



- (51) International Patent Classification:  
*B65D 71/28* (2006.01) *B65D 5/46* (2006.01)  
*B65D 71/36* (2006.01) *B65D 5/468* (2006.01)
- (21) International Application Number: PCT/US2015/064469
- (22) International Filing Date: 8 December 2015 (08.12.2015)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 62/094,110 19 December 2014 (19.12.2014) US
- (71) Applicant: WESTROCK PACKAGING SYSTEMS, LLC [US/US]; 504 Thrasher Street, Norcross, Georgia 30071 (US).
- (72) Inventors: RAMSUER, Brandon L.; 3009 Skipwith Road, Henrico, Virginia 23294 (US). PEELER, Andrew T.; 3610 New Market Road, Henrico, Virginia 23231 (US). GAIDAEVA, Ekaterina V.; 8.5 West Canal Street, Richmond, Virginia 23220 (US).
- (74) Agents: SUZUKI, Tsugihiko et al.; WestRock Company, 501 South 5th Street, Richmond, Virginia 23219-0501 (US).
- (81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: CARTON AND CARTON BLANK

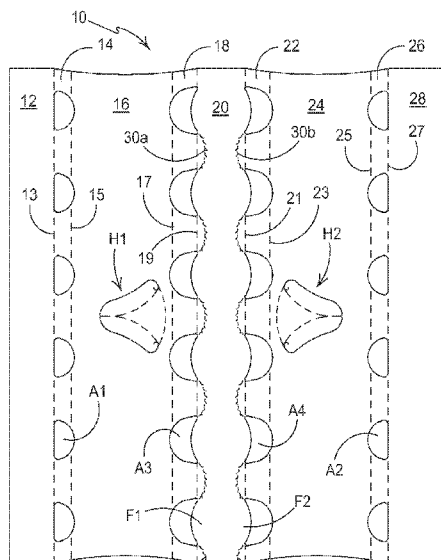


FIGURE 1

(57) Abstract: A carton for packaging articles (C) has panels including a first side wall panel (16). At least a first side wall panels includes a first handle structure (H1) for facilitating carrying of the carton. The handle structure includes a handle flap (42) defining at least in part a handle opening. The handle structure includes a first fold line (36) and a second fold line (38) defined in the handle flap (42). The first fold line is arranged convergently with the second fold line. The first fold line intersects the second fold line.

**WO 2016/100010 A1**



---

**Published:**

— *with international search report (Art. 21(3))*

## CARTON AND CARTON BLANK

## TECHNICAL FIELD

The present invention relates to a carton and to a blank for forming the carton, more particularly to a carton having a carrying handle; more specifically, but not exclusively, to a carton of the wraparound style having a carrying handle provided in opposing side panels thereof.

## BACKGROUND

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

It is desirable to provide a carrying handle so that a consumer can readily carry the multipack. It is also desirable that the carrying handle be comfortable and ergonomic.

20

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

## SUMMARY

According to a first aspect of the present invention there is provided a carton for packaging a plurality of articles, the carton comprising a plurality of panels including a top panel, a bottom panel, a first side wall panel, and a second side wall panel;

wherein at least a first one of the plurality of panels comprises a first handle structure for facilitating carrying of the carton;

the handle structure comprising a handle flap defining at least in part a handle opening;

wherein the handle structure comprises a first fold line and a second fold line defined in the handle flap; the first fold line being arranged convergently with the second fold line, and wherein the first fold line intersects the second fold line.

35 Preferably, the first fold line intersects a third fold line.

More preferably, the second fold line intersects the third fold line.

In some embodiments, the handle structure comprises a fourth fold line extending from a point of intersection of the first fold line and the second fold line.

- 5 In some embodiments, the handle structure comprises a severance line extending from a point of intersection of the first fold line and the second fold line.

Preferably, the severance line extends through the point of intersection of the first fold line and the second fold line.

10

Preferably, the handle structure comprises a pair of wing portions, each of which is foldable about a respective one of a pair of adjacently disposed articles disposed within the carton.

- 15 More preferably, each of the pair of wing portions is defined in part by a respective one of the first and second fold lines.

Preferably, a second one of the plurality of panels disposed opposite the first one of the plurality of panels comprises a second handle structure.

- 20 In some embodiments, the first handle structure is disposed opposite the handle structure such that a user may engage the first and second handle structures simultaneously with one hand.

In some embodiments, the first and second fold lines form an X shape.

25

In other embodiments, the first, second and fourth fold lines form a Y shape.

In some embodiments, the first and second fold lines and the severance line form a Y shape.

- 30 Preferably, the handle flap folds about the first and second fold lines to form an indented finger tab.

Alternatively, the handle flap folds about the first and second fold lines to form a ridge.

- 35 In some embodiments, the handle structure comprises a fifth fold line extending in parallel with the fourth fold line.

Preferably, the handle structure folds about the fourth fold line and about the fifth fold line so as to space a portion of the handle flap from the at least a first one of the plurality of panels.

According to a second aspect of the present invention there is provided a blank for forming a carton, the blank comprising a plurality of panels including a top panel, a bottom panel, a first side wall panel, and a second side wall panel;

wherein at least a first one of the plurality of panels comprises a first handle structure for facilitating carrying of a set-up carton;

the handle structure comprising a handle flap defining at least in part a handle opening;

wherein the handle structure comprises a first fold line and a second fold line defined in the handle flap; the first fold line being arranged convergently with the second fold line, and wherein the first fold line intersects the second fold line.

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

#### BRIEF DESCRIPTION OF THE DRAWINGS

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

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

Figure 1A is an enlarged plan view from above of a portion of the blank of Figure 1;

Figure 2 is a perspective view from above of a carton formed from the blank of Figure 1 and a group of articles loaded into the carton;

Figure 3 is a perspective view from above of the carton of Figure 2 showing a carrying handle in use;

Figure 4 is a perspective view from above of the carton of Figure 2 showing a dispensing feature in use;

Figure 5 is a plan view from above of a blank for forming a carton according to a third embodiment;

Figure 6 is an enlarged plan view from above of a portion of the blank of Figure 5;

Figure 7 is a perspective view from above of a carton formed from the blank of Figure 6;

Figure 8A is an end view of a portion of the carton of Figure 7 showing a carrying handle in a first partially folded condition;

Figure 8B is an end view of a portion of the carton of Figure 7 showing a carrying handle in a second partially folded condition;

5        Figure 9 is a plan view from above of a blank for forming a carton according to a fourth embodiment;

Figure 10 is an enlarged plan view from above of a portion of the blank of Figure 9;

Figure 11A is an end view of a portion of a carton formed from the blank of Figure 9 showing a carrying handle in a first partially folded condition;

10       Figure 11B is an end view of a portion of the carton of Figure 9 showing a carrying handle in a second partially folded condition;

Figure 12 is a plan view from above of a blank for forming a carton according to a second embodiment; and

15       Figure 13 is a perspective view from above of a pair of cartons formed from the blank of Figure 12.

#### DETAILED DESCRIPTION OF EMBODIMENTS

Detailed descriptions of specific embodiments of the package, blanks and cartons are disclosed herein. It will be understood that the disclosed embodiments are merely examples  
20       of the way in which certain aspects of the invention can be implemented and do not represent an exhaustive list of all of the ways the invention may be embodied. As used herein, the word "exemplary" is used expansively to refer to embodiments that serve as illustrations, specimens, models, or patterns. Indeed, it will be understood that the packages, blanks and cartons described herein may be embodied in various and alternative forms. The  
25       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  
30       skilled in the art to variously employ the invention.

Figure 1 shows a plan view of a blank 10 capable of forming a carton 90 of the first embodiment according to the invention, preferably of the wrap around style, as shown in Figure 2, for primary products such as, but not limited to, cans, hereinafter referred to as  
35       articles C. Each of the article, such as a can, is substantially cylindrical in shape so that it has a cylindrical axis and a rounded side.

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

The blanks are formed from a sheet of suitable substrate. It is to be understood that, as used herein, the term “suitable substrate” includes all manner of foldable sheet material such as paperboard, corrugated board, cardboard, plastic, combinations thereof, and the like. It should be recognized that one or other numbers of blanks may be employed, where suitable, for example, to provide the carrier structure described in more detail below.

In the exemplary embodiments, the blanks are configured to form a carton or carrier for packaging an exemplary arrangement of exemplary articles. In some of the illustrated embodiments, the arrangement is a 6 x 1 matrix or array of six cans. In other illustrated embodiments, the arrangement is a 4 x 6 x 2 matrix or array of forty-eight cans (i.e., two tiers of twenty-four cans each); in other embodiments other arrangements may be employed. The blank can be alternatively configured to form a carrier for packaging other types, number and size of article and/or for packaging articles in a different arrangement or configuration.

The blank 10 comprises a plurality of main panels 12, 14, 16, 18, 20, 22, 24, 26, 28 hinged together in a linear series. The plurality of main panels 12, 14, 16, 18, 20, 22, 24, 26, 28 form an open ended tubular structure in a set-up condition.

The blank 10 comprises a first bottom panel 12 hinged to a first bevel panel 14 by a hinged connection such as a fold line 13. The first bevel panel 14 is hinged to a first side panel 16 by a hinged connection such as a fold line 15. The first side panel 16 is hinged to a second bevel panel 18 by a hinged connection such as a fold line 17. The second bevel panel 18 is hinged to a top panel 20 by a hinged connection such as a fold line 19. The top panel 20 is hinged to a third bevel panel 22 by a hinged connection such as a fold line 21. The third bevel panel 22 is hinged to a second side panel 24 by a hinged connection such as a fold line 23. The second side panel 24 is hinged to a fourth bevel panel 26 by a hinged connection such as a fold line 25. The fourth bevel panel 26 is hinged to a second bottom panel 28 by a hinged connection such as a fold line 27.

The first bevel panel 14 comprises a plurality of article heel engaging apertures A1. In the illustrated first embodiment, the first bevel panel 14 comprises six article heel engaging apertures A1.

5 Each of the article heel engaging apertures A1 is struck in part from the first bevel panel 14 and in part from the first side panel 16. Each of the article heel engaging apertures A1 is substantially semi-circular in shape. A linear edge of each article heel engaging aperture A1 is coincident with the fold line 13 so as to interrupt fold line 13. An arcuate or curved edge of each article heel engaging aperture A1 interrupts the fold line 15.

10

The fourth bevel panel 26 comprises a plurality of article heel engaging apertures A2. In the illustrated first embodiment the second bevel panel 26 comprises six article heel engaging apertures A2.

15 Each of the article heel engaging apertures A2 is struck in part from the fourth bevel panel 26 and in part from the second side panel 24. Each of the article heel engaging apertures A2 is substantially semi-circular in shape. A linear edge of each article heel engaging aperture A2 is coincident with the fold line 27 so as to interrupt fold line 27. An arcuate or curved edge of each article heel engaging aperture A2 interrupts the fold line 25.

20

The second bevel panel 18 comprises a plurality of article head engaging apertures A3. In the illustrated embodiment the second bevel panel 18 comprises six article head engaging apertures A3.

25 Each of the article head engaging apertures A3 is struck in part from the second bevel panel 18 and in part from the first side panel 16. Each of the article head engaging apertures A3 is substantially U-shaped. An arcuate or curved edge of each article head engaging aperture A3 interrupts the fold line 17. An upper edge of each of the article head engaging apertures A3 is defined by an arcuate or curved edge of a tab F1. Each tab F1 is struck from the  
30 second bevel panel 18 and is arranged to be integrally formed with the top panel 20. Each of the tabs F1 is arranged to cover an upper end of an article disposed within the respective one of the article head engaging apertures A3.

The third bevel panel 22 comprises a plurality of article head engaging apertures A4. In the  
35 illustrated embodiment the third bevel panel 22 comprises six article head engaging apertures A4.



Each of the article head engaging apertures A4 is struck in part from the third bevel panel 22 and in part from the second side panel 24. Each of the article head engaging apertures A4 is substantially U-shaped. An arcuate or curved edge of each article head engaging aperture A4 interrupts the fold line 23. An upper edge of each of the article head engaging apertures A4 is defined by an arcuate or curved edge of a tab F2. Each tab F2 is struck from the third bevel panel 22 and is arranged to be integrally formed with the top panel 20. Each of the tabs F2 is arranged to cover an upper end of an article disposed within the respective one of the article head engaging apertures A4.

10 The blank 10 comprises a dispenser or access device T, see Figure 4. The access device T comprises a pair of weakened lines of severance 30a, 30b. A first weakened line of severance 30a extends between each of the article head engaging apertures A3 and between an endmost one of the article head engaging apertures A3 and an end edge of the top panel 20. A second weakened line of severance 30b extends between each of the article head engaging apertures A4 and between an endmost one of the article head engaging apertures A4 and an end edge of the top panel 20. In this way a tear strip is formed, wherein the tear strip extends substantially along the top panel 20.

The blank 10 comprises a first handle structure H1. The first handle structure H1 is formed in the first side panel 16. The blank 10 comprises a second handle structure H2. The second handle structure H2 is formed in the second side panel 24. The second handle structure is substantially the same as the first handle structure and will be described in more detail by reference to the first handle structure H1 as shown in Figure 1A.

25 Figure 1A shows the first handle structure H1. The first handle structure H1 comprises a handle flap or tab 42 hinged to the first side panel 16 by the fold line 34. Fold line 34 is preferably arcuate in shape. The tab 42 is defined in part by the fold line 34 and in part by a severance line or weakened line of severance 32. The tab 42 is preferably an inverted bell shape. The weakened line of severance 32 comprises two terminal ends; each of the terminal ends is disposed within the tab 42. End portions 32a, 32b of the weakened line of severance 32 are arcuate in shape such that the end portions of the weakened line of severance 32 curl back on themselves. The fold line 34 comprise a first end and a second end; the first end of the fold line 34 meets or intersects the weakened line of severance 32 at point distal from a first terminal end of the weakened line of severance 32. The second end of the fold line 34 meets or intersects the weakened line of severance 32 at point distal from a second terminal end of the weakened line of severance 32. The arcuate nature of the end portions 32a, 32b of the weakened line of severance 32 prevent or reduce the likelihood of a

tear propagating from the first or second terminal ends of the weakened line of severance 32 when the carrying handle is in use.

5 The tab 42 comprises three fold lines 36, 38, 40. The three fold lines 36, 38, 40 together form a "Y" shaped fold line. An upper end of the left branch of the "Y" shaped fold line 36/38/40 meets a first end portion of the weakened line of severance 32 and an upper end of the right branch of the "Y" shaped fold line 36/38/40 meets a second end portion of the weakened line of severance 32. The lower end of the trunk of the "Y" shaped fold line 36/38/40 meets or intersects with a mid-point of the weakened line of severance 32. In this way the "Y" shaped fold line 36/38/40 defines a first wing portion 42a of the tab 42 and a second wing portion 42b of the tab 42.

Turning to the construction of the carton 90 as illustrated in Figure 2, the carton 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.

A group of articles C is arranged in a row of six articles C. The blank 10 is lowered over the group of articles C.

20 The blank 10 is folded about the fold line 19, such that the second bevel panel 18, the first side panel 16, the first bevel panel 14 and the first bottom panel 12 are folded thereabouts. In doing so upper portions of each article C are received in a respective one of the article head engaging apertures A3. The blank 10 is folded about the fold line 17 such that the first side panel 16, the first bevel panel 14 and the first bottom panel 12 are folded thereabouts. This places the first side panel 16 on or adjacent to the side walls or rounded sides of the articles C.

The blank 10 is folded about the fold line 15, such that the first bevel panel 14 and the first bottom panel 12 are folded thereabouts. In this way lower portions of each article A are received in a respective one of the article heel engaging apertures A1.

The blank 10 is folded about the fold line 13 such that the first bottom panel 12 is folded thereabouts. This places the first bottom panel 12 below the bottom of the group of articles C.

35 The blank 10 is folded about the fold line 21, such that the third bevel panel 22, the second side panel 24, the fourth bevel panel 26 and the second bottom panel 28 are folded

thereabouts. In doing so upper portions of each article C are received in a respective one of the article head engaging apertures A4. The blank 10 is folded about the fold line 23, such that the second side panel 24, the fourth bevel panel 26 and the second bottom panel 28 are folded thereabouts. This places the second side panel 24 adjacent to the side walls of the articles C.

The blank 10 is folded about the fold line 25, such that the fourth bevel panel 26 and the second bottom panel 28 are folded thereabouts. In this way lower portions of each article C are received in a respective one of the article heel engaging apertures A2.

Glue G or other adhesive treatment is applied to the first bottom panel 12 or, in alternative embodiments, to a corresponding portion, an overlapping section, of the second bottom panel 28.

The blank 10 is folded about the fold line 27 such that the second bottom panel 28 is folded thereabouts. This places the second bottom panel 28 below the bottom of the group of articles C.

The second bottom panel 28 is secured to the first bottom panel 12.

Figure 2 illustrates the assembled package formed from the carton 90 and the group of articles C. The handle structure H1 is disposed over a void between two adjacent articles C of the group. The flap fold line 34 is disposed transversely of the cylindrical axes of the two adjacent articles C. The first and second handles structures H1, H2 are arranged such that the trunk of the "Y" shaped fold line 36/38/40 is substantially aligned with the point of abutment of a pair of adjacent articles C, preferably the centre-most pair of articles C in the group of articles C. In this way the tab 42 can be folded internally of the carton 90 into a void between the pair of adjacent articles C and the first or second side panels 16, 24 as shown in Figure 3. In this way first and second handles structures H1, H2 form a carrying handle. A user U can grip the carton 90, for example, between forefinger/index finger and thumb. When the tab 42 is pressed into the interior of the carton 90, the tab 42 engages at its wing portions 42a, 42b with the pair of adjacent articles C respectively, which causes the tab 42 to fold about the fold line 36, 38 and 40 to form an indented or scooped finger tab. The user's finger is received in the scooped finger tab and in this way a comfortable carrying handle is formed.

Figure 4 illustrates the assembled package in which the access device T of the carton 90 has been employed. The tear strip has been partially severed from the top panel 20 by severing the pair of weakened lines of severance 30a, 30b.

5 Referring now to Figures 12 and 13, there is shown an alternative embodiment of the present invention. In the second illustrated embodiment, like numerals have, where possible, been used to denote like parts, albeit with the addition of the prefix "300" to indicate that these features belong to the second embodiment. The alternative embodiments in the application share many common features with the first embodiment and therefore only the differences from the embodiment illustrated in Figures 1 to 4 will hereinafter be described in  
10 any greater detail.

Figure 12 illustrates a blank 310 for forming a pair of cartons 390a, 390b, as shown in Figure 13, according to the second illustrated embodiment.

15

The blank 310 comprises a plurality of panels for forming a pair of cartons 390a, 390b as shown in Figure 13. The cartons 390a, 390b are initially connected to each other and are divisible from each other. A first set of panels P1 of the blank 310 forms a first carton or first package and a second set of panels P2 of the blank 310 forms a second carton or second  
20 package.

20

The blank 310 comprises a plurality of main wall panels 312, 314, 316, 318, 320 for forming a first package. The first package comprises: a first or inner top wall 312, a first side wall 314, a bottom wall 316, a second side wall 318 and a second or outer top wall 320 in a set-up condition. The inner top wall panel 312 is hinged to the first side wall panel 314 by a hinged connection such as a fold line 311. The first side wall panel 314 is hinged to the bottom wall panel 316 by a hinged connection such as a fold line 313. The bottom wall panel 316 is hinged to the second side wall panel 318 by a hinged connection such as a fold line 315. The outer top wall panel 320 is hinged to the second side wall panel 318 along a hinged  
25 connection such as a fold line 317.

30

The blank 310 also comprises a plurality of main wall panels 322, 324, 326, 328, 330 for forming a second package. The second package comprises: a first or inner top wall 330, a first side wall 328, a bottom wall 326, a second side wall 324 and a second or outer top wall 322 in a set-up condition. The outer top wall panel 322 is hinged to the second side wall panel 324 by a hinged connection such as a fold line 321. The second side wall panel 324 is hinged to the bottom wall panel 326 by a hinged connection such as a fold line 323. The  
35

bottom wall panel 326 is hinged to the first side wall panel 328 by a hinged connection such as a fold line 325. The inner top wall panel 330 is hinged to the first side wall panel 328 along a hinged connection such as a fold line 327.

5 The plurality of main panels 312, 314, 316, 318, 320 of the first package form a tubular structure in a set-up condition. Each of the ends of the tubular structure of the first package are at least partially closed by end closure panels 332a, 334a, 336a, 338a, 332b, 334b, 336b, 338b. End closure panels 332a, 334a, 336a, 338a are configured to close a first end of the tubular structure and end panels 332b, 334b, 336b, 338b are configured to close a  
10 second end of the tubular structure. A first end closure panel 332a is hinged to a first end of inner top wall panel 312 by a pair of arcuate fold lines 331a. A second end closure panel 334a is hinged to a first end of bottom panel 316 by a hinged connection such as a fold line 333a. A third end closure panel 336a is hinged to a first end of second side wall panel 318 by a hinged connection such as a fold line 335a. A fourth end closure panel 338a is hinged  
15 to a first end of the second, outer, top wall panel 320 by a hinged connection such as a fold line 337a.

A fifth end closure panel 332b is hinged to a second end of inner top wall panel 312 by a pair of arcuate fold lines 331b. A sixth end closure panel 334b is hinged to a second end of  
20 bottom wall panel 316 by a hinged connection such as a fold line 333b. A seventh end closure panel 336b is hinged to a second end of second side panel 318 by a hinged connection such as a fold line 335b. An eighth end closure panel 338b is hinged to a second end of the second, outer, top wall panel 320 by a hinged connection such as a fold line 337b.

25 The third end closure panel 336a and the seventh end closure panel 336b each form a minor side end closure panel. The second end closure panel 334a and the sixth end closure panel 334b each form a major lower end closure panel. The fourth end closure panel 338a along with the first end closure panel 332a forms a major upper end closure panel. The eighth end closure panel 338b along with the fifth end closure panel 332b also forms a major upper end  
30 closure panel.

The plurality of main panels 322, 324, 326, 328, 330 of the second package form a tubular structure in a set-up condition. Each of the ends of the tubular structure of the second package are at least partially closed by end closure panels 340a, 342a, 344a, 346a, 340b,  
35 342b, 344b, 346b. End closure panels 340a, 342a, 344a, 346a are configured to close a first end of the tubular structure and end panels 340b, 342b, 344b, 346b are configured to close a second end of the tubular structure. A first end closure panel 340a is hinged to a first end

of second or outer top wall panel 322 by a hinged connection such as a fold line 339a. A second end closure panel 342a is hinged to a first end of second side panel 324 by a hinged connection such as a fold line 341a. A third end closure panel 344a is hinged to a first end of bottom wall panel 326 by a hinged connection such as a fold line 343a. A fourth end closure panel 346a is hinged to a first end of the inner top wall panel 330 by a pair of arcuate fold lines 347a.

A fifth end closure panel 340b is hinged to a second end of second or outer top wall panel 322 by a hinged connection such as a fold line 339b. A sixth end closure panel 342b is hinged to a second end of second side wall panel 324 by a hinged connection such as a fold line 341b. A seventh end closure panel 344b is hinged to a second end of bottom panel 326 by a hinged connection such as a fold line 343b. An eighth end closure panel 346b is hinged to a second end of the inner top wall panel 330 by a pair of arcuate fold lines 347b.

The outer top panel 320 of the first package 390a is coupled to the outer top panel 322 of the second package 390b by a frangible line 319. The outer top panel 320 of the first package and the outer top panel 322 of the second package 390b form a common top wall 320/322 of a carton.

The second side wall panel 318 of the first package 390a forms a first outer side wall 318 of the carton. The second side wall panel 324 of the second package 390b forms a second outer side wall 324 of the carton.

The bottom panel 316 of the first package 390a forms a first part 316 of a bottom wall 316/326 of the carton. The bottom panel 326 of the second package 390b forms a second part 326 of a bottom wall 316/326 of the carton.

The end closure panels 332a, 334a, 336a, 338a of the first package 390a and the end closure panels 340a, 342a, 344a, 346a of the second package 390b form a first end wall of the carton.

The end closure panels 332b, 334b, 336b, 338b of the first package 390a and the end closure panels 340b, 342b, 344b, 346b of the second package 390b form a second end wall of the carton.

The first side wall panel 314 of the first package 390a and the first side wall panel 328 of the second package 390b form an internal divider structure in the set-up carton. The internal

divider structure separates a first row of articles disposed in the first package 390a from a second row of articles disposed in the second package 390b.

The blank 310 comprises four handle structures H1, H2, H3, H4. A first handle structure H1 is provided in the first side wall panel 314 of the first package 390a. A second handle structure H2 is provided in the second side wall panel 318 of the first package 390a. A third handle structure H3 is provided in the second side wall panel 324 of the second package 390b. A fourth handle structure H4 is provided in the first side wall panel 328 of the second package 390b.

The blank 310 comprises a pair of access devices D1, D2. A first access device D1 is provided in the portion of the blank 310 forming the first package 390a. A second access device D2 is provided in the portion of the blank 310 forming the second package 390b. The first access device D1 is substantially the same as the second access device D2, and the access devices D1, D2 will be described by reference to the second access device D2.

The second access device D2 is provided for removal of a portion 356 of the first side wall panel 328 of the second package 390b. Removal of said portion 356 facilitates access to the contents of the second package.

The second access device D2 comprises a plurality of weakened lines of severance 351, 353, 354 which define at least in part a removable portion 356 of the first side wall panel 328. The plurality of weakened lines of severance 351, 353, 354 includes: a first weakened line of severance 353 which extends from an end edge of the first side wall panel 328 along a portion of the fold line 325 between the bottom panel 326 and the first side wall panel 328; a second weakened line of severance 354 extends from an end of the first weakened line of severance 353 across the first side wall 328 from the fold line 325 to the fold line 327 between the first side wall panel 328 and the inner top wall panel 330; and a third weakened line of severance 351 extends from an end of second weakened line of severance 354 along a portion of the fold line 327, between the first side wall panel 328 and the first inner top wall panel 330, to the end edge of the first side wall panel 328.

The access device D2 comprises an optional tear initiation tab 350 defined in part by the second weakened line of severance 354 and in part by a hinged connection such as a fold line 352. The tear initiation tab 350 is hinged to the removable portion 356 of the first side wall panel 328 by the fold line 352. The tear initiation tab 350 is detachable from the second package along with the removable portion 356.

Turning to the construction of the first and second cartons 390a, 390b as illustrated in Figure 13, the first and second cartons 390a, 390b can be formed by a series of sequential folding operations in a straight line machine so that the first and second cartons 390a, 390b are not required to be rotated or inverted to complete their construction. The folding process is not limited to that described below and may be altered according to particular manufacturing requirements.

In order to form the first and second cartons 390a, 390b, in a first stage the blank 310 is folded to bring the inner top wall panel 312 of the first package into face contacting relationship with the first side wall panel 314 folding the first top wall panel 312 about the fold line 311.

The inner top wall panel 330 of the second package is folded about the fold line 327 to bring the inner top wall panel 330 of the second package into face contacting relationship with the first side wall panel 328.

Glue or other adhesive treatment is applied to the inner top wall panel 312 of the first package.

Glue or other adhesive treatment is applied to the inner top wall panel 330 of the second package.

In alternative embodiments glue or other adhesive treatment is applied to the corresponding portions of each of the outer top wall panels 320, 322 of the first and second packages respectively.

The inner top wall panel 312, first side wall panel 314 and the bottom panel 316 of the first package are folded about the fold line 315 such that the bottom panel 316 is in overlying relationship with the second side wall panel 318. This brings the inner top wall panel 312 into face contacting relationship with the outer top wall panel 320. Pressure may be applied to the first side panel 314 of the first package to secure the inner top wall panel 312 to the outer top wall panel 320.

The inner top wall panel 330, first side wall panel 328 and the bottom panel 326 of the second package are folded about the fold line 323 such that the bottom panel 326 is in overlying relationship with the second side wall panel 324. This brings the inner top wall



panel 330 into face contacting relationship with the outer top wall panel 322. Pressure may be applied to the first side panel 328 of the second package to secure the inner top wall panel 330 to the outer top wall panel 322.

- 5     Glue or other adhesive treatment is applied to the first side wall panel 314 of the first package and/or to the first side wall panel 328 of the second package.

10     The blank 310 may then be folded about the frangible line 319 to bring the first side wall panel 314 of the first package into contacting relationship with the first side wall panel 328 of the second package.

15     In an alternative embodiment, the second side panel 324 of the second package may be folded with respect to the outer top wall panel 322 about the fold line 321. Simultaneously the first side wall panel 328 may be folded with respect to the inner top wall panel 330 by unfolding the first side wall panel 328 about the fold line 327. The bottom wall panel 326 may be folded with respect to the first side wall panel 328 by folding about the fold line 325 to place the bottom wall panel 326 in face contacting relationship with the first side wall panel 328. Simultaneously, the bottom wall panel 326 is folded with respect to the second side wall panel 324, by unfolding the bottom wall panel 326 about the fold line 323. In this way  
20     the portion of the blank 310 forming the second package is folded into a flat collapsed state which overlies the portion of the blank 310 forming the first package which is also in a folded, flat collapsed condition. This provides a unitary carton, which is in a flat collapsed state in which it can be shipped and distributed to a converter plant. It will be appreciated that this alternative folding method could be readily modified to bring the portion of the blank 310  
25     forming the first package into a flat, folded, collapsed state which overlies the portion of the blank 310 forming the second package which is also in a folded, flat, collapsed condition. These alternative methods avoid folding the blank 310 about the frangible line 319 and thus reduce the risk of the first and second packages 390a, 390b becoming separated during assembly and filling of the first and second cartons 390a, 390b.

30

The first and second cartons 390a, 390b may be erected into a tubular structure by engaging with a pair of adjacent walls of the one of the first and second cartons 390a, 390b and folding said adjacent walls such that they are disposed perpendicularly with respect to each other.

35

The erected tubular structure is loaded with articles through one or both open ends of each package. One or more of the end closure panels 332a, 334a, 336a, 338a, 332b, 334b, 336b,

338b, 340a, 342a, 344a, 346a, 340b, 342b, 344b, 346b may be folded outwardly to act as a funnel to facilitate insertion of the articles into the first and second cartons 390a, 390b .

Once the articles are loaded into the tubular structure, the ends of the tubular structure are closed. A first end of the first package is closed by folding the third end closure panel 336a about fold line 335a. Glue or other adhesive treatment may be applied to an outer surface of the second end closure panel 334a. In alternative embodiments, the glue or adhesive treatment may be applied to an inner surface of the corresponding region of the first, second and fourth end closure panels 332a, 334a, 338a. The second end closure panel 334a is then folded about the fold line 333a and is optionally secured to the third end closure panel 336a. Glue or adhesive treatment is applied to an outer surface of the second end closure panel 334a. In an alternative embodiment, glue or adhesive treatment is applied to an inner surface of the fourth end closure panel 338a and/or to the first end closure panel 332a. The fourth end closure panel 338a is folded about fold line 337a and brought into contact with the second end closure panel 334a such that part of the fourth end closure panel 338a is in overlapping relationship with part of the second end closure panel 334a and is secured and affixed thereto. The first end closure panel 332a, which is secured to the inner surface of the fourth end closure panel 338a, is folded about arcuate fold lines 331a, simultaneously with the fourth end closure panel 338a being folded about fold line 337a.

A second end of the first package is closed by folding the seventh end closure panel 336b about fold line 335b. Glue or other adhesive treatment may be applied to an outer surface of the seventh end closure panel 336b. In alternative embodiments, the glue or adhesive treatment may be applied to an inner surface of the corresponding regions of the fifth, sixth and eighth end closure panels 332b, 334b, 338b. The sixth end closure panel 334b is folded about the fold line 333b and optionally secured to the seventh end closure panel 336b. Glue or adhesive treatment is applied to an outer surface of the sixth end closure panel 334b. In an alternative embodiment, glue or adhesive treatment is applied to an inner surface of the eighth end closure panel 338b and/or the fifth end closure panel 332b. The eighth end closure panel 338b is folded about fold line 337b and brought into contact with the sixth end closure panel 334b such that a portion of the eighth end closure panel 338b is in overlapping relationship with a portion of the sixth end closure panel 334b and is secured thereto. The fifth end closure panel 332b, which is secured to the inner surface of the eighth end closure panel 338b, is folded about arcuate fold lines 331b, simultaneously with the eighth end closure panel 338b being folded about fold line 337b.

A first end of the second package is closed by folding the second end closure panel 342a about fold line 341a. Glue or other adhesive treatment may be applied to an outer surface of the second end closure panel 342a. In alternative embodiments, the glue or adhesive treatment may be applied to an inner surface of the corresponding regions of the first, third and fourth end closure panels 340a, 344a, 346a. The third end closure panel 344a is then folded about the fold line 343a and is optionally secured to the second end closure panel 342a. Glue or other adhesive treatment is applied to an outer surface of the third end closure panel 344a. In an alternative embodiment, glue or other adhesive treatment is applied to an inner surface of the first end closure panel 340a and/or fourth end closure panel 346a. The first end closure panel 340a is folded about fold line 339a and brought into contact with the third end closure panel 344a such that part of the first end closure panel 340a is in overlapping relationship with part of the third end closure panel 344a and is secured and affixed thereto. The fourth end closure panel 346a, which is secured to the inner surface of the first end closure panel 340a, is folded about arcuate fold lines 347a, simultaneously with the first end closure panel 340a being folded about fold line 339a.

A second end of the second package is closed by folding the sixth end closure panel 342b about fold line 341b. Glue or other adhesive treatment may be applied to an outer surface of the sixth end closure panel 342b. In alternative embodiments, the glue or other adhesive treatment may be applied to an inner surface of the corresponding regions of the fifth, seventh and eighth end closure panels 340b, 344b, 346b. The seventh end closure panel 344b is folded about the fold line 343b and optionally secured to the sixth end closure panel 342b. Glue or adhesive treatment is applied to an outer surface of the seventh end closure panel 344b. In an alternative embodiment, glue or other adhesive treatment is applied to an inner surface of the fifth end closure panel 340b and/or to an inner surface of the eighth end closure panel 346b. The fifth end closure panel 340b is folded about fold line 339b and brought into contact with the seventh end closure panel 344b such that a portion of the fifth end closure panel 340b is in overlapping relationship with a portion of the seventh end closure panel 344b and is secured thereto. The eighth end closure panel 346b, which is secured to the inner surface of the fifth end closure panel 340b, is folded about arcuate fold lines 347b, simultaneously with the fifth end closure panel 340b being folded about fold line 339b.

In some embodiments, one end of the tubular structure may be closed before loading articles through a remaining open end of the tubular structure.

Figure 13 illustrates the first and second packages 390a, 390b in a separated condition. A retailer has severed the frangible line 319 such that the first package is separate to the second package. In those embodiments, in which the first side wall panel 314 of the first package is glued to the first side wall panel 328 of the second package, the retailer severs or  
5 breaks the glue connection. In some embodiments, the first side wall panels 314, 328 of the first and/or second package may comprise one or more glue locations which are surrounded by a half-cut perforation. In this way the retailer may readily, controllably and neatly tear an outer layer or skin of the substrate forming the first side wall panel 314, 328.

- 10 Once the retailer has separated the first package 390a from the second package 390b, and the consumer wishes to carry one of the packages from the shelf, they may employ the carrying handle.

A user may engage with the first and second handle structures H1, H2 to form a carrying  
15 handle to carry the first package 390a. A user may engage with the third and fourth handle structures H3, H4 to form a carrying handle to carry the second package 390b.

A user may alternatively engage with the second and third handle structures H2, H3 to form a carrying handle to carry the unitary carton formed by the first and second packages 390a,  
20 390b when still in a connected state.

Referring now to Figures 5 to 8, there is shown a further alternative embodiment or third embodiment of the present invention. In the third illustrated embodiment, like numerals have, where possible, been used to denote like parts, albeit with the addition of the prefix "100" to  
25 indicate that these features belong to the third embodiment.

Figure 5 illustrates a blank 110 for forming a carton 190 for packaging can arranged in two tiers, according to the third illustrated embodiment. The cans in each tier preferably are  
30 arranged in a 4-by configuration such as a 4x4, 4x5 or 4x6.

The blank 110 comprises a plurality of main panels 112, 114, 116, 118, 120 which form a tubular structure in a set-up condition.

35 The blank 110 comprises a securing panel 112 hinged to a top panel 114 by a hinged connection such as a fold line 113. The top panel 114 is hinged to a first side panel 116 by a hinged connection such as a fold line 115. The first side panel 116 is hinged to a bottom

panel 118 by a hinged connection such as a fold line 117. The bottom panel 118 is hinged to a second side panel 120 by a hinged connection such as a fold line 119.

Each of the ends of the tubular structure is at least partially closed by end closure panels 126a, 128a, 130a, 132a, 126b, 128b, 130b, 132b. End closure panels 126a, 128a, 130a, 132a are configured to close a first end of the tubular structure and end closure panels 126b, 128b, 130b, 132b are configured to close a second end of the tubular structure.

A first end closure panel 126a is hinged to a first end of top panel 114 by a hinged connection such as a fold line 127a. A second end closure panel 128a is hinged to a first end of first side panel 116 by a hinged connection such as a fold line 129a. A third end closure panel 130a is hinged to a first end of bottom panel 118 by a hinged connection such as a fold line 131a. A fourth end closure panel 132a is hinged to a first end of the second side panel 120 by a hinged connection such as a fold line 133a.

A fifth end closure panel 126b is hinged to a second end of first top panel 114 by a hinged connection such as a fold line 127b. A sixth end closure panel 128b is hinged to a second end of the first side panel 116 by a hinged connection such as a fold line 129b. A seventh end closure panel 130b is hinged to a second end of bottom panel 118 by a hinged connection such as a fold line 131b. An eighth end closure panel 132b is hinged to a second end of second side panel 120 by a hinged connection such as a fold line 133b.

The second end closure panel 128a and the fourth end closure panel 132a each form a minor side end closure panel. The sixth end closure panel 128b and the eighth end closure panel 132b each form a minor side end closure panel.

The first end closure panel 126a and the fifth end closure panel 126b each form a major upper end closure panel. The third end closure panel 130a and the seventh end closure panel 130b each form a major lower end closure panel.

The blank 110 comprises a first reinforcing panel 112a hinged to a first end of securing panel 112. The blank 110 comprises a second reinforcing panel 112b hinged to a second end of securing panel 112. The blank 110 comprises a third reinforcing panel 134a hinged to an upper end of second end closure panel 128a by a hinged connection such as a fold line 135a. The blank 110 comprises a fourth reinforcing panel 134b hinged to an upper end of sixth end closure panel 128b by a hinged connection such as a fold line 135b.

The blank 110 comprises a first recess R1 struck from an end edge of second end closure panel 128a. The blank 110 comprises a second recess R2 struck from an end edge of sixth end closure panel 128b. The blank 110 comprises a third recess R3 struck from an end edge of fourth end closure panel 132a. The blank 110 comprises a fourth recess R4 struck from an end edge of eighth end closure panel 132b.

The blank 110 comprises an access device Z, which comprises a door or gateway struck in part from the top panel 114 and in part from the first side panel 116. The access device Z is defined in part by a pair of weakened lines of severance 140, 142 and a hinged connection such as a fold line 146. The door or gateway is hinged to the first side panel 116 by the fold line 146. The access device Z comprises a tear initiation device 148 disposed within the top panel 114.

The blank 110 comprises a first handle structure H1 defined in the first end closure panel 126a and a second handle structure H2 defined in and the fifth end closure panel 126b. Figure 6 illustrates the first handle structure H1. The second handle structure H2 is substantially the same as the first handle structure H1 and will be described in more detail by reference to the first handle structure H1 as shown in Figure 6.

The first handle structure H1 comprises a handle flap 170. The handle flap 170 is hinged to the first end closure panel 126a by a hinged connection such as a fold line 150. The handle flap 170 is defined in part by a first weakened line of severance 158a, in part by a second weakened line of severance 158b, in part by a third weakened line of severance 158c, a first aperture A5, a second aperture A6 and a fold line 150.

A first end of the first weakened line of severance 158a intersects or meets with a first end of the fold line 150. A second end of the first weakened line of severance 158a intersects or meets with first aperture A5. A first end of the third weakened line of severance 158c intersects or meets with first aperture A5. A second end of the third weakened line of severance 158c intersects or meets with second aperture A6. A first end of the second weakened line of severance 158b intersects or meets with second aperture A6. A second end of the second weakened line of severance 158b intersects or meets with a second end of the fold line 150.

The handle flap 170 comprises a first hinged connection such as a fold line 152 extending there-across and arranged in a parallel spaced apart relationship with the fold line 150.

The handle flap 170 comprises a second hinged connection such as a fold line 154 extending from the second end of the fold line 150 across the handle flap 170 to an edge defined by the second aperture A6.

- 5 The handle flap 170 comprises a third hinged connection such as a fold line 156 extending from the first end of the fold line 150 across the handle flap 170 to an edge defined by the first aperture A5.

10 The second and third fold lines 154, 156 define in part foldable wing portion of the handle flap 170.

The handle flap 170 comprises a V shaped fold line defined by a fourth fold line 160 and a fifth fold line 162. A first end of the fourth fold line 160 intersects or meets with the first fold line 152. A first end of the fifth fold line 162 intersects or meets with the first fold line 152. A  
15 second end of the fourth fold line 160 intersects or meets with a second end of the fifth fold line 162 to form the vertex of a "V".

A severance line 164 intersects the V shaped fold line at the vertex of the "V". The severance line 164 is orientated substantially perpendicularly to the first fold line 152.  
20

Turning to the construction of the cartons 190 as illustrated in Figure 7, the carton 190 can be formed by a series of sequential folding operations in a straight line machine so that the carton 190 is not required to be rotated or inverted to complete its construction. The folding process is not limited to that described below and may be altered according to particular  
25 manufacturing requirements.

Glue or other adhesive treatment is applied to the third reinforcing panel 134a or, in alternative embodiments, to a corresponding adjacent portion of the second end closure panel 128a.  
30

Glue or other adhesive treatment is applied to the fourth reinforcing panel 134b or, in alternative embodiments, to a corresponding adjacent portion of the sixth end closure panel 128b.

- 35 The third reinforcing panel 134a is folded about fold line 135a and placed in face contacting relationship with the second end closure panel 128a. The third reinforcing panel 134a is secured to the second end closure panel 128a.

The fourth reinforcing panel 134b is folded about fold line 135b and placed in face contacting relationship with the sixth end closure panel 128b. The fourth reinforcing panel 134b is secured to the sixth end closure panel 128b.

5

The blank is folded about fold line 115 such that the securing panel 112 and the top panel 114 are folded thereabouts. The top panel 114 is placed in face contacting relationship with the first side panel 116.

10    Glue or other adhesive treatment is applied to the securing panel 112 or, in alternative embodiments, to a corresponding portion or overlapping section of the second side panel 120.

15    Glue or other adhesive treatment is applied to the first reinforcing panel 112a or, in alternative embodiments, to a corresponding portion or overlapping section of the fourth end closure panel 132a.

20    Glue or other adhesive treatment is applied to the second reinforcing panel 112b or, in alternative embodiments, to a corresponding portion or overlapping section of the eighth end closure panel 132b.

25    The blank is folded about fold line 119 such that the second side panel 120 is folded thereabouts. The second side panel 120 is placed in face contacting relationship with the bottom panel 118. The second side panel 120 is placed in overlapping relationship with the securing panel 112. The fourth end closure panel 132a is placed in overlapping relationship with the first reinforcing panel 112a. The eighth end closure panel 132b is placed in overlapping relationship with second reinforcing panel 112b.

30    The securing panel 112 is secured to the second side panel 120. The fourth end closure panel 132a is secured to the first reinforcing panel 112a. The eighth end closure panel 132b is secured to second reinforcing panel 112b.

In this way a flat collapsed tubular structure is formed; the flat collapsed tubular structure can be readily shipped or distributed.

35



The flat collapsed tubular structure can be erected into a tubular structure by engaging a pair of adjacent panels and unfolding them such that they are disposed substantially perpendicularly with respect to each other.

5 The erected tubular structure is loaded with articles (e.g., cans arranged in two tiers) through one or both open ends thereof. One or more of the end closure panels 126a, 128a, 130a, 132a, 126b, 128b, 130b, 132b may be folded outwardly to act as a funnel to facilitate insertion of the articles into the carton 190. In some embodiments, one end of the carton may be closed before loading articles through the remaining open end.

10

Once the articles are loaded into the tubular structure, the ends of the carton 190 are closed. A first end of the carton 190 is closed by folding the second end closure panel 128a about fold line 129a. The fourth end closure panel 132a is folded about fold line 133a.

15 Glue or other adhesive treatment may be applied to an outer surface of the second end closure panel 128a. Glue or other adhesive treatment may be applied to an outer surface of the fourth end closure panel 132a.

In alternative embodiments, the glue or other adhesive treatment may be applied to an inner  
20 surface of the corresponding regions of the first and/or third end closure panels 126a, 130a.

The first end closure panel 126a is then folded about the fold line 127a and is optionally secured to the second and fourth end closure panels 128a, 132a.

25 Glue or other adhesive treatment is applied to an outer surface of the first end closure panel 126a. In an alternative embodiment, glue or other adhesive treatment is applied to an inner surface of the third end closure panel 130a.

The third end closure panel 130a is folded about fold line 131a and brought into contact with  
30 the first end closure panel 126a such that part of the third end closure panel 130a is in overlapping relationship with part of the first end closure panel 126a and is secured and affixed thereto.

In alternative embodiments, the third end closure panel 130a may be folded about fold line  
35 131a prior to folding the first end closure panel 126a about fold line 127a. In such embodiments, the first end closure panel 126a is disposed outermost.

A second end of the carton 190 is closed by folding the sixth end closure panel 128b about fold line 129b. The eighth end closure panel 132b is folded about fold line 133b.

5      Glue or other adhesive treatment may be applied to an outer surface of the sixth end closure panel 128b. Glue or other adhesive treatment may be applied to an outer surface of the eighth end closure panel 132b.

10      In alternative embodiments, the glue or other adhesive treatment may be applied to an inner surface of the corresponding regions of the fifth and/or seventh end closure panels 126b, 130b.

The fifth end closure panel 126b is then folded about the fold line 127b and is optionally secured to the sixth and eighth end closure panels 128b, 132b.

15      Glue or other adhesive treatment is applied to an outer surface of the fifth end closure panel 126b. In an alternative embodiment, glue or other adhesive treatment is applied to an inner surface of the seventh end closure panel 130b.

20      The seventh end closure panel 130b is folded about fold line 131b and brought into contact with the fifth end closure panel 126b such that part of the seventh end closure panel 130b is in overlapping relationship with part of the fifth end closure panel 126b and is secured and affixed thereto, thereby forming the carton 190 shown in Figure 7.

25      In alternative embodiments, the seventh end closure panel 130b may be folded about fold line 131b prior to folding the fifth end closure panel 126b about fold line 127b. In such embodiments, the fifth end closure panel 126b is disposed outermost.

30      The package 190 shown in Figure 7 contains a group of can arranged in two tiers. Each tier contains the same number of cans arranged in, for example, a 4-by configuration. The cans in each tier are arranged such that their cylindrical axes are parallel to one another and are disposed generally perpendicularly to the top and bottom panels 114, 118. The cans in the upper tier are placed directly, or via a divider panel, on tops of the cans of the lower tier such that the cans of the upper tier are vertically aligned with the cans of the lower tier respectively. The first and second handle structures H1, H2 are arranged such that the  
35      severance line 164 is in general alignment with the point or line of abutment of a pair of adjacent cans, preferably the center-most pair of cans in the upper tier. In this way, the triangular panel 161 (which is defined by the fourth fold line 160, the fifth fold line 162 and

the first fold line 152) can be folded internally of the carton 190 into a void between the respective top end closure panel 126a, 126b and the pair of adjacent cans C, C as shown in Figures 8A and 8B.

5 Figures 8A and 8B illustrate the first handle structure H1 of the carton 190 in a partially folded condition. Figure 8A shows the first handle structure H1 having been folded to a first partially folded position whereas Figure 8B shows the same in a second partially folded position. Referring to Figures 6, 7, 8A and 8B, a user can press his/her hands on the handle structures H1, H2 to sever the first, second and third weakened lines of severance 158a,  
10 158b, 158c and to thereby fold the handle structures H1, H2 into the carton 190. The hands are inserted into the hand openings as they are defined in the top end closure flaps 126a, 126b when the handle structures H1, H2 are folded inward. Referring to Figures 6 and 8A, the triangular panel 161 of handle structure remains almost flat and rotates inward of the carton 190 about one or both of the two fold lines 150, 152 while the remainder of the handle  
15 flap 170 is folded about the fold lines 160, 162 with respect to the triangular panel 161. While the triangular panel 161 is rotated inward, the lower portion of the handle flap 170 (which is immediately below the severance line 164) is folded about the severance line 164 such that outer surfaces of the two halves of the lower portion are moved toward each other (see Figure 8A). The rotation of the triangular panel 161 and the folding of the lower portion  
20 take place almost simultaneously. The folded lower portion of the handle flap 170 is then squeezed into the narrow space between the two adjacent center cans C, C while the remaining parts of the handle flap 170 (such as the outer wing areas 165, 166 and the lower peak areas 167, 168) are pressed against the rounded side surfaces of the center cans C, C respectively (see Figure 8B). The fold lines 154, 156 facilitate the outer wing areas 165, 166  
25 to be folded with respect to the remainder of the handle flap 170 and thereby, if desired, eventually to clear the cans C, C so that the handle flap 170 can be folded to a fully folded position (not illustrated) above the fold line 150. The recesses A5, A6 (Figure 6) receive the cans C, C respectively during the flap-folding process to facilitate that process. . It should be understood that to bring the handle flap 170 to the fully folded position that is inside the  
30 carton 190, the handle glap 170 is rotated inward and upward about 180 degrees about one or both of the fold lines 150, 152 and as such the handle flap 170 would not be visible through the hand opening when the carrying handle is in use.

Referring now to Figures 9 to 11, there is shown yet a further alternative embodiment or  
35 fourth embodiment of the present invention. In the fourth illustrated embodiment, like numerals have, where possible, been used to denote like parts, albeit with the addition of the

prefix "200" to indicate that these features belong to the fourth embodiment. The fourth illustrated embodiment shares many common features with the third embodiment and therefore only the differences from the embodiment illustrated in Figures 5 to 8 will be described in any greater detail.

5

Figure 9 illustrates a blank 210 for forming a carton (not shown) according to the fourth illustrated embodiment.

10

The blank 210 comprises a plurality of main panels 212, 214, 216, 218, 220 which form a tubular structure in a set-up condition.

15

The blank 210 comprises a securing panel 212 hinged to a top panel 214 by a hinged connection such as a fold line 213. The top panel 214 is hinged to a first side panel 216 by a hinged connection such as a fold line 215. The first side panel 216 is hinged to a bottom panel 218 by a hinged connection such as a fold line 217. The bottom panel 218 is hinged to a second side panel 220 by a hinged connection such as a fold line 219.

20

Each of the ends of the tubular structure is at least partially closed by end closure panels 226a, 228a, 230a, 232a, 226b, 228b, 230b, 232b. End closure panels 226a, 228a, 230a, 232a are configured to close a first end of the tubular structure and end panels 226b, 228b, 230b, 232b are configured to close a second end of the tubular structure.

25

A first end closure panel 226a is hinged to a first end of top panel 214 by a hinged connection such as a fold line 227a. A second end closure panel 228a is hinged to a first end of first side panel 216 by a hinged connection such as a fold line 229a. A third end closure panel 230a is hinged to a first end of bottom panel 218 by a hinged connection such as a fold line 231a. A fourth end closure panel 232a is hinged to a first end of the second side panel 220 by a hinged connection such as a fold line 233a.

30

A fifth end closure panel 226b is hinged to a second end of first top panel 214 by a hinged connection such as a fold line 227b. A sixth end closure panel 228b is hinged to a second end of the first side panel 216 by a hinged connection such as a fold line 229b. A seventh end closure panel 230b is hinged to a second end of bottom panel 218 by a hinged connection such as a fold line 231b. An eighth end closure panel 232b is hinged to a second end of second side panel 220 by a hinged connection such as a fold line 233b.

35

The blank 210 comprises a first handle structure H1 defined in the first end closure panel 226a and second handle structure H2 defined in the fifth end closure panel 226b. Figure 10 illustrates the first handle structure H1. The second handle structure H2 is substantially the same as the first handle structure H1 and will be described in more detail by reference to the first handle structure H1 as shown in Figure 10.

The first handle structure H1 comprises a handle flap 270. The handle flap 270 is hinged to the first end closure panel 226a by a hinged connection such as a fold line 250. The handle flap 270 is defined in part by a first weakened line of severance 258a, in part by a second weakened line of severance 258b, in part by a third weakened line of severance 258c, a first aperture or recess A5, a second aperture or recess A6 and fold line 250.

A first end of the first weakened line of severance 258a intersects or meets with a first end of the fold line 250. A second end of the first weakened line of severance 258a intersects or meets with first aperture A5. A first end of the third weakened line of severance 258c intersects or meets with first aperture A5. A second end of the third weakened line of severance 258c intersects or meets with second aperture A6. A first end of the second weakened line of severance 258b intersects or meets with second aperture A6. A second end of the second weakened line of severance 258b intersects or meets with a second end of the fold line 250.

The handle flap 270 comprises a first hinged connection such as a fold line 252 extending there-across and arranged in a parallel spaced apart relationship with the fold line 250.

The handle flap 270 comprises a second hinged connection such as a fold line 254 extending from the second end of the fold line 250 across the handle flap 270 to an edge defined by the second aperture A6.

The handle flap 270 comprises a third hinged connection such as a fold line 256 extending from the first end of the fold line 250 across the handle flap 270 to an edge defined by the first aperture A5.

The second and third fold lines 254, 256 define in part the foldable wing portion of the handle flap 270.

The handle flap 270 comprises an X shaped fold line defined by a fourth hinged connection such as a fold line 260 and a fifth hinged connection such as a fold line 262. The fourth fold

line 260 intersects or meets with the first fold line 252. A first end of the fourth fold line 260 intersects or meets with the first fold line 252. A second end of the fourth fold line 260 intersects or meets with the third weakened line of severance 258c. A first end of the fifth fold line 262 intersects or meets with the first fold line 252. A second end of the fifth fold line 262 intersects or meets with the third weakened line of severance 258c. The fourth fold line 260 intersects and crosses the fifth fold line 262 to form the X shaped fold line. A severance line 264 intersects the X shaped fold line at the crossing point of the "X". The severance line 264 is orientated substantially perpendicularly to the first fold line 252.

Figures 11A and 11B illustrate the first handle structure H1 of the carton 290 in partially folded conditions. The first handle structure H1 has been illustrated in a first partially folded condition in Figure 11A and in a second partially folded condition in Figure 11B. Figure 11A illustrates folding the handle flap 270 out of the plane of the first end closure panel 226a in to the carton 290. In use as a carrying handle it should be understood that the handle flap 270 may be folded substantially further inside the carton 290, preferably 180 degrees about one or both of the fold lines 250, 252 and as such, the handle flap 270 would not be visible through the opening when the carrying handle is in use.

More specifically, in reference to Figures 10, 11A and 11B, a user can press his/her hand on the handle structure H1 to sever the first, second and third weakened lines of severance 258a, 258b, 258c and to thereby fold the handle structure H1 into the carton 290. The hand is inserted into the hand opening as it is defined in the top end closure flap 226a when the handle structure H1 is folded inward. Referring to Figures 10 and 11A, the upper triangular panel 261 remains almost flat and rotates inward of the carton 290 about one or both of the two fold lines 250, 252 while the remainder of the handle flap 270 is folded about the respective upper sections of the fold lines 260, 262 with respect to the upper triangular panel 261. While the upper triangular panel 261 is rotated inward, the lower triangular panel 263 is folded about the severance line 264 into two halves such that outer surfaces of the two halves of the lower triangular panel 263 are moved toward each other (see Figure 11A).

The rotation of the upper triangular panel 261 and the folding of the lower triangular panel 263 take place almost simultaneously. Also at almost simultaneously, the two halves of the lower triangular panel 263 are folded about the respective lower sections of the fold lines 260, 262 of the X-shaped fold line arrangement. The folded two halves of the lower triangular panel 263 is then squeezed into the narrow space between the two adjacent center cans C, C while the remaining parts of the handle flap 270 (such as the outer wing areas 265, 266 and the lower peak areas 267, 268) are pressed against the rounded side surfaces of the center cans C, C respectively (see Figure 11B). The fold lines 254, 256

facilitate the outer wing areas 265, 266 to be folded with respect to the remainder of the handle flap 270 and thereby, if desired, eventually to clear the cans C, C so that the handle flap 270 can be folded to a fully folded position (not illustrated) above the fold line 250. The recesses A5, A6 (Figure 10) receive the cans C, C respectively during the flap-folding process to facilitate that process.

In the folding process, the handle flap 270 is deformed or folded along the X-shaped fold line and the center severance line 264 so as to be concave as viewed from the outside of the carton 290

It will be appreciated that in the foregoing embodiments, the handle flap 170, 270 is folded about the fold line 150, 250 and/or about the first fold line 152, 252 such that the portion of the handle flap 170, 270 between the fold line 150, 250 and the first fold line 152, 252 spaces the remainder of the handle flap away from the respective one of the first or fifth end closure panels 126a, 126b, 226a, 226b.

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 recognized that as used herein, directional references such as "top", "bottom", "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" each refers to all manner of lines that define hinge features in a substrate of sheet material, for facilitating folding portions of the substrate with respect to one another, or otherwise for indicating optimal folding locations in the substrate. For example, a hinged connection should not be construed as necessarily referring to a single fold line only: indeed a hinged connection can be formed from one or more fold lines. A fold line may be, but not limited to, a single score line, a single half cut, a line of perforations, a line of short slits (i.e., an interrupted slit), a line of half-cuts, a line of cuts (i.e., an interrupted cut line), a series of short score lines (i.e., an interrupted score line), any combination thereof or the like.

As used herein, the terms "weakened line of severance", "severance line" and "frangible line" each refers to all manner of lines formed in a substrate of sheet material, that facilitate

separating portions of the substrate from one another, or otherwise indicate optimal separation locations on the substrate. For example, a severance line, frangible line or weakened line of severance in a substrate of sheet material is predisposed to allow a tear to propagate there-along. A severance line, frangible line or weakened line of severance may be a weakened line which includes, but not limited to, a single cut, a single slit, a single half cut, a line of perforations, a line of short slits (i.e., an interrupted slit), a line of half-cuts, a line of cuts (i.e., an interrupted cut line), a series of short score lines (i.e., an interrupted score line), any combination thereof or the like.

It should be understood that hinged connection, fold lines, severance lines, frangible lines and weakened lines of severance 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 cut line, an interrupted cut line, slits, scores, any combination thereof, and the like. Those elements can be dimensioned and arranged to provide the desired functionality. For example, a line of perforations can be dimensioned or designed with degrees of weakness to define a fold line and/or a severance line. The line of perforations can be designed to facilitate folding and resist breaking to provide a fold line, to facilitate folding and facilitate breaking with more effort to provide a severable or frangible fold line, or to facilitate breaking with little effort to provide a severance line.

The phrase "aligned with" and "in alignment with" as used herein each refers to alignment of two or more elements in an erected carton, such as a first line formed in a first of two overlapping panels and a second line formed in a second of two overlapping panels. Those elements in alignment with each other may be aligned with each other in the direction of the thickness of the overlapping panels, in the direction parallel to the plane of either one of the overlapping panels or otherwise simply horizontally or vertically. For example, when a first line in a panel is in alignment with a second element, the second element may be facing either side of the panel right behind or in front of the first line, may be located at a position within the plane of the panel proximate to either end of the first line or may be at a position within the plane of the panel proximate to either side of first line.

As used herein the terms "opening" and "aperture" each refers to all manner of shapings, recesses, notches, apertures, openings, cuts, slots, holes and gaps which may be circular, rectangular, capsule shaped, irregular shaped and many other shapes that are pre-formed or pre-defined in a substrate of sheet material.



## CLAIMS

1. A package comprising:
  - a carton having a plurality of panels including a first side wall panel; and
  - 5 a group of substantially cylindrical articles packaged in the carton, the articles each having a cylindrical axis and a rounded side,
    - wherein the first side wall panel is disposed on the rounded sides of the articles, the first side panel comprising a first handle structure for facilitating carrying of the carton, the handle structure comprising a handle flap hingedly connected to the first side wall
    - 10 panel by a flap fold line, the handle flap is disposed over a void between two adjacent articles of the group, the flap fold line is disposed transversely of the cylindrical axes of the two adjacent articles
2. The package according to claim 1 wherein handle flap is sized and configured such that
- 15 the handle flap is pressed against the rounded sides of the two adjacent articles when folded about the flap fold line into the void.
3. The package according to claim 2 wherein the flap fold line is arcuate in shape.
- 20 4. The package according to claim 2 wherein the handle flap comprises a substantially "Y" shaped fold line, wherein the Y-shape fold line is arranged such that a trunk of the "Y" shaped fold line is substantially aligned with a point of abutment of the two adjacent articles.
- 25 5. The package according to claim 4 wherein the "Y" shaped fold lines defines a pair of wing portions along opposite side edges thereof respectively such that the handle flap engages at the wing portions with the two adjacent articles respectively when folded into the void.
6. A carton for packaging a plurality of articles, the carton comprising a plurality of panels including a top panel, a bottom panel, a first side wall panel, and a second side wall panel;
  - wherein at least a first one of the plurality of panels comprises a first handle structure for facilitating carrying of the carton;
  - the handle structure comprising a handle flap defining at least in part a handle opening;

wherein the handle structure comprises a first fold line and a second fold line defined in the handle flap; the first fold line being arranged convergently with the second fold line, and wherein the first fold line intersects the second fold line.

7. The carton according to claim 6 wherein the first fold line intersects a third fold line.
8. The carton according to claim 7 wherein the second fold line intersects the third fold line.
9. The carton according to claim 6 wherein the handle structure comprises a fourth fold line extending from a point of intersection of the first fold line and the second fold line.
10. The carton according to claim 6 wherein the handle structure comprises a severance line extending from a point of intersection of the first fold line and the second fold line.
11. The carton according to claim 10 wherein the severance line extends through the point of intersection of the first fold line and the second fold line.
12. The carton according to claim 6 wherein the handle structure comprises a pair of wing portions each of which is foldable about a respective one of a pair of adjacently disposed articles disposed within the carton.
13. The carton according to claim 12 wherein each of the pair of wing portions is defined in part by a respective one of the first and second fold lines.
14. The carton according to claim 6 wherein a second one of the plurality of panels disposed opposite the first one of the plurality of panels comprises a second handle structure.
15. The carton according to claim 6 wherein the first handle structure is disposed opposite the handle structure such that a user may engage the first and second handle structures simultaneously with one hand.
16. The carton according to claim 6 wherein the first and second fold lines form an X shape.
17. The carton according to claim 6 wherein the first, second and fourth fold lines form a Y shape.
18. The carton according to claim 11 wherein the first and second fold lines and the severance line form a "Y" shape.

19. The carton according to claim 6 wherein the handle flap folds about the first and second fold lines to form an indented finger tab.
20. The carton according to claim 6 wherein the handle flap folds about the first and second fold lines to form a ridge.
21. The carton according to claim 6 wherein the handle structure comprises a fifth fold line extending in parallel with the fourth fold line.
22. The carton according to claim 6 wherein the handle structure folds about the fourth fold line and about the fifth fold line so as to space a portion of the handle flap from the at least a first one of the plurality of panels.
23. A blank for forming a carton, the blank comprising a plurality of panels including a top panel, a bottom panel, a first side wall panel, and a second side wall panel;  
    wherein at least a first one of the plurality of panels comprises a first handle structure for facilitating carrying of a set-up carton;  
    the handle structure comprising a handle flap defining at least in part a handle opening;  
    wherein the handle structure comprises a first fold line and a second fold line defined in the handle flap; the first fold line being arranged convergently with the second fold line, and wherein the first fold line intersects the second fold line.

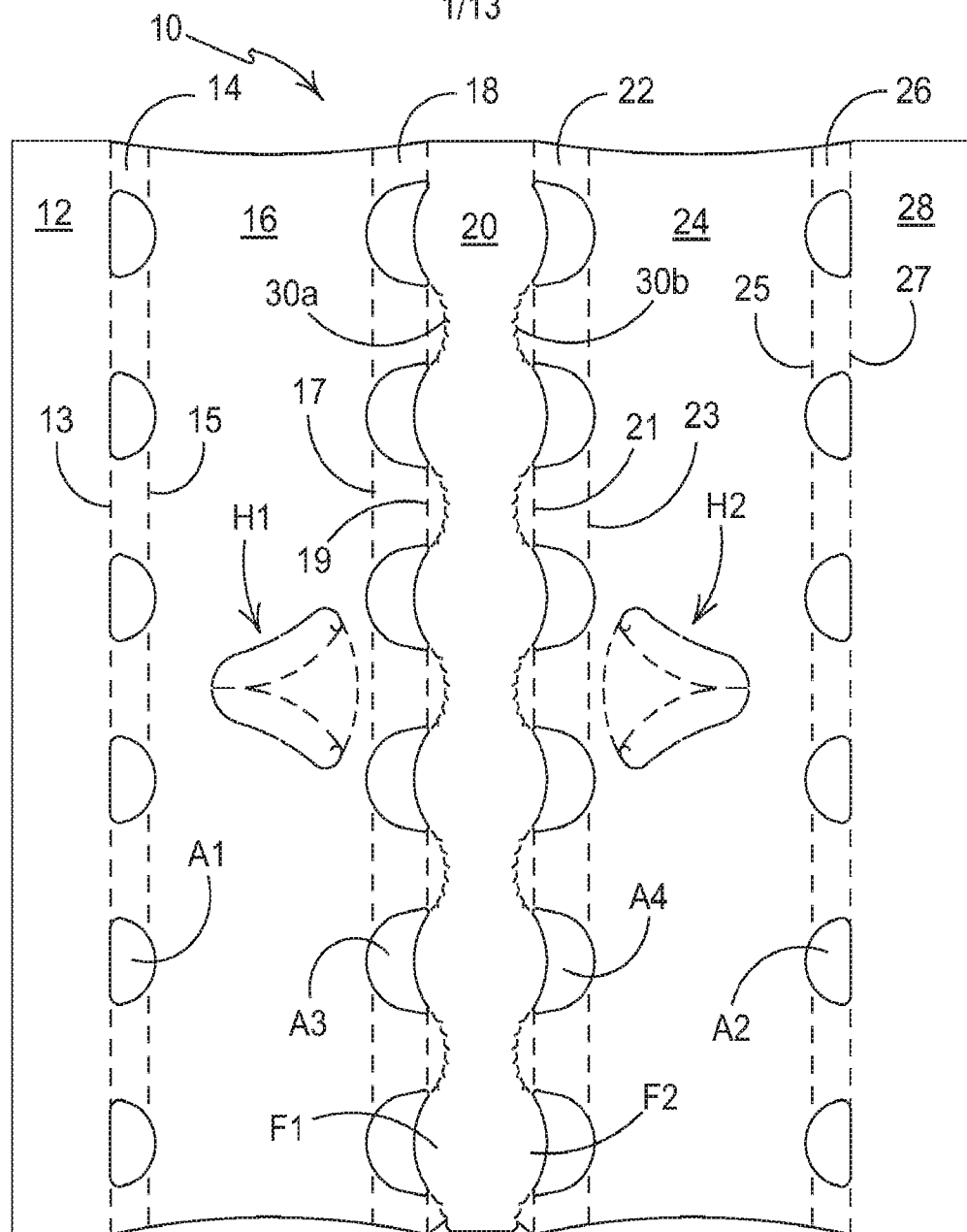


FIGURE 1

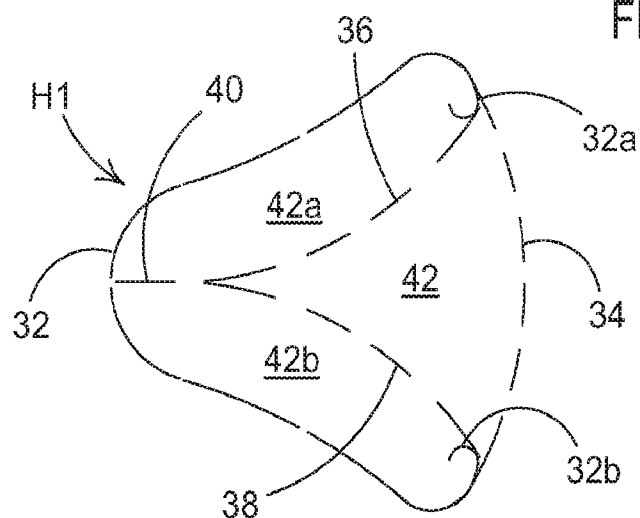


FIGURE 1A

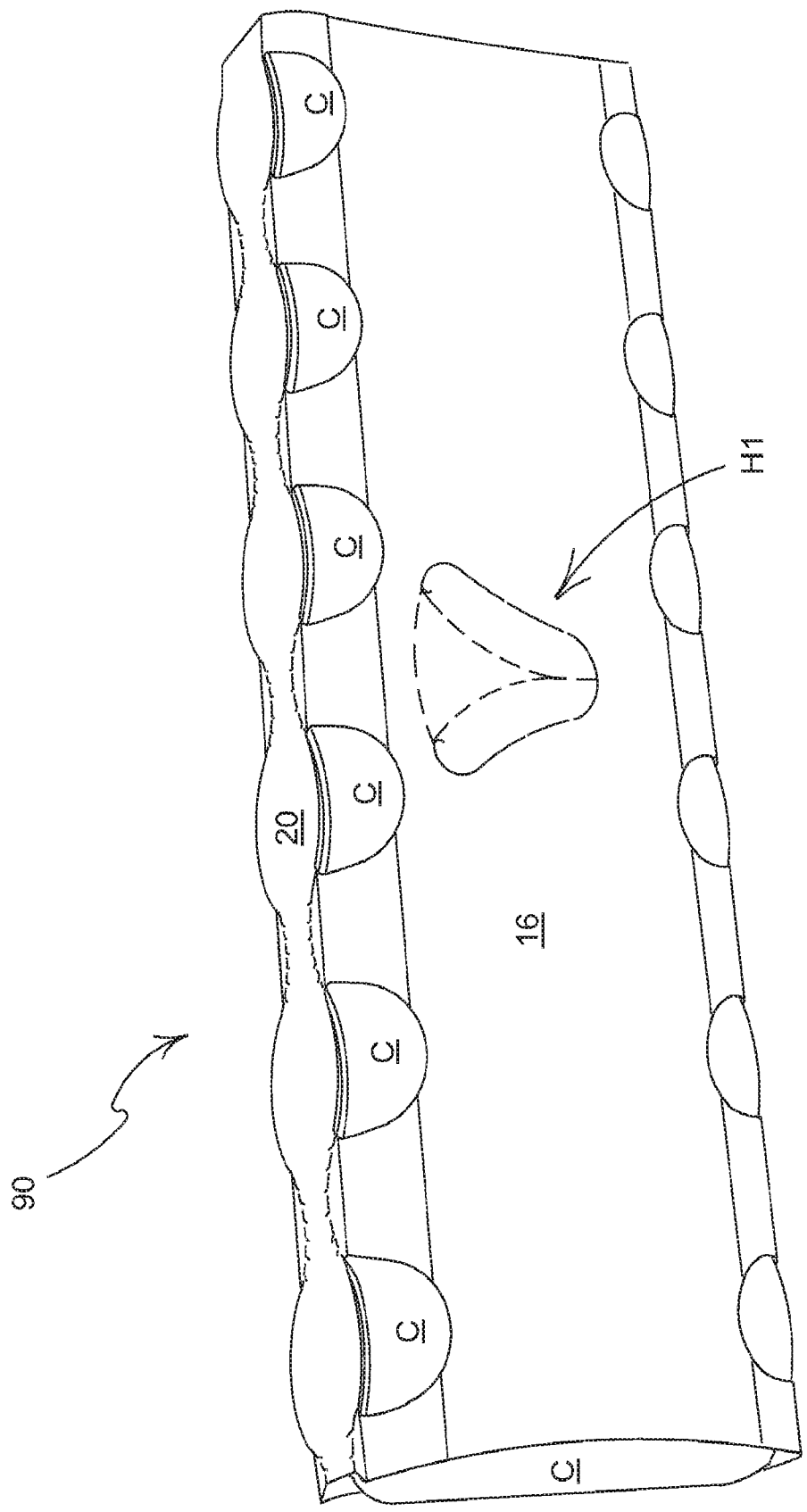


FIGURE 2

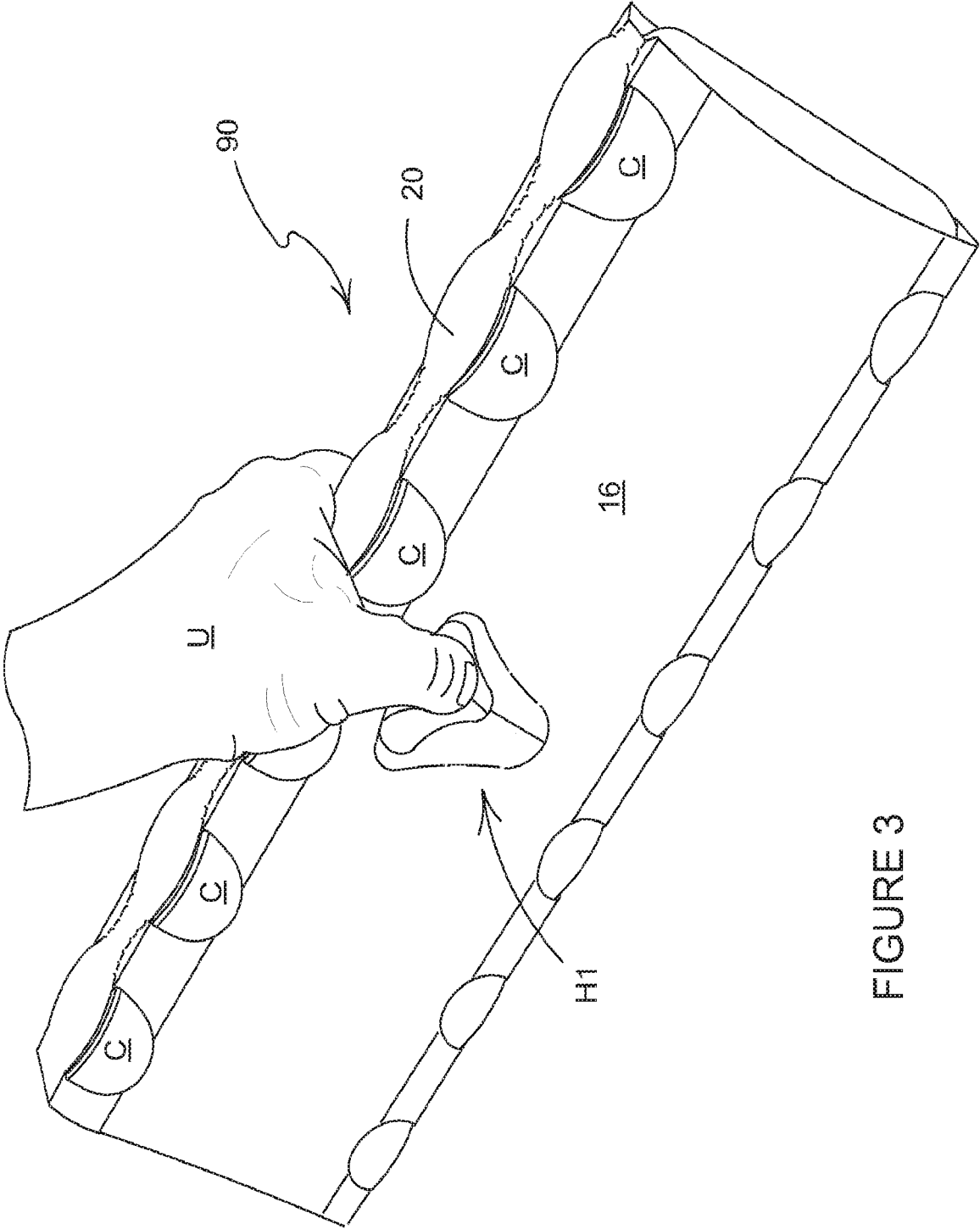


FIGURE 3

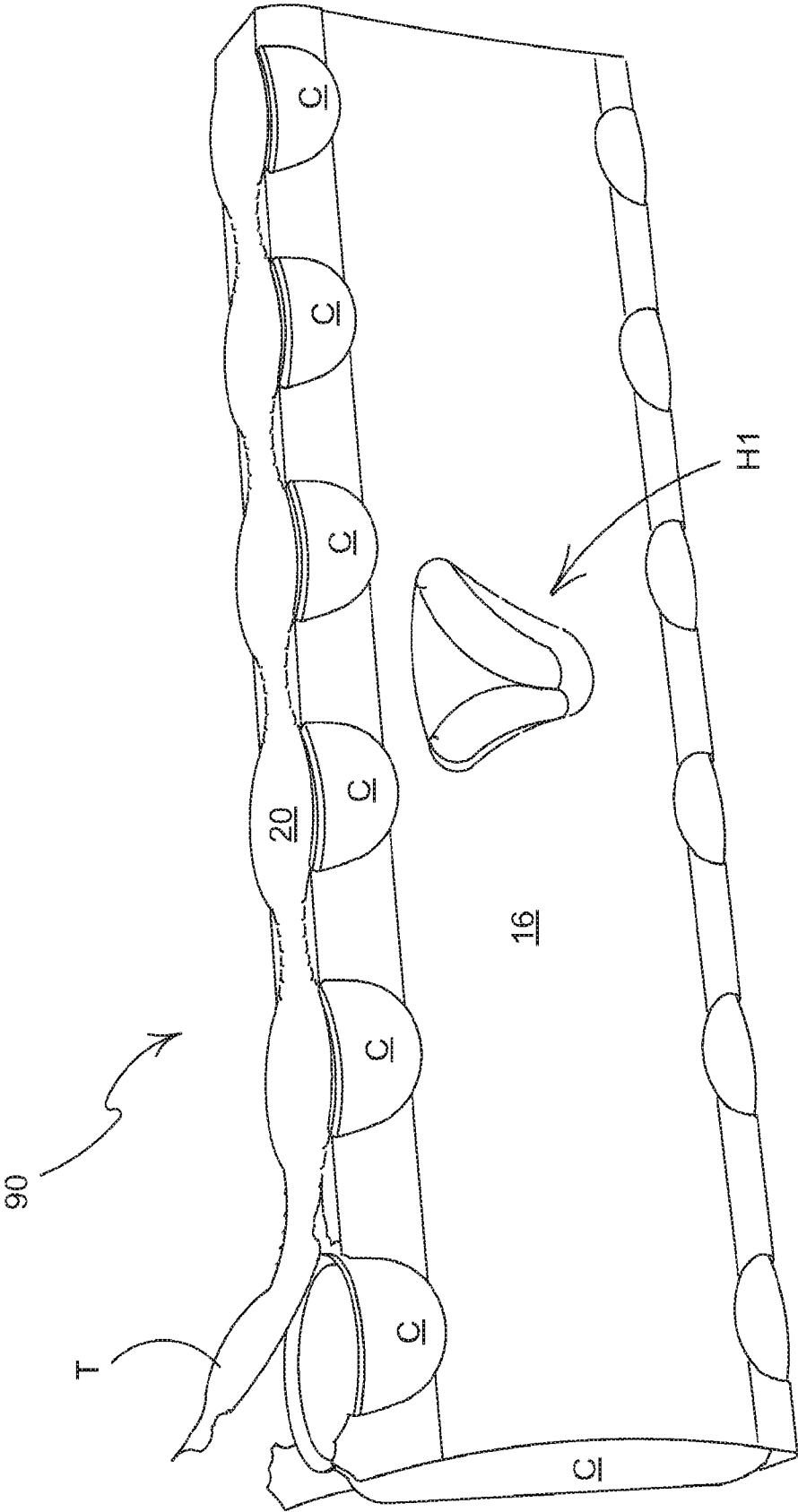


FIGURE 4

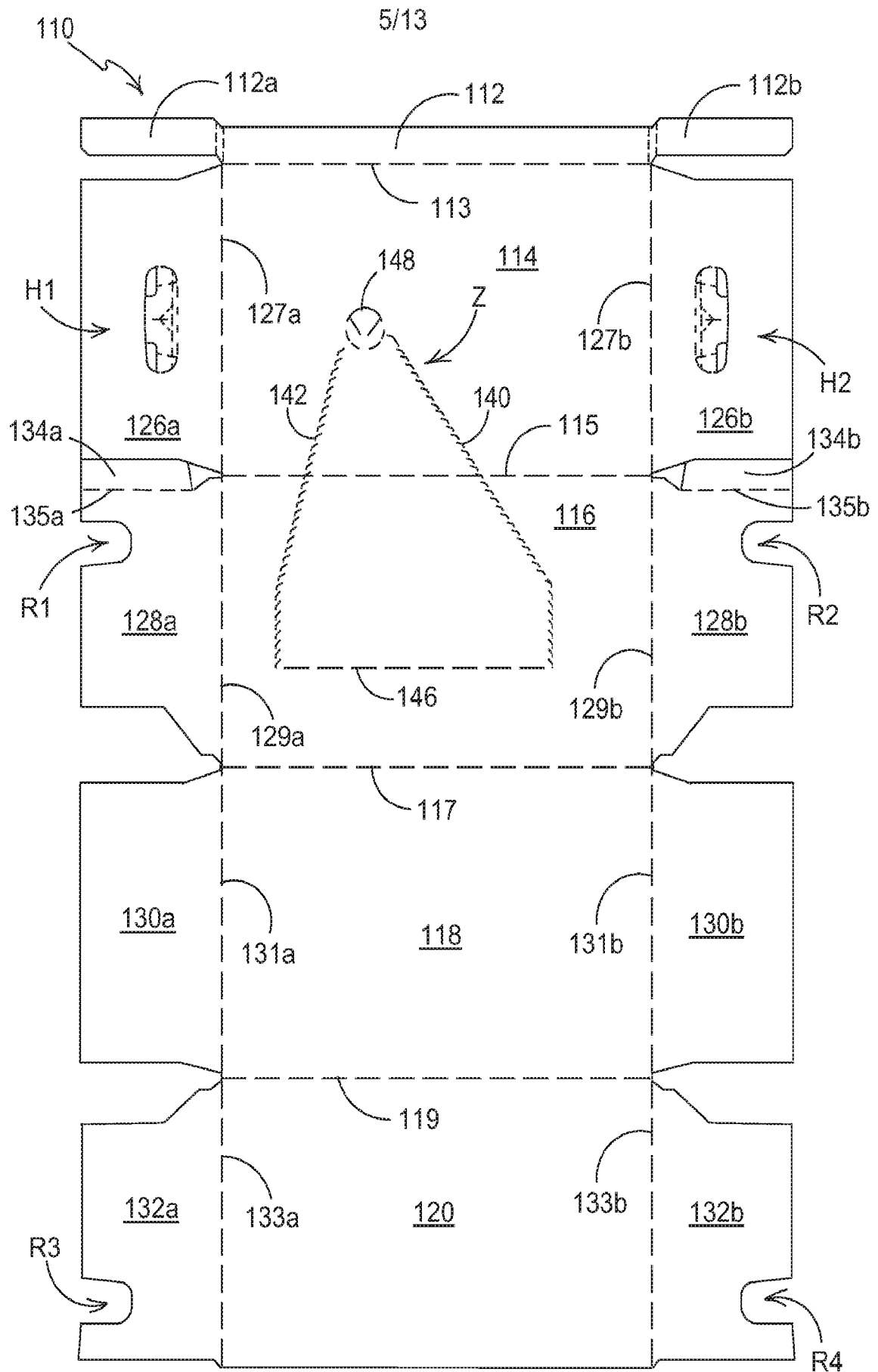


FIGURE 5  
SUBSTITUTE SHEET (RULE 26)



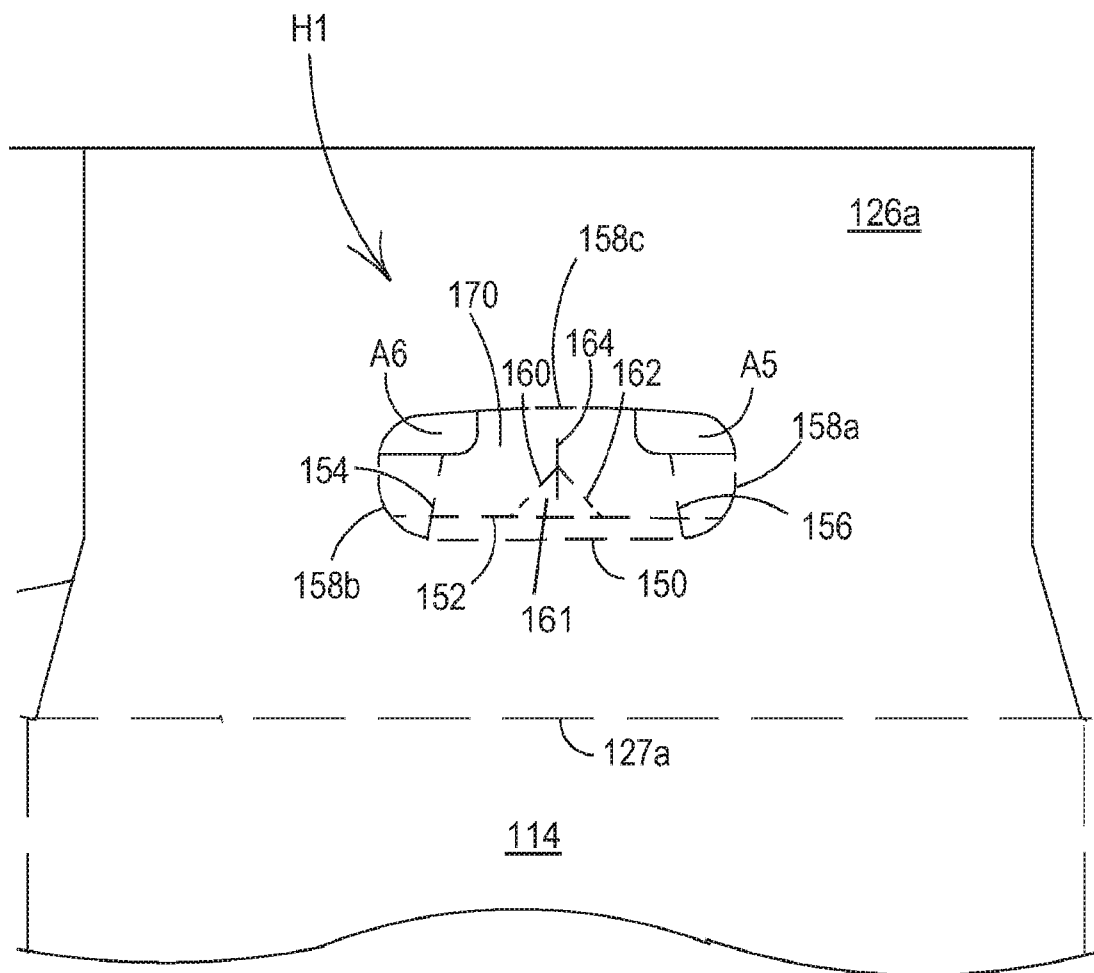


FIGURE 6

7/13

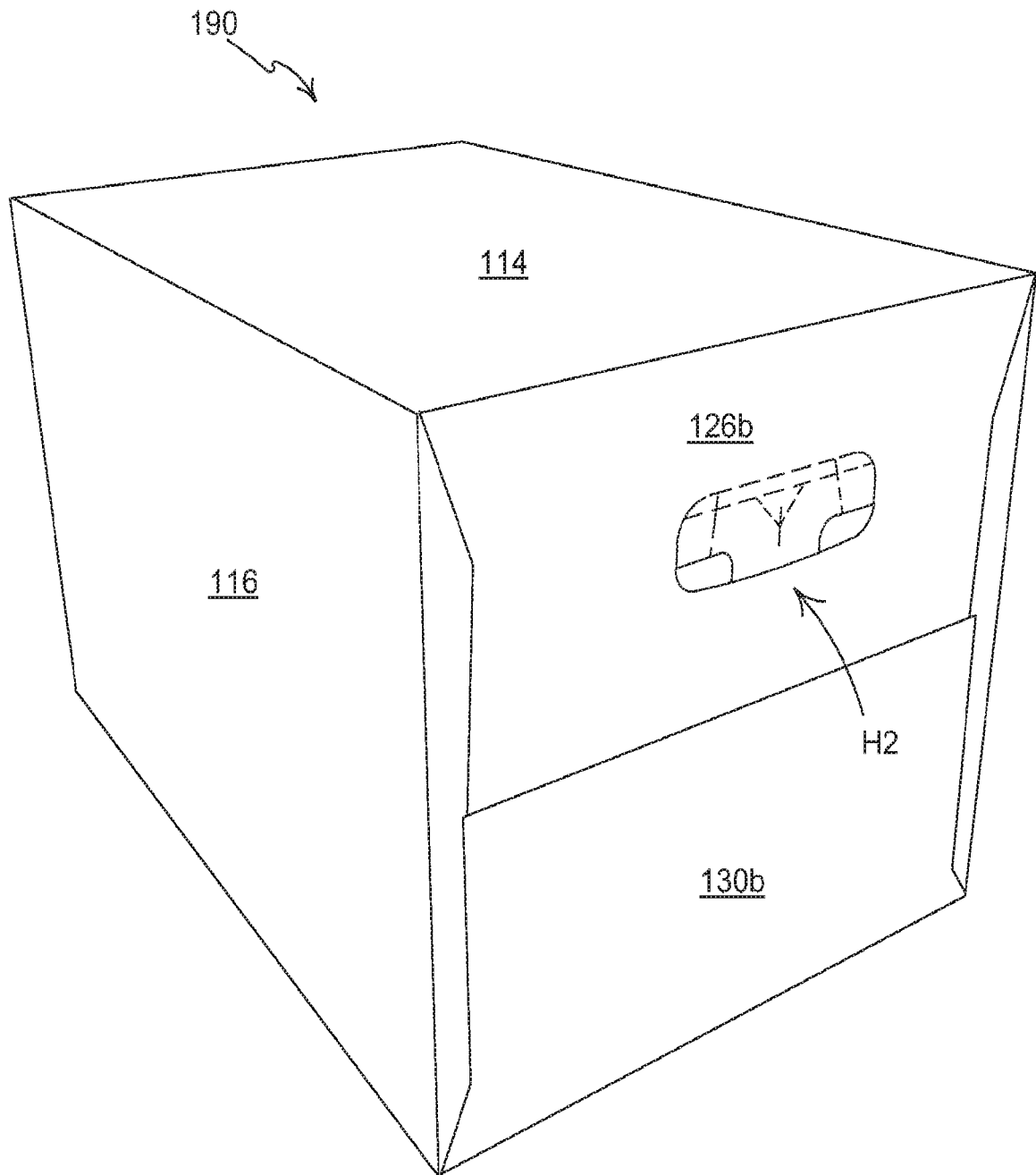


FIGURE 7

8/13

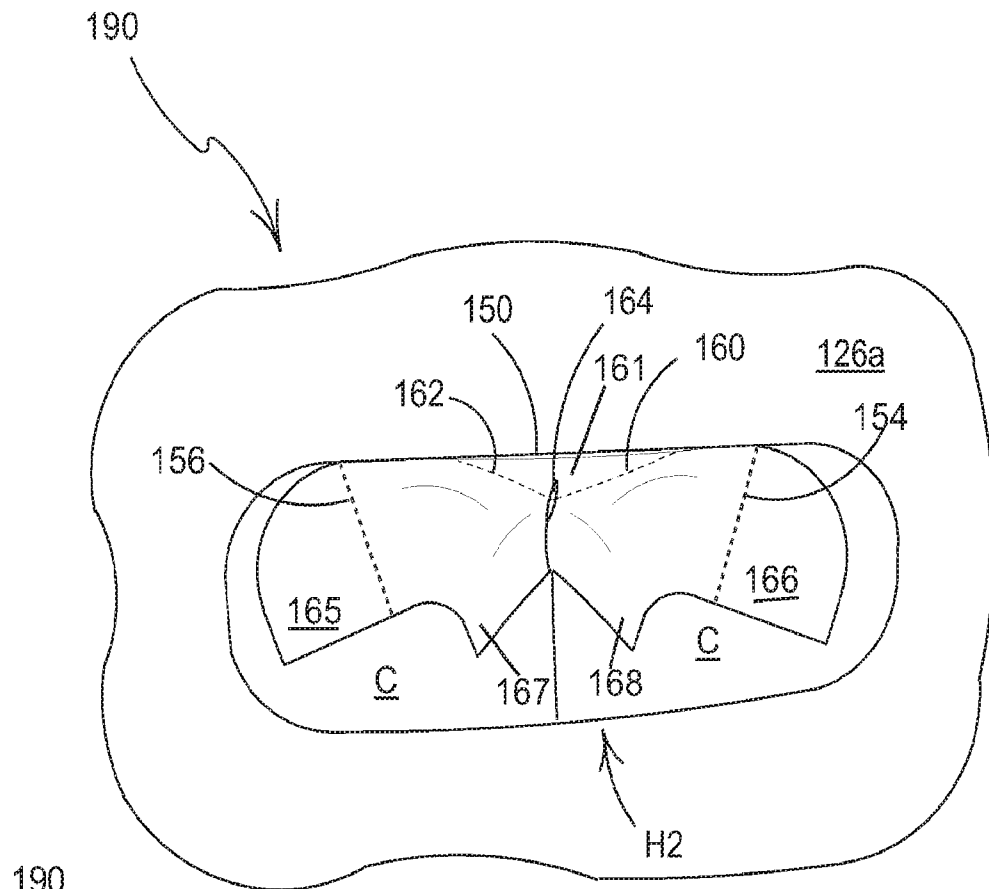


FIGURE 8A

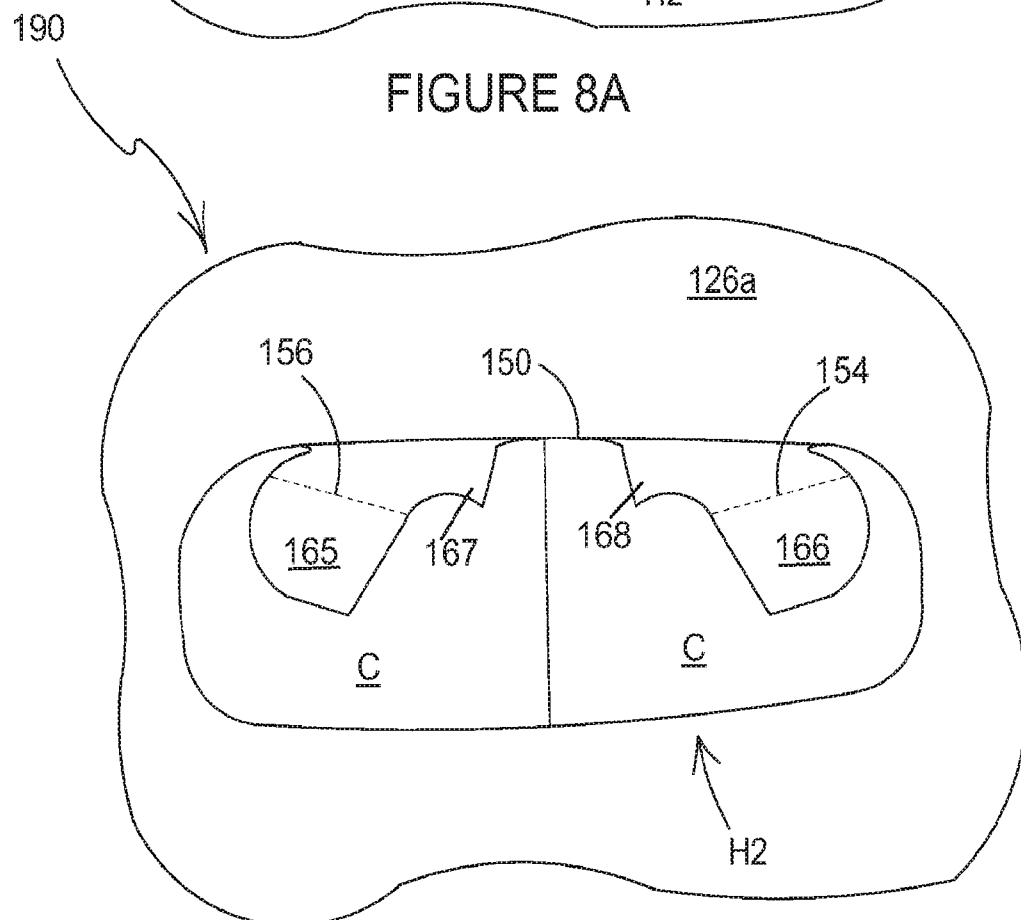


FIGURE 8B

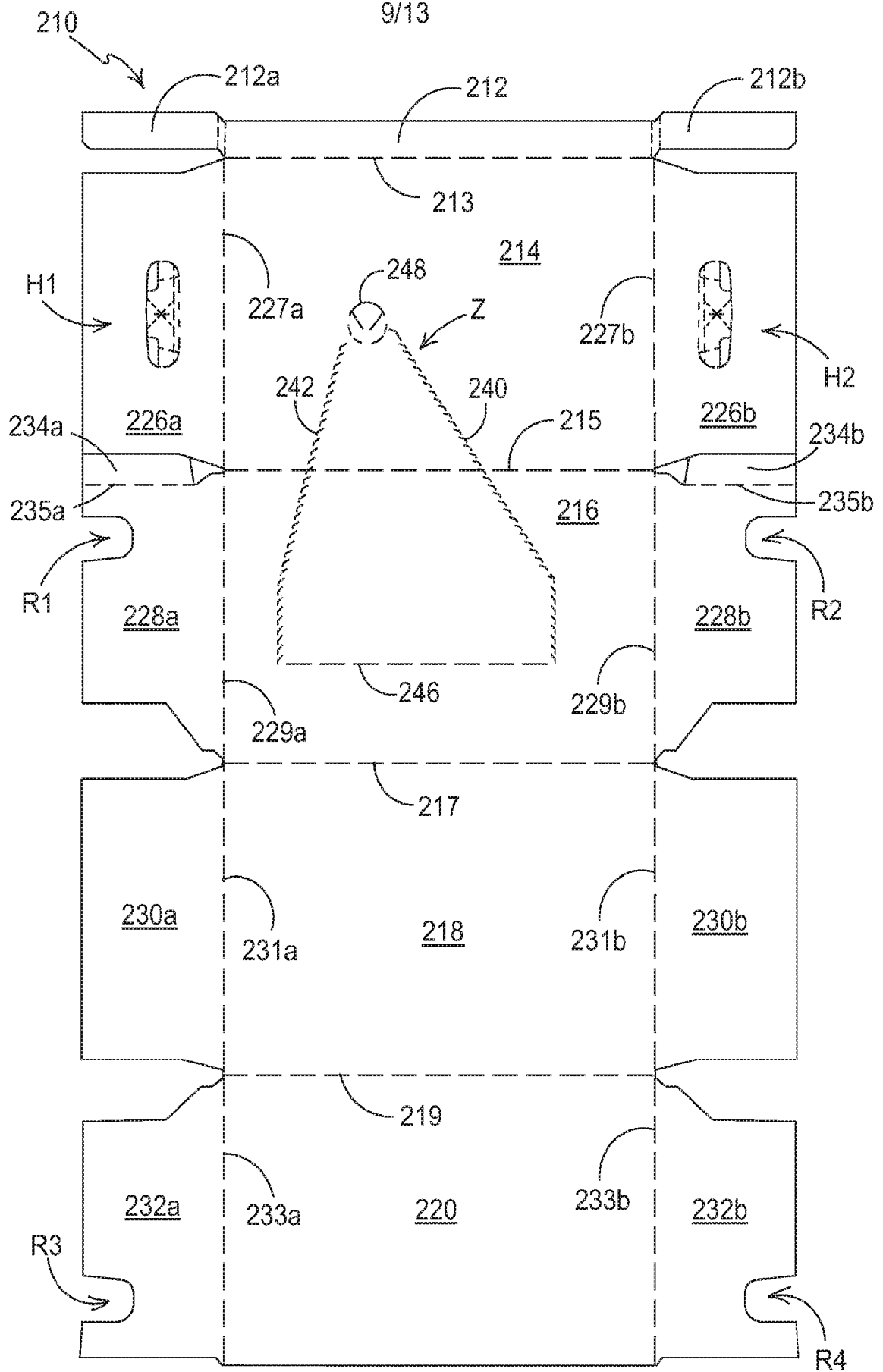


FIGURE 9

SUBSTITUTE SHEET (RULE 26)

10/13

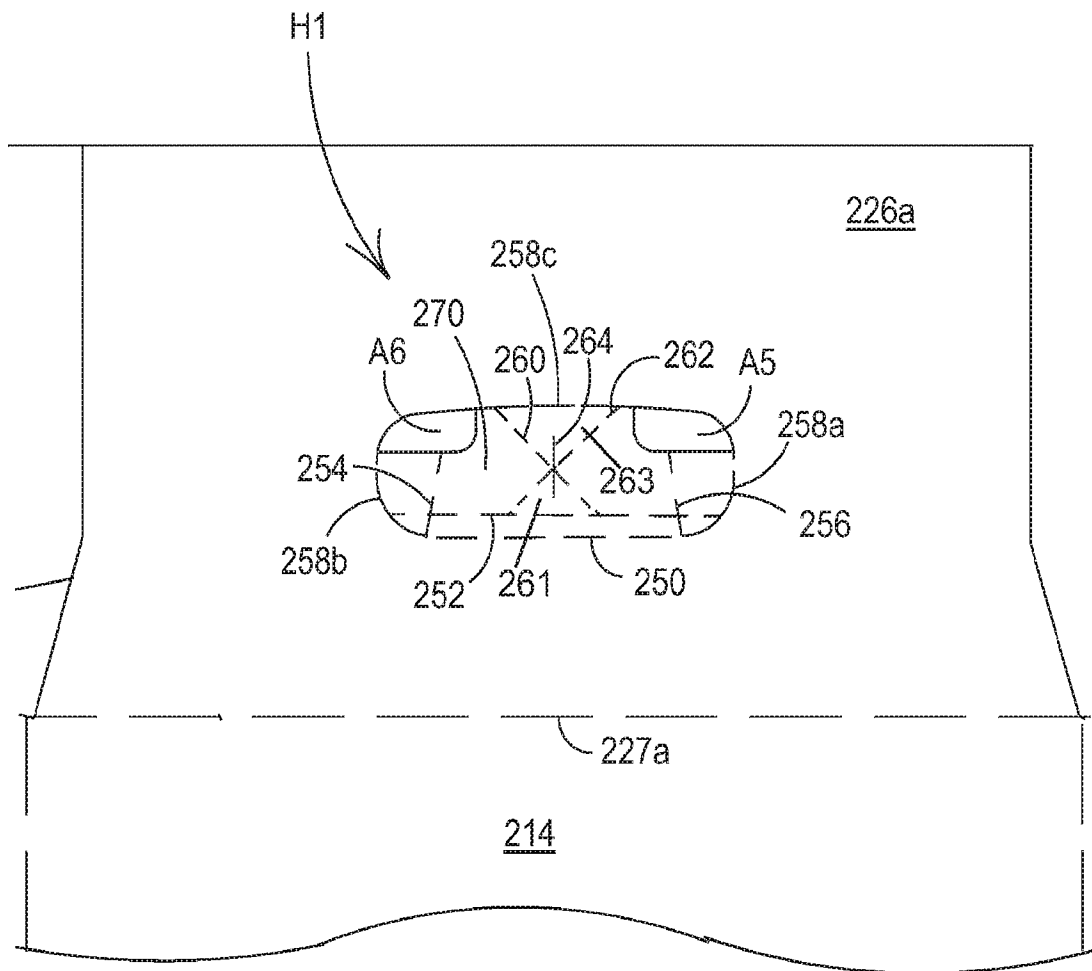


FIGURE 10

11/13

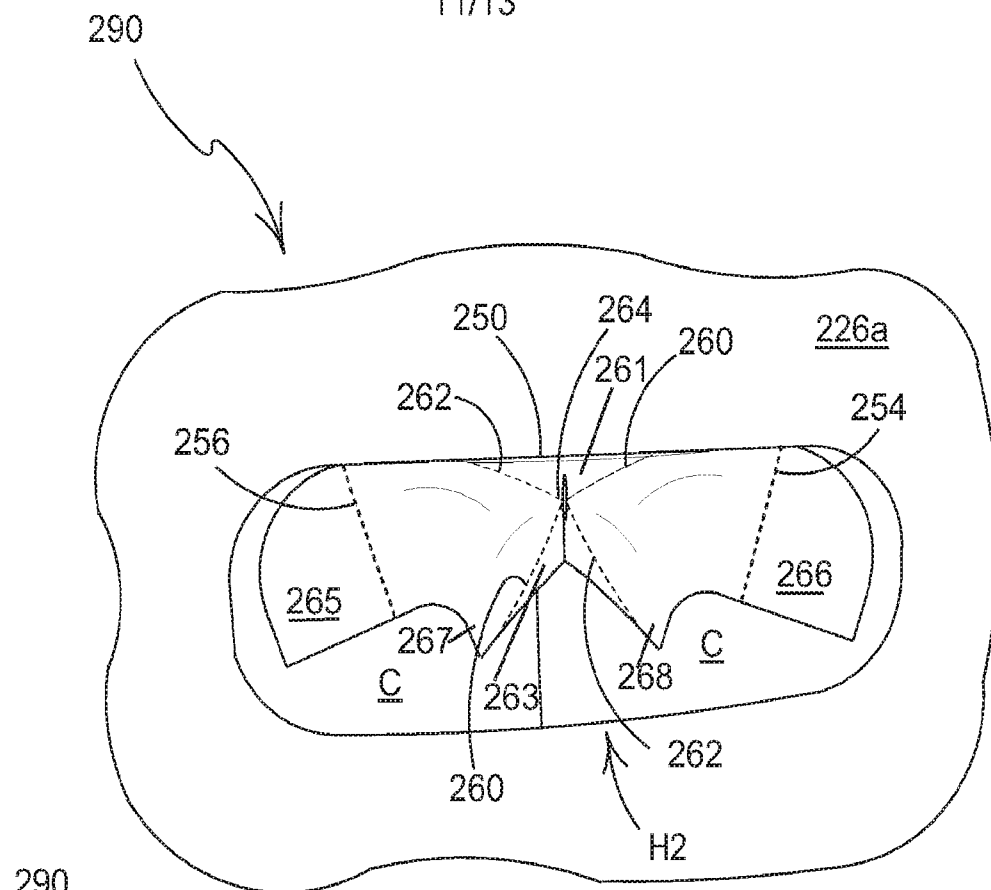


FIGURE 11A

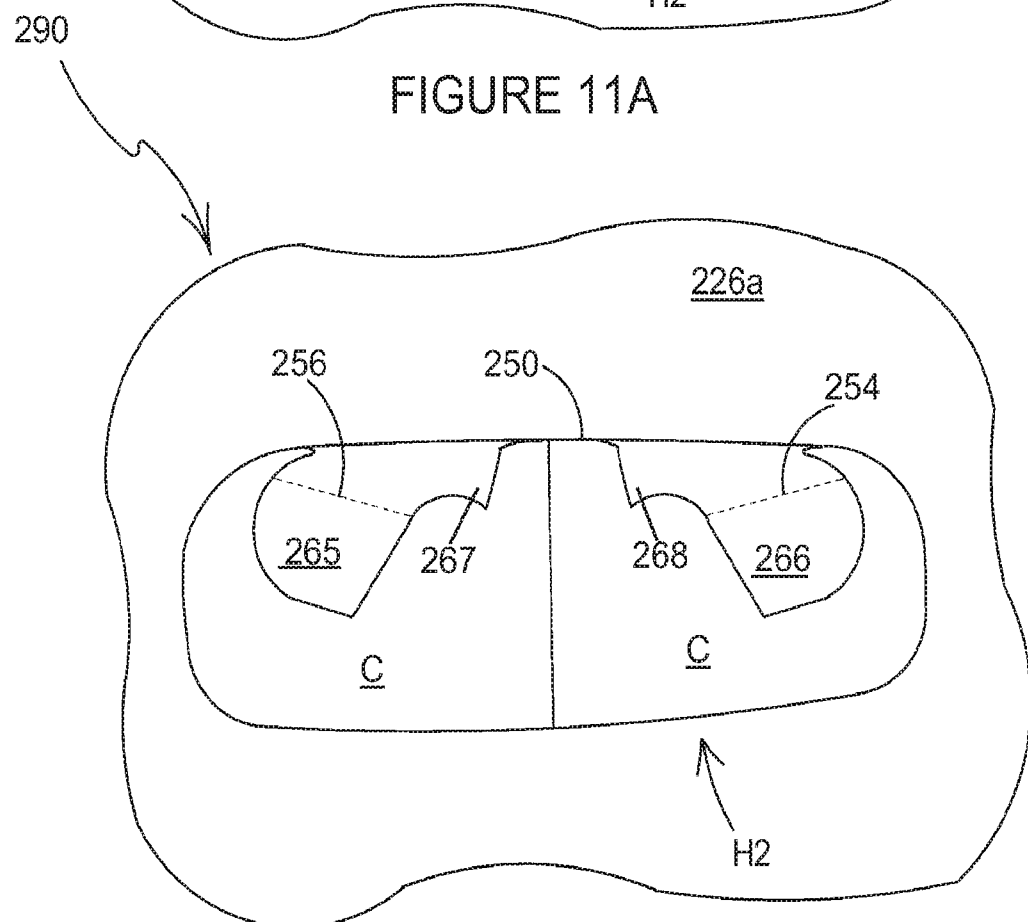


FIGURE 11B

12/13

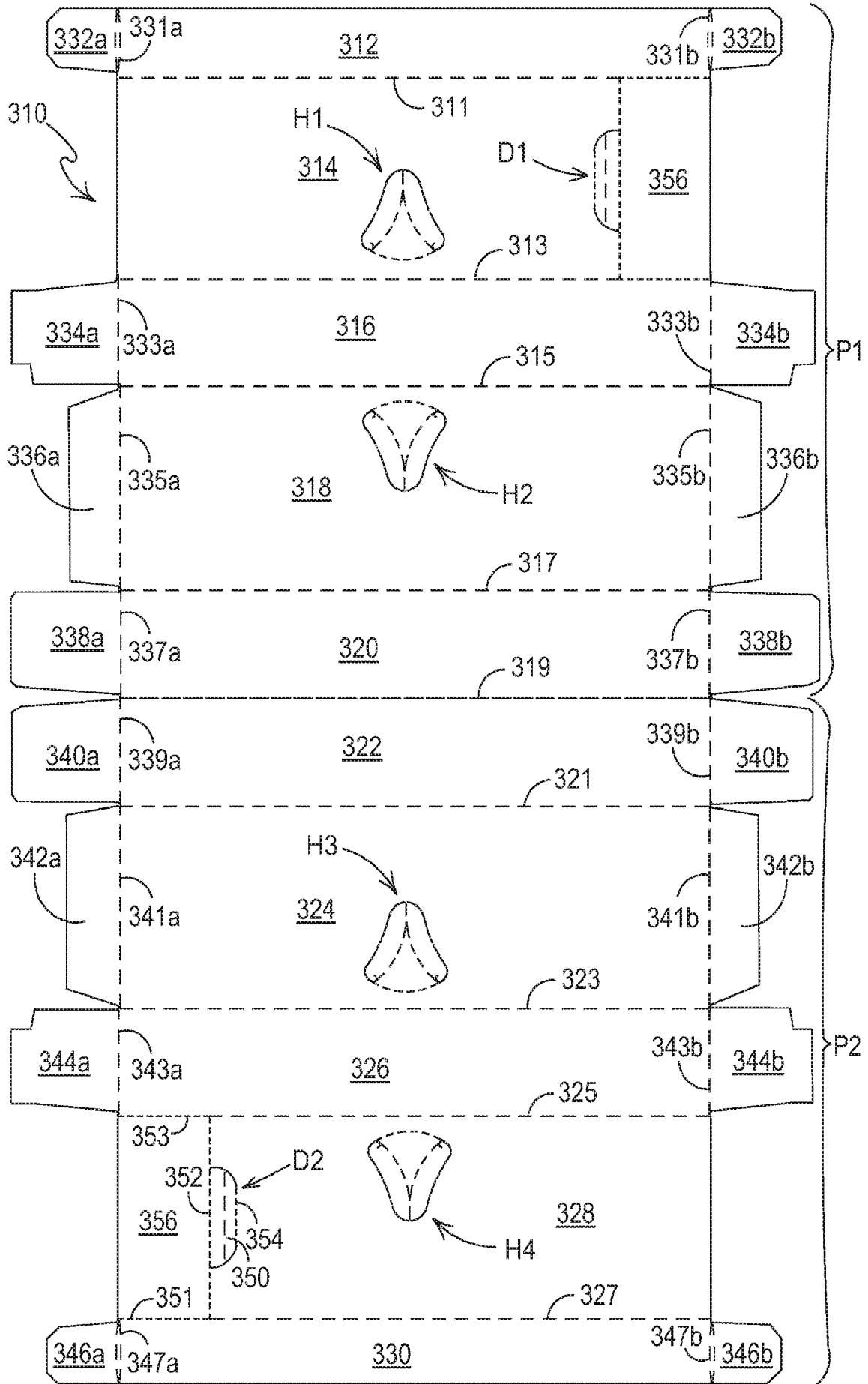


FIGURE 12

SUBSTITUTE SHEET (RULE 26)

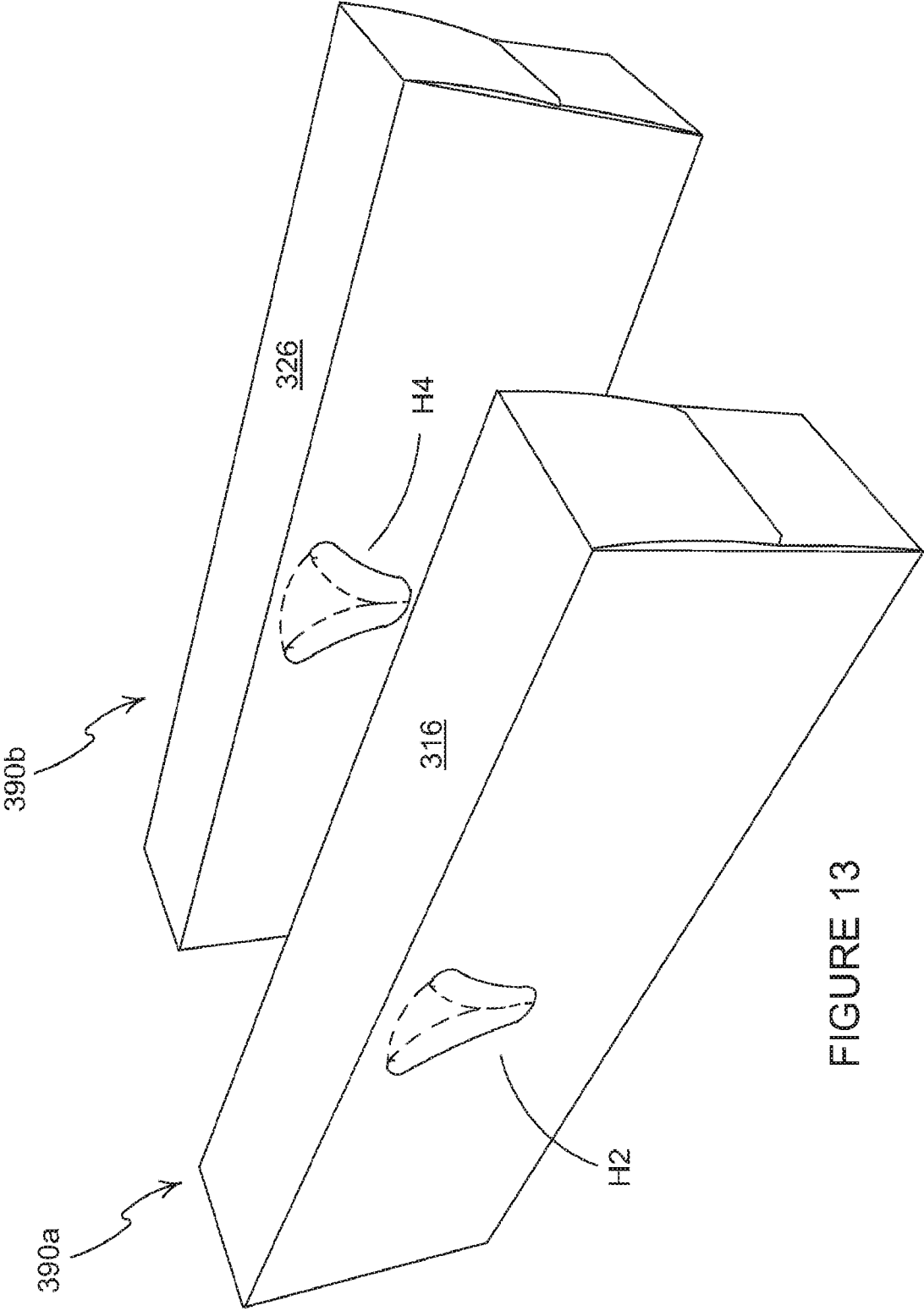


FIGURE 13



# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2015/064469

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>INV. B65D71/28      B65D71/36      B65D5/46      B65D5/468<br>ADD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                               |
| According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                               |
| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>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)<br>EPO-Internal, WPI Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                               |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                               |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                                  | Relevant to claim No.                                                                                                         |
| X<br><br>A<br><br><br>X<br><br>A<br><br>X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | US 2013/092725 A1 (KASTANEK RAYMOND S [US]) 18 April 2013 (2013-04-18)<br><br>paragraphs [0030] - [0032]; figures 8,9<br><br>-----<br>US 2014/021082 A1 (HOLLEY JR JOHN MURDICK [US]) 23 January 2014 (2014-01-23)<br>paragraphs [0034], [0035]; figures 1,1a<br>-----<br>US 2009/261008 A1 (DILLON RALPH L [US] ET AL) 22 October 2009 (2009-10-22)<br>abstract; figure 1<br>----- | 1,2,4-9,<br>12-14,<br>19-23<br>3,10,11,<br>15-18<br><br><br><br>1-14,<br>19-23<br>15-18<br><br><br>1                          |
| <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> Further documents are listed in the continuation of Box C.         </div> <div> <input checked="" type="checkbox"/> See patent family annex.         </div> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                               |
| <div style="display: flex;"> <div style="flex: 1;"> <p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="flex: 1;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p> </div> </div> |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                               |
| Date of the actual completion of the international search<br><br><div style="text-align: center; font-size: 1.2em;">16 February 2016</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                     | Date of mailing of the international search report<br><br><div style="text-align: center; font-size: 1.2em;">25/02/2016</div> |
| Name and mailing address of the ISA/<br>European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                     | Authorized officer<br><br><div style="text-align: center; font-size: 1.2em;">Serrano Galarraga, J</div>                       |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2015/064469

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                                                                                                                                                                                                                                                                                                                   | Publication<br>date                                                                                                                                                                                                                                      |
|-------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| US 2013092725 A1                          | 18-04-2013          | AU 2012326314 A1<br>CA 2849944 A1<br>CN 103889852 A<br>EP 2768745 A1<br>NZ 623327 A<br>US 2013092725 A1<br>WO 2013059261 A1                                                                                                                                                                                                                  | 17-04-2014<br>25-04-2013<br>25-06-2014<br>27-08-2014<br>31-07-2015<br>18-04-2013<br>25-04-2013                                                                                                                                                           |
| US 2014021082 A1                          | 23-01-2014          | AU 2013290754 A1<br>AU 2013290758 A1<br>AU 2013290760 A1<br>CA 2875973 A1<br>CA 2876185 A1<br>CA 2877289 A1<br>CN 104470823 A<br>CN 104520206 A<br>CN 104583092 A<br>EP 2874904 A1<br>EP 2874905 A1<br>EP 2874906 A1<br>US 2014021082 A1<br>US 2014021084 A1<br>US 2014021247 A1<br>WO 2014014510 A1<br>WO 2014014514 A1<br>WO 2014014516 A1 | 22-01-2015<br>22-01-2015<br>22-01-2015<br>23-01-2014<br>23-01-2014<br>23-01-2014<br>25-03-2015<br>15-04-2015<br>29-04-2015<br>27-05-2015<br>27-05-2015<br>27-05-2015<br>23-01-2014<br>23-01-2014<br>23-01-2014<br>23-01-2014<br>23-01-2014<br>23-01-2014 |
| US 2009261008 A1                          | 22-10-2009          | NONE                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                          |