (2020-11-18) figures	1-22

X	US 4 621 734 A (HEIJNEN JOHAN [NL] ET AL) 11 November 1986 (1986-11-11) figure 2	20-22

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12 May 2023	22/05/2023

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2

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INTERNATIONAL SEARCH REPORT

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2

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