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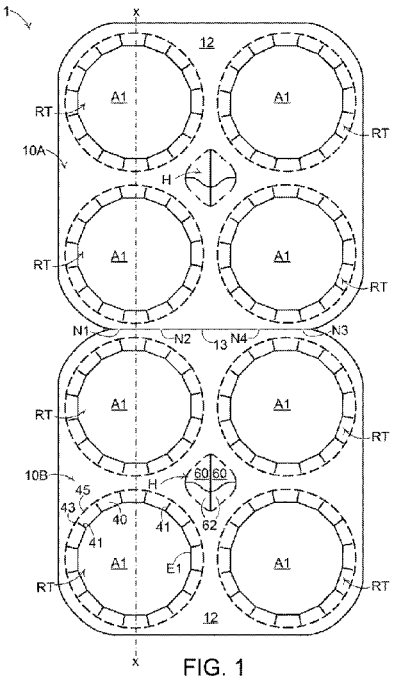


FIG. 1

(57) Abstract: Aspects of the disclosure relate to a packaging system, an apparatus for forming a package, an article carrier (90; 290) for packaging one or more articles, a plurality of connected blanks (10A-B; 110A-D; 310A-F, 410A-C) for forming carriers, and to a method of packaging one or more articles. The blanks (10A-B; 110A-D; 310A-F, 410A-C) comprise a main panel (12; 112; 312; 412) having one or more article retention structures (RT; RT1, RT2) for receiving and securing the main panel (12; 112; 212; 312; 412) to a respective article (B). The plurality of connected blanks (10A-B; 110A-D; 310A-F, 410A-C) comprise frangible connections therebetween which are sever prior to application of the blanks (10A-B; 110A-D; 310A-F, 410A-C) to groups of articles (B).

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PACKAGING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

The present application claims the benefit of priority to U.S. Provisional Patent Application Serial No. 63/250,821, Filed 30 September 2021, the entire contents which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

The present invention relates to packaging systems, to packaging machines and apparatus therefor, to article carriers and blanks for forming the same, and to methods of packaging articles. More specifically, but not exclusively, the invention relates to a carrier of the top-gripping type having one or more apertures for receiving and retaining an article therein and to methods and apparatus for forming the same.

BACKGROUND

In the field of packaging, it is known to provide cartons for carrying multiple articles. Cartons are well known in the art and are useful for enabling consumers to transport, store and access a group of articles for consumption. For cost and environmental considerations, such cartons or carriers need to be formed from as little material as possible and cause as little wastage in the materials from which they are formed as possible. Further considerations are the strength of the carton and its suitability for holding and transporting large weights of articles. It is desirable that the contents of the carton are secure within the carton.

It is well known to provide top gripping article carriers in which an aperture is formed in a panel of the carrier, wherein tabs are struck from said panel and are arranged about the aperture. The tabs are displaced out of the plane of said panel when an article is received in the aperture, wherein said tabs engage the article generally about a flange or lip of the article.

It is desirable to automate formation of the packages from the article carriers by employing a packaging machine capable of operating at high production capacities. In particular it is desirable to package articles as they are in continuous motion, in a downstream direction, through a packaging apparatus.

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

SUMMARY

A first aspect of the invention provides an applicator device for separating a plurality of connected blanks into discrete blanks and pressing each a blank onto two or more groups of articles. The applicator comprises a plurality of article receiving orifices each for receiving a respective article and a disconnecting device for breaking frangible connections between adjacently disposed blanks.

Optionally, the applicator comprises at least one stabilisation peg receivable in an opening of a stabilisation device provided in a main panel of each blank, the at least one stabilisation peg being configured to constrain movement of said blank with respect to the applicator.

Optionally, the at least one stabilisation peg is detachably mounted to a plate in which the article receiving orifices are provided.

Optionally, the at least one stabilisation peg is keyed to a given receiving location on the plate.

Optionally, the at least one stabilisation peg is keyed to a given receiving orientation with respect to the plate.

Optionally, the applicator comprises a plate and at least one guide depending therefrom for retaining the groups of articles in a predefined arrangement.

Optionally, the disconnecting device comprises one or more blades mounted to a plate in which the article receiving orifices are provided.

Optionally, the one or more blades is detachably mounted to the plate.

Optionally, the one or more blades comprises at least one detent for engaging a catch in a slot provided in the plate. The detent may be resiliently biased.

Optionally, the plate comprises one or more release openings for enabling release of the detent from the catch.

Optionally, the plate comprises plurality of blade receiving locations and a plurality of blades that can be reconfigured a desired arrangement to accommodate a given configuration of connected blanks.

A second aspect of the invention provides a disconnecting apparatus for separating a plurality of connected article carriers engaged with groups of articles. The disconnecting apparatus comprises a plate having a plurality of article receiving orifices each for receiving a respective article and a plurality of blade receiving locations each capable of detachably mounting a disconnecting blade for breaking frangible connections between adjacently disposed carriers, and a plurality of blades is detachably mounted to the plate. The plurality of blades being reconfigurable to a desired arrangement to accommodate a given configuration of connected carriers.

Optionally, the plurality of blades is mountable to the plate in first arrangement to separate a first configuration of connected carriers and is mountable to the plate in second, different, arrangement to separate a second, different, configuration of connected carriers.

A third aspect of the invention provides a plurality of connected blanks for forming a plurality of article carriers. Each blank is frangibly connected to at least one adjacent blank by a frangible connection comprising at least one pair of connecting nicks. Each blank comprises an engaging panel having at least one article retention device for receiving and suspending an article therefrom. A first article retention device in a first blank and a second article retention device in a second blank define a notional line passing through the centre of each of the first and second article retention devices. The notional line is perpendicular to a frangible connection between the first and second blank. A pair of connecting nicks are disposed on opposing sides of the notional line. The notional line defines a region of closest proximity between the first and second article retention devices.

A fourth aspect of the invention provides an apparatus for packaging one or more articles in an article carrier. The apparatus comprises an article engagement tool for engaging an article and conveying the article in a downstream direction. The article engagement tool comprises a reference device for aligning a plurality of connected blanks with two or more groups of articles.

Optionally, the apparatus comprises an applicator for separating the plurality of connected blanks into discrete blanks and pressing each a blank onto the two or more groups of articles, the applicator comprises a plurality of article receiving orifices each for receiving a respective article and a disconnecting device for breaking frangible connections between adjacently disposed blanks.

Optionally, the applicator comprises at least one stabilisation peg receivable in an opening of a stabilisation device provided in a main panel of each blank, the at least one stabilisation peg being configured to constrain movement of said blanks with respect to the applicator.

Optionally, the at least one stabilisation peg prevents or inhibits movement of the blanks with respect to the group of articles in a direction parallel with the direction of flow of the blanks through the apparatus and in a lateral direction perpendicular with respect to the direction of flow of the blanks through the apparatus.

Optionally, the applicator is mounted to an overhead conveyor, in the form of a wheel, such that the applicator applies the blanks to the groups of articles as it is conveyed downstream by the plurality of article engagement tools.

Optionally, the apparatus comprises an overhead conveyor for conveying the plurality of connected blanks onto the one or more articles.

Optionally, the reference device comprises an abutment pin extending upwardly from the article engagement tool beyond the upper extremity of the one or more articles.

Optionally, the article engagement tool comprises a removable head to which the reference device is mounted.

Optionally, the head comprises part of a tool-less attachment system.

Optionally, the tool-less attachment system comprises a bayonet fitting.

Optionally, the apparatus comprises a plurality of article engagement tools each for engaging a respective article, metering and grouping the articles and conveying said articles in a downstream direction as metered groups.

Optionally, each of the plurality of article engagement tools is driven independently about an endless track having a working reach and a return reach.

Optionally, the plurality of article engagement tools comprises at least one leading article engagement tool and at least one trailing article engagement tool.

Optionally, the at least one leading article engagement tool is configured to engage a respective leading registration edge of a blank.

Optionally, the at least one trailing article engagement tool is configured to engage a respective trailing registration edge of the blank.

A fifth aspect of the invention provides method of packaging a plurality of articles, the method comprising:

forming at least two groups of articles,

applying a plurality of connected blanks to upper ends of the articles;

engaging reference pins with the plurality of connected blanks and aligning the plurality of connected blanks to the articles;

lowering an applicator with respect to the articles and the plurality of connected blanks so as to insert a stabilisation pin in an opening in each of the blanks;

further lowering the applicator to cleave through frangible connections between adjacently disposed blanks;

bringing a plate of the applicator into contact with each of the discrete blanks;

lowering the applicator further to press the discrete blanks over upper ends of the articles; and

displacing engaging tabs upwardly out of the plane of the blanks until the tabs engage a flange about the upper ends of the articles.

A sixth aspect of the invention provides method of packaging a plurality of articles, the method comprising:

conveying a stream of articles in a downstream direction through a packaging apparatus;

engaging each article with an article engagement tool;

grouping a plurality of groups of articles, and simultaneously

applying a plurality of connected blanks to upper ends of the articles;

engaging at least one leading registration edge of the plurality of connected blanks with a reference pin mounted to a leading article engagement tool;

metering the groups of articles; and

engaging a reference pin mounted to a trailing article engagement tool with at least one trailing registration edge of the plurality of connected blanks.

Optionally, the method further comprises;

separating the plurality of connected blanks into discrete blanks; and

applying said discrete blanks to the groups of articles to engage each article in a respective article retention device provided in a main panel of the blanks.

Optionally, applying the blanks to the groups of articles comprises;

inserting a stabilising peg in an opening of a stabilisation device provided in a main panel of each blank prior to separating the plurality of connected blanks into discrete blanks.

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

Within the scope of this application, it is envisaged or intended that the various aspects, embodiments, examples, features and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings may be considered or taken independently or in any combination thereof.

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

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

BRIEF DESCRIPTION OF THE DRAWINGS

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 pair of connected blanks each for forming a carrier according to an embodiment of the present disclosure;

Figures 2 to 5 illustrate stages of construction of the connected blanks of Figure 1 into carriers by an applicator device;

Figure 6 illustrates disconnecting blades according to various embodiments for use with an applicator device;

Figure 7 is a side view of a packaging apparatus forming a part of a packaging system according to embodiments of the present disclosure;

Figure 8 is a plan view from above of a plurality of connected blanks each for forming a carrier according to an embodiment of the present disclosure;

Figure 9 illustrates an applicator device for applying the plurality of connected blanks of Figure 8 to groups of articles;

Figure 10 is a sectional view of the applicator device of Figure 9 taken along line m-m;

Figures 11A to 11D show various components for use with the applicator device of Figure 9;

Figure 12 is a plan view from above of a blank for forming a carrier according to an embodiment of the present disclosure;

Figure 13 is a perspective view from above of a carrier formed from the blank of Figure 12;

Figure 14 illustrates an applicator device for applying the blank of Figure 13 to a group of articles;

Figure 14B is a perspective view from below of the applicator device of Figure 14;

Figure 15A is a sectional view of the applicator device of Figure 14;

Figure 15B is a side view of the applicator device of Figure 14;

Figures 16A and 16B are further sectional views of the applicator device of Figure 14;

Figure 16C is a sectional view of an applicator device of Figure 14 having an alternative post mounting arrangement;

Figure 17 illustrates a first component of a disconnecting device for separating a plurality of connected article carriers;

Figure 18 illustrates the first component of Figure 17 forming a disconnecting device in a first configuration for separating a plurality of connected article carriers;

Figure 19 is a plan view from above of a plurality of connected blanks each for forming a carrier according to an embodiment of the present disclosure for use with the disconnecting device in the configuration shown in Figure 18;

Figure 20 illustrates the first component of Figure 17 forming a disconnecting device in a second configuration for separating a plurality of connected article carriers as shown in Figure 8;

Figure 21 illustrates the first component of Figure 17 forming a disconnecting device in a third configuration for separating a plurality of connected article carriers as shown in Figure 22; and

Figure 22 is a plan view from above of a plurality of connected blanks each for forming a carrier according to an embodiment of the present disclosure for use with the disconnecting device in the configuration shown in Figure 21.

DETAILED DESCRIPTION OF EMBODIMENTS

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

Referring to Figure 1, there is shown a plan view of a pair of connected blanks 1 each of which is capable of forming a carton or carrier 90, as shown in Figure 2, for containing and carrying a group of primary products such as, but not limited to, bottles or cans, hereinafter referred to as articles B, as shown in Figure 2. The articles B may be generally cylindrical; the articles B may comprise a circular cross-sectional shape, at least about a region of engagement with the carrier 90. The blanks 10A, 10B form a secondary package for packaging at least one primary product container or package. Alternative blank configurations 101; 210; 301; 401 are shown in Figures 8, 12, 19 and 23 for forming an alternative cartons or carriers 290.

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

The blanks 10A-B; 110A-D; 210; 310A-F, 410A-C are formed from a sheet of suitable substrate. It is to be understood that, as used herein, the term "suitable substrate" includes all manner of foldable sheet material such as paperboard, corrugated board, cardboard, plastic, combinations thereof, and the like. It should be recognised that one or other numbers of blanks may be employed, where suitable, for example, to provide the carrier structure described in more detail below.

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

In the illustrated embodiments, the blanks 10A, 10B; 110A, 110B, 110C, 110D; 210; 310A, 310B, 310C, 310D, 310E, 310F; 410A, 410B, 410C are configured to form a carton or carrier for packaging an exemplary arrangements of exemplary articles B. In the embodiments illustrated in Figures 1 and 19, each blank 10A, 10B; 310A, 310B, 310C, 310D, 310E, 310F is configured to package article in a 2 x 2 matrix or array arrangement -two rows of two articles B are provided- and the articles B are beverage cans. In the embodiments illustrated in Figures 8 and 12, each blank 110A, 110B, 110C, 110D; 210 is configured to package article in a 2 x 3 matrix or array arrangement -three rows of two articles B are provided- and the articles B are beverage cans. In the embodiment illustrated in Figure 23, each blank 410A, 410B, 410C is configured to package article in a 2 x 4 matrix or array arrangement -two rows of four articles B are provided- and the articles B are beverage cans.

Alternatively, the blanks 10A, 10B; 110A, 110B, 110C, 110D; 210; 310A, 310B, 310C, 310D, 310E, 310F; 410A, 410B, 410C may be configured to form a carrier for packaging other types, number and size of articles and/or for packaging articles in a different arrangement or configuration.

Referring to Figure 1 there is shown a pair of connected blanks 1 comprising a first blank 10A and a second blank 10B. The second blank 10B is severable or frangibly connected to the first blank 10A by a frangible connection 13.

Each of the blanks 10A, 10B comprises a main or engaging panel 12 for forming a top wall or an engaging panel of a carrier 90.

The frangible connection 13 may take the form of a plurality of cutlines spaced apart to define connecting nick or bridge portions N1, N2, N3, N4 therebetween. The bridge portions N1, N2, N3, N4 couple the first blank 10A to the second blank 10B. In the illustrated embodiment, the frangible connection 13 comprises four connecting nick or bridge portions N1, N2, N3, N4 arranged in pairs N1/N2, N3/N4. A first pair of connecting nicks N1/N2 is disposed between a first article retention structure RT in the first blank 10A and a second article retention structure RT in the second blank 10B. The second article retention structure RT is disposed adjacent to the first article retention structure RT and each lies upon a notional longitudinal line or axis x-x, the longitudinal line or axis x-x passing through the centre of each of the first and second article retention structures RT. The first pair of connecting nicks N1/N2 are disposed on opposite sides of the longitudinal line x-x. The longitudinal line x-x may define or pass through a region of closest proximity between an article B received in the first blank 10A and an article B received in the second blank 10B. The frangible connection 13 comprises a second pair of connecting nicks N3/N4 disposed between a third article retention structure RT in the first blank 10A and a fourth article retention structure RT in the second blank 10B. The second pair of connecting nicks N3/N4 are disposed on opposing sides of a notional line (not shown) extending longitudinally of the pair of connected blanks 1 and passing through the centres of each of the third and fourth article retention structures RT.

The main panels 12 include at least one article retention structure RT. In the illustrated embodiment, the main panels 12 each comprise a plurality of article retention structures RT specifically four article retention structures RT arranged in 2 x 2 matrix or array. Each of the main panels 12 comprises two columns of article retention structures RT, each column comprises two article retention structures RT. Each of the article retention structures RT comprises an aperture A1.

Each of the article retention structures RT is substantially similar in construction and will therefore be described in detail with reference to a first one of the article retention structures RT located adjacent to a first end of the second blank 10B as shown in Figure 1.

The article retention structure RT comprises an article receiving opening defined in part by an aperture A1.

The article retention structure RT comprises a plurality of engaging teeth 40 disposed about the aperture A1.

The plurality of teeth 40 are hinged to the main panel 12 by a fold line. The fold line may be defined by a plurality of cut lines 43, 45. The plurality of cut lines 43, 45 may define or approximate a circle.

Each of the plurality of teeth 40 comprises an engaging edge E1 opposing a hinged edge. The engaging edges E1 are defined by a linear portion of a cut line defining the aperture A1. Each engaging edge E1 defines a part of a polygon. The illustrated embodiment comprises sixteen teeth 40. Each tooth 40 comprises a pair of side edges, the side edges are defined by cut lines 41 extending radially outward from respective vertices of the polygon. That is to say from a respective vertex between a pair of adjacent linear portions of the cut line defining the aperture A1. The cut

lines 41 are divergently arranged with respect to each other and define an angle therebetween, the angle may be about 22.5°.

The article retention structure RT may comprise a plurality of first circumferential cut lines 43. Each of the plurality of first circumferential cut lines 43 is aligned with one of the radial cut lines 41 such that said one of the radial cut lines 41 or a notional extension thereof bisects a respective one of the plurality of first circumferential cut lines 43.

Each of the plurality of first circumferential cut lines 43 is spaced apart from said one of the radial cut lines 41 bisecting it so as to define a connecting nick or bridge portion between a pair of adjacently disposed teeth 40.

Each of the plurality of first circumferential cut lines 43 may be linear in shape.

The article retention structure RT may comprise a plurality of second circumferential cut lines 45. Each of the plurality of second circumferential cut lines 45 is disposed between a pair of the plurality of first circumferential cut lines 43 and is spaced apart therefrom so as to define a pair of connecting nick or bridge portions between each tooth 40 and the main panel 12. The pair of connecting nick or bridge portions provide a hinged or foldable connection between each tooth 40 and the main panel 12.

Each of the plurality of second circumferential cut lines 45 may be linear in shape. In alternative embodiments, each of the plurality of first circumferential cut lines 43 may be arcuate or curved. In alternative embodiments, each of the plurality of second circumferential cut lines 45 may be arcuate or curved.

In the illustrated embodiment, the radius of curvature of each of the plurality of second circumferential cut lines 45 is equal to the radius of curvature of each of the plurality of first circumferential cut lines 43 however in other embodiments it may be different.

The blanks 10A, 10B comprise a handle structure H. The handle structure H comprises a handle or finger opening disposed on a longitudinal axis bisecting the main panel 12. The handle opening is provided between a group of four article retention structures RT. The handle opening is provided centrally or medially of the main panel 12.

Each handle opening is defined by a plurality of tabs 60, 62. The handle openings comprises four tabs 60, 62. Each tab 60, 62 is hinged to the main panel 12 by a hinged connection in the form of a fold line. An arcuate or curvilinear cut line may be provided between each fold line to define a corner or vertex of the handle opening. The handle openings are substantially rhombus or diamond shaped, in other embodiments other shapes may be employed such as, but not limited to square. The handle openings comprise a pair of major tabs 60 and a pair of minor tabs 62.

The pair of major tabs 60 are separated from each other by a first cut line or severable line. The pair of minor tabs 62 are separated from each other by the first cut line or severable line. The pair of major tabs 60 are separated from the pair of minor tabs 62 by a second cut line or severable line.

The first cut line is colinear with a notional line passing longitudinally though the centre of the group of four article retention structures RT.

The first cut line may be linear in shape and may extend between a first pair of opposed vertices of the handle opening. The second cut line may be non-linear in shape and may extend between a second pair of opposed vertices

of the handle opening. The second cut line intersects the first cutline, the second cut line comprises a “V” or “U” shaped medial portion; a vertex of the “V” or “U” shaped portion intersects the first cutline.

One of the pair of major tabs 60 is hinged to the main panel 12 by a first fold line. The other one of the pair of major tabs 60 is hinged to the main panel 12 by a second fold line. The first fold line is divergently arranged with respect to the second fold line.

One of the pair of minor tabs 62 is hinged to the main panel 12 by a third fold line. The other one of the pair of minor tabs 62 is hinged to the main panel 12 by a fourth fold line. The third fold line is divergently arranged with respect to the fourth fold line.

The first fold line is divergently arranged with respect to the third fold line. The second fold line is divergently arranged with respect to the fourth fold line.

The handle openings may form a stabilisation device during application of the blanks 10A, 10B to a group of articles B. The stabilisation devices are configured to receive an abutment peg or dog (described in further detail below).

The opening of the stabilisation devices may be non-circular in shape, and may be substantially square or diamond shaped.

A peg or dog may be provided for engaging the blanks 10A, 10B via the handle opening to prevent or inhibit linear or rotation movement of the blanks 10A, 10B with respect to the dog. The dog may be mounted to, or integral with, an applicator device, described in more detail below, for applying the blanks 10A, 10B to a group of articles B.

The opening of the stabilization device or handle opening may comprise at least one flat or linear portion for engaging a complementary flat or linear portion of the dog. In other embodiments, the stabilization device or handle opening may comprise at least one generally “V” or “U” shaped portion for engaging a complementary portion of the dog.

The blanks 10A, 10B are applied simultaneously to a pair of article groups. The main panels 12 of each blank 10A, 10B is applied to one of the groups of articles B. The pair of connected blanks 1 is lowered with respect to the articles B to be at rest thereupon as shown in Figure 2.

An applicator device AP is provided to engage the blanks 10A, 10B with the articles B. The applicator device AP comprises a plate or body 50 from which a plurality of guides G may extend. The guides G depend downwardly from the plate 50 and ensure the articles B are maintained in the desired configuration or arrangement to be received by the blanks 10A, 10B. The guides may also ensure or retain the pair of connected blanks 1 in alignment with the groups of articles B. In the illustrated embodiment, the guides G take the form of a plurality of fingers or elongate members however in other embodiments the guides may take the form of vertical walls depending downwardly from the plate 50 so as to surround at least an upper portion of the pair of article groups.

The applicator device AP comprises a pair of posts P1, P2 forming retention or stabilising pins or lugs depending from the lower or engaging surface of the plate 50. The illustrated embodiment comprises two stabilising pins, best shown in Figure 2. As the applicator device AP is lowered over the pair of connected blanks 1 and articles B, a first

post P1 engages the stabilisation device provided by the handle opening of the first blank 10A. A second post P2 engages the stabilisation device provided by the handle opening of the second blank 10B, best shown in Figure 3. The tabs 60, 62 of the handle structures H are folded out of the plane of the main panels 12 as the stabilising pins are received.

A disconnecting device BL depends from a lower surface of the plate 50, the disconnecting device BL may take the form of a blade mounted substantially perpendicularly with respect to the lower surface of the plate 50. The disconnecting device BL extends transversely across the plate 50.

As the applicator device AP is lowered further with respect to the pair of connected blanks 1 and articles B, the post P1, P2 are inserted further through the handle openings, the disconnecting device BL is aligned with the frangible connection 13 and moves downwardly with respect thereto. In doing so the disconnecting device BL severs or cleaves the connecting nicks or bridge portions N1, N2, N3, N4 thereby separating the first and second blanks 10A, 10B from each other.

Continued lowering of the applicator device AP with respect to the pair of blanks 10A, 10B and articles B brings a lower or engaging surface of the plate 50 into contact with the blanks 10A, 10B, as shown in Figure 4.

The lower or engaging surface of the plate 50 comprises a plurality of recesses or orifices OR each adapted to receive an upper portion of an article B. The illustrated embodiment comprises eight orifices OR arranged in 2 x 4 matrix or array. The orifices OR may be at least partially blind, that is to say they comprise an end stop ES preventing the articles B from passing through the plate 50.

The stabilising pins are now fully inserted into the stabilisation devices so as to prevent or inhibit movement of the pair of blanks 10A, 10B with respect to the applicator AP and retain each blank 10A, 10B in correct alignment with the articles B.

The applicator AP is lowered still further with respect to the articles B so as to press the blanks 10A, 10B over the upper ends of the articles B. The applicator AP presses the blanks 10A, 10B downwardly such that an article B is received in each of the article retention structures RT. The tabs 40 are folded out of the plane of the engaging panels 12 and engage below a flange or other suitable projection provided on the articles B, best shown in Figure 5 to form packages.

The applicator AP is raised with respect to the packages, the assembled packages may be conveyed to further processing stations or to a point of sale.

Figure 6 illustrates a number of alternative blade configurations BL1, BL2, BL3, BL4, BL5. A first blade BL1 comprises a single breaking edge CE which is parallel to a mounting edge ME. The entirety of the breaking edge CE engages the frangible connection simultaneously when in use.

A second blade BL2 comprises a pair of breaking edges CE1, CE2 arranged divergently with respect each other to form a point or vertex. Each of the pair of breaking edges CE1, CE2 is non-parallel, or divergently arranged, with respect to a mounting edge ME.

A third blade BL3 is shown in Figure 6, the third blade BL3 is substantially similar to the second blade BL2 albeit the pair of breaking edges CE1, CE2 are arranged such that a smaller internal angle is defined therebetween.

A fourth blade BL4 is shown in Figure 6, the fourth blade BL4 is substantially similar to the second and third blades BL2, BL3 albeit the pair of breaking edges CE1, CE2 are arranged such that a smaller internal angle is defined therebetween. In order to achieve this without substantially increasing the height of the fourth blade BL4 each of the pair of breaking edges CE1, CE2 comprises a marginal portion arranged substantially parallel with the mounting edge ME.

A fifth blade BL5 is shown in Figure 6, the fifth blade BL5 comprises a recess, scalloped or serrated breaking edge. The fifth blade BL5 comprises four divergently arranged breaking edges CE1, CE2, CE3, CE4. A first breaking edge CE1 and a second breaking edge CE2 are divergently arranged with respect each other to form a point or vertex substantially at a centre or medial region of the fifth blade BL5. Third and fourth breaking edges CE3, CE4 are provided at marginal regions of the fifth blade BL5. The third breaking edge CE3 is divergently arranged with respect to the first breaking edge CE1 to define a recess R therebetween. The fourth breaking edge CE4 is divergently arranged with respect to the second breaking edge CE2 to define a recess R therebetween.

The third breaking edge CE3 may be arranged to be parallel to the second breaking edge CE2. The fourth breaking edge CE4 may be arranged to be parallel to the first breaking edge CE1.

The fifth blade BL5 may be considered to have a plurality of breaking edges or blades CE1, CE2, CE3, CE4 mounted to a common base or mounting body.

The fifth blade BL5 may be advantageous when separating a pair of blanks 10A, 10B in which the articles B in a first group being engaged by the first blank 10A are in contact or close proximity to the articles B in a second group being engaged by the second blank 10B. The recesses R avoid a region of contact or close proximity between pairs or cylindrical articles B. In this way the fifth blade BL5 avoids contact or impact with the articles B.

Referring now to Figure 7 there is shown a packaging apparatus configured to automate application of the pair of connected blanks 1 to groups of articles B. The packaging apparatus comprises a plurality of tool heads 600 mounted to an overhead wheel arrangement 654.

The overhead wheel arrangement 654 is adapted to maintain the orientation of an applicator 620 with respect to a conveyor 653. The applicator 620 is maintained substantially parallel with the conveyor 653, such that the engaging surface of the plate 50 faces towards the articles B and/or conveyor throughout the rotation of the overhead wheel.

The applicator 620 is moveably mounted to the tool head 600, and is resiliently biased towards the conveyor 653 by spring mounts 658 depending from a mounting plate 656.

The applicator 620 differs from that shown in Figures 2 to 5 in that the guides G have been omitted, instead the pair of connected blanks 1 are aligned with respect to the articles B by reference posts 640 mounted to article engaging tools 632A, 632B, 634.

The packaging apparatus comprises a grouping and metering apparatus and an overhead applicator for applying the blanks 10A, 10B to metered groups of articles B.

The metering apparatus comprises a first plurality of article engaging tools 632A, 632B, 634 for engaging, metering and driving a first column of articles B through the packaging apparatus. The metering apparatus comprises a second plurality of article engaging tools (not shown in Figure 7) for engaging, metering and driving a second column of articles B through the packaging apparatus. The second plurality of article engaging tools is arranged in opposition to the first plurality of article engaging tools 632A, 632B, 634.

Each of the article engaging tools 632A, 632B, 634 is coupled to or comprises a drive mechanism to propel each of the first and second plurality of article engaging tools 632A, 632B, 634 about a respective track or loop.

Each of the article engaging tools 632A, 632B, 634 is coupled to or mounted to a track a respective track or loop (not shown) having a working reach and a return reach. The article engaging tools 632A, 632B, 634 may comprise a magnet (not shown) for holding the article engaging tools 632A, 632B, 634 to the track. The track comprises a drive mechanism for driving the article engaging tools 632A, 632B, 634 about the track. The drive mechanism may take the form of a linear motor. A stator comprising coils is mounted to the track and generates propulsive force by acting upon the magnet to drive the article engaging tools 632A, 632B, 634 about the track. Each of the article engaging tools 632A, 632B, 634 can be independently or individually controlled, in this way the pitch between article engaging tools 632A, 632B, 634 can be varied and the article engaging tools 632A, 632B, 634 can be individually accelerated or decelerated.

Each article engaging tools 632A, 632B, 634 in the first plurality of article engaging tools 632A, 632B, 634 is driven in synchronicity with a respective one of the article engaging tools in the second plurality of article engaging tools, at least through a working reach of the packaging apparatus.

The packaging apparatus may merge a first stream of articles B with a second stream of articles B, the first plurality of article engaging tools 632A, 632B, 634 engaging articles from the first stream and the second plurality of article engaging tools engaging articles from the second stream.

Each article engaging tool 632A, 632B, 634 comprises a carriage having at least one wheel or follower 646, in some embodiments two, three, four or more wheels or followers 646 may be provided on each carriage and engage with the track.

Each carriage comprises a head detachably mounted thereto by a securing mechanism. In some embodiments, the lock mechanism may take the form of a bayonet style fitting or mount. In this way the head is readily separated from the carriage and may be interchanged, swapped or replaced. This allows the head to be changed for a different head to accommodate a different carton blank or article B or to enable replacement of a damaged or broken head.

Each of the heads comprises a gripper or scoop providing at least one engaging surface for engaging an article B. The gripper comprises a pair of fingers or limbs defining a recess or channel arranged to accommodate a portion of the article B.

Each of the heads may comprise a reference pin or post 640 extending upwardly therefrom. The reference pin 640 is mounted to the head at a first proximal end and extends upwardly to a distal free end. The distal free end is disposed at an elevation above the upper end of the articles B. In this way the reference pin 640 is configured to engage with blanks 10A, 10B when placed upon the upper ends of the articles B in the group of articles B. The heads forming leading and trailing article engaging tools 632A, 632B may comprise a first reference pin or post 640. The heads forming intermediate article engaging tools 634 may comprise an optional second reference pin or post. The second reference pin or post may be offset, in a direction transverse to the article flow direction F, with respect to the first reference pins 640 provided by the leading and trailing article engaging tools 632A, 632B.

The reference pin 640 is arranged to be located between a leading portion of the head and a trailing portion of the head. The reference pin 640 is located upstream of a downstream end, edge or wall of the article B engaged by the head to which it is mounted and the reference pin 640 is located downstream of an upstream end, edge or wall of the article B engaged by said head.

The reference pin 640 may be disposed within the footprint of the carriage and/or head. In this way two adjacent carriages or head can be brought into close proximity without interference by the reference pin 640 or its mounting. This enables two or more article engaging tools 632A, 632B, 634 to bring two or more articles B into close proximity or to engage two or more articles B which are disposed in close proximity.

In order to form metered groups of articles B pairs of article engaging tools 632A, 632B, 634 bring together pairs of articles B, one from each of the first and second columns or streams of articles B.

Two or more pairs of article engaging tools 632A, 632B, 634 may be employed to form a group of articles B, in the illustrated embodiment, four pairs of article engaging tools 632A, 632B, 634 form two groups of four articles B each in a 2x2 matrix or array.

In order to form the groups, the leading pair of article engaging tools 632B may be retarded to allow the intermediate pairs of article engaging tools 634, and the trailing pair of article engaging tools 632A to catch up with the pair of article engaging tools 632A, 632B, 634 disposed downstream thereof. Once each upstream pair of article engaging tools 632A, 632B, 634 catch the adjacent downstream pair of article engaging tools 632A, 632B, 634, they too may be retarded to match the speed of said downstream pair. In alternative embodiments, it will be appreciated that speed of an upstream pair of article engaging tools 632A, 632B, 634 may be increased or accelerated to catch an adjacent downstream pair of article engaging tools 632A, 632B, 634.

As the article engaging tools 632A, 632B, 634 form the groups of articles B connected blanks 10A, 10B are lowered onto the upper ends of the articles B forming the group.

The overhead wheel arrangement brings the applicator 620 into contact with the connected blanks 10A, 10B substantially similarly to the applicator AP of Figure 2 to 5 to applying the blanks 10A, 10B to the articles B.

Referring now to Figures 8 to 11D there is shown an alternative blank and packaging system of the present disclosure. In the illustrated embodiment, like numerals have, where possible, been used to denote like parts, albeit

with the addition of the prefix "100" to indicate that these features belong to the second embodiment. The alternative embodiment shares many common features with the embodiment of Figures 1 to 7, therefore only the differences from the embodiment illustrated in Figures 1 to 7 will be described in any greater detail.

Referring to Figure 8 there is shown a plurality of connected blanks 101 comprising a first blank 110A, a second blank 110B, third blank 110C, and fourth blank 110D. The second blank 110B is severable or frangibly connected to the first blank 110A by a first frangible connection 113. The third blank 110C is severable or frangibly connected to the first blank 110A by a second frangible connection 115. The third blank 110C is severable or frangibly connected to the fourth blank 110D by a first frangible connection 113. The second blank 110B is severable or frangibly connected to the fourth blank 110D by a second frangible connection 115.

Each of the blanks 110A, 110B, 110C, 110D comprises a main or engaging panel 112 for forming a top wall or an engaging panel of a carrier.

The first frangible connections 113 may take the form of a plurality of cutlines spaced apart to define connecting nick or bridge portions N1, N2, N3, N4, N5, N6 therebetween. The bridge portions N1, N2, N3, N4, N5, N6 couple the first blank 110A to the second blank 110B or the third blank 110C to the fourth blank 110D. In the illustrated embodiment, the first frangible connections 113 comprises six connecting nick or bridge portions N1, N2, N3, N4, N5, N6 arranged in pairs N1/N2, N3/N4, N5/N6.

Each of the first frangible connections 113 is substantially similar in construction and will be described with reference to the first frangible connection 113 between the first blank 110A and the second blank 110B. A first pair of connecting nicks N1/N2 is disposed between a first article retention structure RT in the first blank 110A and a second article retention structure RT in the second blank 110B. The second article retention structure RT is disposed adjacent to the first article retention structure RT and each lies upon a notional transverse line or axis y-y, the transverse line or axis y-y passing through the centre of each of the first and second article retention structures RT. The first pair of connecting nicks N1/N2 are disposed on opposite sides of the transverse line y-y. The first frangible connection 113 comprises a second pair of connecting nicks N3/N4 disposed between a third article retention structure RT in the first blank 110A and a fourth article retention structure RT in the second blank 110B. The second pair of connecting nicks N3/N4 are disposed on opposing sides of a notional line (not shown) extending transversely of the plurality of connected blanks 101 and passing through the centres of each of the third and fourth article retention structures RT. The first frangible connection 113 comprises a third pair of connecting nicks N5/N6 disposed between a fifth article retention structure RT in the first blank 110A and a sixth article retention structure RT in the second blank 110B. The third pair of connecting nicks N5/N6 are disposed on opposing sides of a notional line (not shown) extending transversely of the plurality of connected blanks 101 and passing through the centres of each of the fifth and sixth article retention structures RT.

The second frangible connections 115 may take the form of a plurality of cutlines spaced apart to define connecting nick or bridge portions N7, N8, N9, N10 therebetween. The bridge portions N7, N8, N9, N10 couple the first blank 110A

to the third blank 110C or the second blank 110B to the fourth blank 110D. In the illustrated embodiment, the second frangible connections 114 comprises four connecting nick or bridge portions N7, N8, N9, N10 arranged in pairs N7/N8, N9/N10.

Each of the second frangible connections 115 is substantially similar in construction and will be described with reference to the second frangible connection 115 between the second blank 110B and the fourth blank 110D. A first pair of connecting nicks N1/N2 is disposed between a first article retention structure RT in the second blank 110B and a second article retention structure RT in the fourth blank 110D. The second article retention structure RT is disposed adjacent to the first article retention structure RT and each lies upon a notional longitudinal line or axis x-x, the longitudinal line or axis x-x passing through the centre of each of the first and second article retention structures RT. The first pair of connecting nicks N7/N8 are disposed on opposite sides of the longitudinal line x-x. The second frangible connection 115 comprises a second pair of connecting nicks N9/N10 disposed between a third article retention structure RT in the second blank 110B and a fourth article retention structure RT in the fourth blank 110D. The second pair of connecting nicks N9/N10 are disposed on opposing sides of a notional line (not shown) extending longitudinally of the plurality of connected blanks 101 and passing through the centres of each of the third and fourth article retention structures RT.

The main panels 112 include at least one article retention structure RT. In the illustrated embodiment, the main panels 112 each comprise a plurality of article retention structures RT specifically six article retention structures RT arranged in 2 x 3 matrix or array. Each of the main panels 112 comprises two columns of article retention structures RT, each column comprises three article retention structures RT. Each of the article retention structures RT comprises an aperture A1. The article retention structures RT of Figure 8 are substantially similar to those of Figure 1 albeit only those tabs 140 disposed in marginal regions of the main panel 112 comprise second circumferential cut lines 145. The second circumferential cut lines 145 have been omitted from those tabs 140 disposed in a medial region of the main panel 112.

The blanks 110A, 110B, 110C, 110D comprise a handle structure H. The handle structure H comprises a pair of handle or finger openings disposed on a longitudinal axis bisecting the main panel 112. Each handle opening is provided between groups of four article retention structures RT.

Each handle opening is defined by a pair of tabs 160. Each tab 160is hinged to the main panel 12 by a hinged connection in the form of a fold line. An arcuate or curvilinear cut line may be provided between each fold line to define a corner or vertex of the handle opening. The handle openings are substantially rhombus or diamond shaped, in other embodiments other shapes may be employed such as, but not limited to square.

The pair of tabs 160 are separated from each other by a cut line or severable line. The cut line is colinear with a notional line passing longitudinally though the centre of the group of four article retention structures RT.

The first cut line may be linear in shape and may extend between a first pair of opposed vertices of the handle opening.

One of the pair of tabs 160 is hinged to the main panel 112 by a first fold line. The other one of the pair of tabs 160 is hinged to the main panel 112 by a second fold line. The first fold line is divergently arranged with respect to the second fold line.

Referring to Figure 9 and 10 there is shown an applicator device AP for engaging the plurality of connected blanks 101 with articles B. The applicator device AP comprises a plate or body 150 from which a plurality of guides G may extend. The guides G depend downwardly from the plate 150 and ensure the articles B are maintained in the desired configuration or arrangement to be received by the blanks 110A, 110B, 110C, 110D. In the illustrated embodiment, the guides G take the form of a plurality of fingers or elongate members. Some of the guides G may extend from a common body portion taking the form of a vertical wall portion depending downwardly from the plate 150.

The applicator device AP comprises posts P1, P2 forming retention or stabilising pins or lugs depending from the lower or engaging surface of the plate 150. The illustrated embodiment comprises two stabilising pins, best shown in Figure 9. As the applicator device AP is lowered over the plurality of connected blanks 101 and articles B, a first post P1 engages the stabilisation device provided by one of the handle openings in each of the blanks 110A, 110B, 110C, 110D. A second post P2 engages the stabilisation device provided by the other handle openings in each of the blanks 110A, 110B, 110C, 110D. The tabs 160 of the handle structures H are folded out of the plane of the main panel 112 as the stabilising pins are received.

A disconnecting device depends from a lower surface of the plate 150. The disconnecting device take the form of a plurality of blades BL, BL2, BL3 mounted substantially perpendicularly with respect to the lower surface of the plate 150. A first group of blades BL, BL3 extends transversely across the plate 150. A second group of blades BL, BL2, BL3 extends longitudinally across the plate 150.

The first group of blades BL, BL3 bisects the plate 150 transversely. The second group of blades BL, BL2, BL3 bisects the plate 150 longitudinally.

The first group of blades BL, BL3 is arranged to be in vertical registry with the second frangible connections 115 of the plurality of connected blanks 101. The second group of blades BL, BL2, BL3 is arranged to be in vertical registry with the first frangible connections 113 of the plurality of connected blanks 101. The blades BL, BL2, BL3 are arranged to sever or cleave the bridge portions N1, N2, N3, N4, N5, N6, N7, N8, N9, N10.

The plate 150 comprises a plurality of slots S1, S2 for receiving blades BL, BL2, BL3. The plate 150 comprise a plurality of transverse slots S1 and a plurality of longitudinal slots, in Figure 9 the longitudinal slots are not visible as they are occupied by blades BL, BL2.

The plate 150 comprise a plurality of half or perimeter slots S2, the perimeter slots S2 are shorter in length than the transverse slots S1 or longitudinal slots and are disposed proximate a wall 152, 154, 156, 158 of the applicator AP. The wall 152, 154, 156, 158 comprise a wall slot SW aligned with a respective one of the perimeter slots S2. The wall slot SW and the perimeter slots S2 together received a half or perimeter blade BL3, best shown in Figure 11D.

Figure 10 shows a sectional view through line m-m of Figure 9, the transversely oriented blades BL, BL3 are shown engaged the transverse slots S1. The blades BL, BL3 comprises resiliently biased detents 168, best shown in Figures 11C, 11D. The first blades BL comprise a pair of resiliently biased detents 168 arranged in opposition to each other. A slot 172 is cut or formed in a lower portion of the blades BL, BL3. The slot 172 provides a gap into which the detent 168 may be displaced, best shown in Figure 11C, to release the blade BL, BL3 from the applicator AP. An arm 166 provides a living hinge allowing displacement of the detent 168 connected thereto and inherently biasing the arm 166/detent 168 to a rest or locked position. The arm 166 may be nonlinear, and may comprise a first proximal portion connected to the main body 173 of the blade BL and a second portion divergently arranged with respect to the first portion. The second portion providing the detent 168. The detent 168 extends beyond a side edge of a body portion 173 of the blade BL from which the arm 166 depends. The plate 150 comprises openings 160, 162 in a rear or upper surface. First openings 160 are in vertical alignment with the detents 168 and enable a tool (not shown) to be inserted to release the detent from a catch 164 provided by the plate 150.

Second openings 162 are in vertical alignment with centre or medial portion of the blade BL and may facilitate removal of the blade BL by allowing a tool to be inserted to push the blade BL out of the slot S1.

The blade BL may comprise a receiver for receiving a portion of a support SP or second blade BL2. The receiver takes the form of a cutaway, slot or recess 170 struck from a lower portion of the body portion 173 disposed between the pair of arms 166.

The blade BL may comprise pair of breaking edges CE1, CE2 arranged divergently with respect each other to form a point or vertex. Each of the pair of breaking edges CE1, CE2 is non-parallel, or divergently arranged, with respect to a base edge BE.

Figure 11A shows a support SP for providing support to the blade BL in a direction transverse to the blade BL. The support SP comprises a receiver 171 for receiving a portion of the blade BL. The receiver takes the form of a cutaway, slot or recess 171 struck from an upper portion of a body portion 173.

Figure 11B shows a second blade BL2 for providing support to the blade BL in a direction transverse to the blade BL and providing a pair of breaking edges CE1, CE2 transverse to those of the blade BL. Each of the pair of breaking edges CE1, CE2 is non-parallel, or divergently arranged, with respect to a base edge BE. The second blade BL2 comprises a receiver 171 for receiving a portion of the blade BL. The receiver takes the form of a cutaway, slot or recess 171 struck from an upper portion of a body portion 173.

The support SP and the second blade BL2 each comprise a pair of resiliently biased detents 168 arranged substantially similarly to that of the blade BL and will not be described in further detail.

The support SP is shorter in height than the second blade BL2 and is not intended to sever frangible connections 113, 115 in the plurality of connected blanks 101.

The perimeter blade BL3, shown in Figure 11D, comprises a single resiliently biased detent 168 and an opposing static detent 168B, the static detent 168B comprises a ledge or inclined edge protruding from a side edge of the body

173 of the perimeter blade BL3. In order to insert the perimeter blade BL3 into the perimeter slot S2 the static detent 168B is inserted first with the perimeter blade BL3 rotated out of the vertical orientation as shown in Figure 11D. Once inserted the perimeter blade BL3 is rotated back into a vertical orientation engaging the resiliently biased detent 168 with a catch provided by the plate 150 or side wall 152, 154, 156, 158 of the applicator AP. A portion of the perimeter blade BL3 is received in the wall slot SW to stabilise the blade BL3

The perimeter blade BL3 comprises at least one breaking edge CE1, CE2 that is non-parallel, or divergently arranged, with respect to a base edge BE. If the perimeter blade BL3 comprises a pair of breaking edges CE1, CE2 they may be different in length and asymmetrically arranged, that is to say the vertex defined by the breaking edges CE1, CE2 is off-centre.

When the support SP or the second blade BL2 are used in conjunction with the blade BL the support SP or the second blade BL2 is inserted into one of the longitudinal and transverse slots S1, S3 prior to insertion of the blade BL into the other one of the longitudinal and transverse slots S1, S3.

Referring now to Figures 12 to 16C there is shown an alternative blank and packaging system of the present disclosure. In the 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 third embodiment. The alternative embodiment shares many common features with the embodiment of Figures 1 to 11D, therefore only the differences from the embodiment illustrated in Figures 1 to 11D will be described in any greater detail.

Referring to Figure 8 there is shown a single blank 210 for forming a carrier 290 as shown in Figure 13. The blank 210 comprises a main or engaging panel 212 for forming a top wall or an engaging panel of the carrier 290. In the illustrated embodiment, the main panel 212 comprises a plurality of article retention structures RT1, RT2 specifically six article retention structures RT arranged in 2 x 3 matrix or array.

The blank 210 comprises four first article retention structures RT1 which are substantially similar in construction to the article retention structures RT of the illustrated embodiments shown in Figures 1 and 8 albeit with the inclusion of at least one cutaway in the form of a recess C4, C5. The recesses C4, C5 are flanked by a pair of transition teeth or tabs 240c, 250c, a transition tab 240c, 250c being disposed on each side of the recess C4, C5. The transition tab 240c, 250c may be shaped to provide a gradual or curvilinear transition between the recess C4, C5 and the engaging edges of the first teeth 240a. The transition tabs 240c, 250c may comprise an inclined side edge. The transition tabs 240c, 250c may comprise rounded or filleted corners adjacent to the respective recess C4, C5 which it flanks.

The first article retention structures RT1 each comprise two recesses C4, C5 and two engaging teeth 240c disposed therebetween, the two engaging teeth 240c may be each smaller or narrower in width, angular width, at least along an engaging edge, than first teeth 240a. The two engaging teeth 240c are disposed across or adjacent to, and/or define, a corner region 212a of the main panel 212. In other embodiments, more than two engaging teeth 240a, 240c may be disposed between the pair of recesses C4, C5.

The blank 210 comprises two second article retention structures RT2 which are substantially similar in construction to the first article retention structures RT1, albeit one of the recesses C4 and has been omitted and replaced with a pair of first engaging teeth 240a.

Further the arrangement of the radial cutlines 241, 251 of the first and second article retention structures RT1, RT2 has been modified such that the arrangement is rotated about a centre of the respective aperture A1, A2. The arrangement is rotated through an angle equivalent to half of the angular width of the first teeth 240a, 250a, which, in the illustrated embodiment, is about 12.25°.

In the first article retention structures RT1 the radial cutline 241 separating the pair of transition tabs 240c disposed between a first recess C4 and a second recess C5 is oriented such that it bisects the angle between the end edge Ee and the side edge Es. A notional line N1 passing through the radial cutline 241 separating said pair of transition tabs 240c intersects a corner or vertex, real or notional, defined by the end edge Ee and the side edge Es of the main panel 212.

Referring to Figures 14 to 16B there is shown an applicator device AP for engaging the blank 210 with a group of articles B. The applicator AP is substantially similar to the applicator AP of Figure 2 albeit adapted to accommodate a six articles B grouped in a 2 x 3 matrix or array arrangement. The blade BL has been omitted or removed since the applicator AP applies a single blank 210 to a single group of articles B.

The posts P1, P2 are removably or detachably mounted to the plate 250 of the applicator AP. The plate 250 comprises a receiver RC for mounting a portion of the post P1, P2 therein, best shown in Figure 16B. The posts P1, P2 comprise a base portion which is received by the receiver RC. The mounting portion of the posts P1, P2 may be asymmetric so that the posts are 'coded' or 'keyed' to the applicator AP. This may ensure the posts P1, P2 are mounted in the correct orientation or in the correct receiver RC. This may be advantageous when the handle openings are asymmetric in shape and ensures the posts P1, P2 are correctly oriented for insertion into the handle openings. The posts P1, P2 may comprise a suitable securing mechanism such as a snap fit or bayonet fit although another suitable fastening device may be employed.

Figure 16C illustrate a portion of an applicator AP have a modified post mounting system. The post P1 comprises a base portion which is received in an orifice in the plate 250'. The base portion of the post P1 comprises a bore hole BH, the bore hole BH optionally comprises an internal screw thread. A countersunk via hole is provide in the plate 250' and a screw or bolt SC is received therein. The screw or bolt SC passes into the bore hole BH in the base of the post P1 and is tightened to secure the post to the plate 250'.

Referring now to Figures 17 to 22 there is shown alternative blanks and packaging system of the present disclosure. In the illustrated embodiment, like numerals have, where possible, been used to denote like parts, albeit with the addition of the prefix "300", "400" to indicate that these features belong to the fourth and fifth embodiments respectively. The alternative embodiments share many common features with the embodiment of Figures 1 to 16C,

therefore only the differences from the embodiment illustrated in Figures 1 to 16C will be described in any greater detail.

Referring to Figure 17 there is shown a disconnecting device CT for separating a plurality of connected article carriers. The disconnecting device CT is not employed to apply a plurality of connected blanks to a plurality of groups of articles B. The plurality of connected blanks is applied to the articles B by a separate device (not shown).

The disconnecting device CT is substantially similar to the applicator AP of Figure 9 and 10 albeit with the omission of the posts P1, P2, and the change in shape of the orifices OR in the plate 350. In the embodiment illustrated in Figure 17 the orifices OR are substantially square in shape albeit with rounded corners. Those orifices OR located at corner of the applicator AP may be pentagonal in shape so as to strengthen the corner regions

The plate 350 may comprises at least one blind orifice OB, the illustrated embodiment comprises a plurality of blind orifices OB.

The plate 350 comprises a plurality of longitudinal slots S1, a plurality of transverse slots S3, and a plurality of perimeter slots S2.

The longitudinal slots S1 and transverse slots S3 are arranged pairs to form a cruciform slot disposed between a group of four orifices OR, OB.

The disconnecting device CT comprises walls 352, 354, 356, 358 extending from the plate 350, the walls may comprise at least one wall slot SW aligned with a perimeter slot S2.

The disconnecting device is configured to receive the blades BL, BL2, BL3 and support SP of Figures 11A to 11D.

Figure 18 shows the disconnecting device CT in a first configuration, a number of blades BL, BL2, BL3 and supports SP have been mounted in the slots S1, S2, S3, SW. The configuration of the blades BL, BL2, BL3 is selected to sever the frangible connection 313, 315, specifically the connecting nicks or bridge portions N provided in the plurality of connected blanks 301 shown in Figure 19.

Figure 19 shows six blanks 310A, 310B, 310C, 310D, 310E, 310F. the plurality of blanks 310A, 310B, 310C, 310D, 310E, 310F are arranged in a 2 x 3 matrix or array. Each blank 310A, 310B, 310C, 310D, 310E, 310F is configured to accommodate a plurality of articles, specifically four articles B arranged in a 2 x 2 matrix or array.

Figure 20 shows the disconnecting device CT in a second configuration, a number of blades BL, BL2, BL3 and supports SP have been mounted in the slots S1, S2, S3, SW. The configuration of the blades BL, BL2, BL3 is arranged to sever the frangible connection 313, 315, specifically the connecting nicks or bridge portions N1, N2, N3, N4, N5, N6, N7, N8, N9, N10 provided in the plurality of connected blanks 101 shown in Figure 8.

Figure 21 shows the disconnecting device CT in a third configuration, a number of blades BL, BL2, BL3 and supports SP have been mounted in the slots S1, S2, S3, SW. The configuration of the blades BL, BL2, BL3 is arranged to sever the frangible connection 415, specifically the connecting nicks or bridge portions N provided in the plurality of connected blanks 401 shown in Figure 22.

Figure 22 shows three blanks 410A, 410B, 410C. the plurality of blanks 410A, 410B, 410C are arranged in a 1 x 3 matrix or array. Each blank 410A, 410B, 410C is configured to accommodate a plurality of articles, specifically eight articles B arranged in a 2 x 4 matrix or array.

The disconnecting device CT may be readily adapted to accommodate a plurality of connected carriers formed from a plurality of connected blanks arranged in alternative configurations, whilst in the illustrated examples each blank in the arrangement accommodates the same number of articles B in the same matrix or array arrangement in other embodiments the plurality of connected blanks may be formed form individual blanks having different size and/or shape.

In this way the disconnecting device CT has a modular construction enabling the device to be reconfigured depending upon the specific arrangement of carrier to be separated.

The present disclosure provides a carrier 90; 290 of the top engaging type having article retention structures RT, RT1, RT2 for engaging articles B and a blank 10A-B; 110A-D; 210; 310A-F, 410A-C for forming the article carrier 90; 290. The present disclosure provides a plurality of connected blanks 1; 101; 301; 401 which can be simultaneously applied to a plurality of groups of articles B. Each of the blanks 10A-B; 110A-D; 310A-F, 410A-C in a plurality of connected blanks 1; 101; 301; 401 is frangibly connected to at least one other blank 10A-B; 110A-D; 310A-F, 410A-C.

The carrier 90; 290 comprises a main panel 12; 112; 212, 312; 412 having one or more article retention structures RT, RT1, RT2 for receiving and securing the main panel 12; 112; 212, 312; 412 to a respective article B.

The main or engaging panel 12; 112; 212, 312; 412 may comprise at least one stabilisation device providing an opening in the main panel 12; 112; 212, 312; 412 and arranged to inhibit movement in two orthogonal directions.

The present disclosure provides an apparatus for packaging one or more articles in an article carrier 290. The apparatus may comprise an article engaging tool 632A, 632B, 634 for engaging an article B and conveying the article B in a downstream direction. The article engaging tool 632A, 632B, 634 comprises a reference device, in the form of an abutment pin or peg 640, for aligning a plurality of connected blanks 1 with respect to the articles B.

The article engaging tool 632A, 632B, 634 may comprise a removable head to which the reference device is mounted. The head may comprise part of a tool-less attachment or mounting system, such as, but not limited to, a bayonet fitting.

The apparatus may comprise a plurality of article engaging tools 632A, 632B, 634 each for engaging a respective article B, metering and grouping the articles B and conveying said articles B in a downstream direction as a metered group. Each of the plurality of article engaging tools 632A, 632B, 634 is driven independently about an endless track having a working reach and a return reach.

The plurality of article engaging tools 632A, 632B, 634 may be configured to form metered groups of articles B and align a plurality of connected blanks 1 therewith. The articles B may be formed into the metered groups and simultaneously aligned with a plurality of connected blanks 1 as it is fed onto the upper ends of the articles B. The plurality of connected blanks 1 may be brought into contact or alignment with an abutment pin 640 mounted to a leading or downstream one of the plurality of article engaging tools 632A, 632B, 634 forming the article groups.

The plurality of connected blanks 1 may be brought into contact or alignment with an abutment pin 640 mounted to each of a pair of leading or downstream one of the plurality of article engaging tools 632A, 632B, 634 forming the article groups.

At least one abutment pin 640 mounted to a trailing or upstream one of the plurality of article engaging tools 632A, 632B, 634 forming the article groups may be brought into contact with the plurality of connected blanks 1 as the formation of the article group is completed.

The abutment pin 640 may be shaped to provide at least two points of contact with the registration edge to inhibit movement of the plurality of connected blanks 1 parallel with the direction of flow of the plurality of connected blanks 1 through the apparatus and perpendicularly or laterally with respect to the direction of flow of the plurality of connected blanks 1 through the apparatus.

The present disclosure provides an applicator AP; 620 for pressing the plurality of connected blanks 1; 101, 301; 401 onto the groups of articles B. The applicator AP; 620 may comprise a plurality of article receiving orifices each for receiving a respective article B of the group.

The applicator 620 may form part of tool head 600 mounted to an overhead wheel arrangement 654 for applying or engaging the plurality of connected blanks 1 to the groups of articles B as they are conveyed upon a conveyor in a downstream direction.

The applicator AP; 620 comprises at least one stabilisation peg P1, P2 receivable in an opening of a stabilisation device provided in the main panel 12; 112; 212, 312; 412. The at least one stabilisation peg P1, P2 constrains movement of the plurality of connected blanks 1; 101, 301; 401 with respect to the applicator AP; 620.

The at least one stabilisation peg P1, P2 prevents or inhibits movement of the plurality of connected blanks 1 with respect to the articles B in a direction parallel with the direction of flow of the plurality of connected blanks 1 through the packaging apparatus and in a lateral direction perpendicular with respect to the direction of flow of the plurality of connected blanks 1 through the packaging apparatus.

The stabilisation peg P1, P2 may be detachably or removably mounted to the applicator AP; 620. The stabilisation peg P1, P2 may be coded or keyed to a specific mounting location or orientation.

The applicator AP; 620 comprises at least one disconnecting or separating device for breaking the frangible connections 13; 113, 115; 313, 315; 415 between adjacently disposed blanks 10A-B; 110A-D; 310A-F, 410A-C.

The disconnecting or separating device may comprise one or more blades CE1, CE2, CE3, CE4, BL, BL2, BL3 arranged to avoid collision with the articles being packaged. The blades may be mounted to a common body in a spaced apart configuration. The blades be arranged to be received in gaps or voids between two or more articles B, the articles B being generally cylindrical in shape. The frangible connections 13; 113, 115; 313, 315; 415 may comprise connecting nicks or bridging portions N, N1, N2, N3, N4, N5, N6, N7, N8, N9, N10 in vertical registry with the gaps or voids between two or more articles B. The connecting nicks or bridging portions N, N1, N2, N3, N4, N5, N6, N7, N8,

N9, N10 may be arranged in pairs disposed on substantially opposing sides of a region of closest proximity between an article B in a first blank and an article B in a second connected blank.

The blades BL, BL2, BL3 may be detachably or removably mounted to the applicator AP; 620 such that the arrangement of the blades BL, BL2, BL3 is reconfigurable depending upon the arrangement and/or size of the blanks being applied to the articles B.

The present disclosure also provides a disconnecting apparatus CT for separating a plurality of connected article carriers into discrete carriers. The disconnecting apparatus CT may comprise a plurality of article receiving orifices each for receiving a respective article B of the group. The disconnecting apparatus CT may comprise at least one blades BL, BL2, BL3 detachably or removably mounted thereto such that the arrangement of the blades BL, BL2, BL3 is reconfigurable depending upon the arrangement and/or size of the blanks being applied to the articles B.

The blade BL may be supported in a direction transverse by a support SP or supplementary blade BL2, the blade and the support SP or supplementary blade BL2 each comprising receiver in the form of recess or slot for receiving a portion of the other.

The present disclosure provides a method of packaging a plurality of articles B. The method comprises conveying a stream of articles B in a downstream direction through a packaging apparatus, engaging each article B with an article engaging tool 632A, 632B, 634, grouping a plurality of articles B, and simultaneously applying a plurality of connected blanks 1 to upper ends of the articles B. The method comprises engaging at least one leading registration edge of the blank plurality of connected blanks 1 with a reference pin 640 mounted to a leading article engaging tool 632A, 632B, 634. The method comprises metering the group of articles B and engaging a reference pin 640 mounted to a trailing article engaging tool 632A, 632B, 634 with at least one trailing registration edge of the plurality of connected blanks 1.

The method further comprises separating the plurality of connected blanks 1 into discrete blanks 10A, 10B and applying the discrete blanks 10A, 10B simultaneously to respective groups of articles B. Separating the plurality of connected blanks 1 comprises inserting a stabilising peg P1, P2 in an opening of a stabilisation device provided in the main panel 12 prior to severing a frangible connection between pairs of blanks 10A, 10B.

The blanks 10A-B; 110A-D; 210; 310A-F, 410A-C include at least a paperboard substrate. The material of the paperboard substrate may be selected from any conventional paperboard, for example, ranging in weight upwardly from about 10pt., preferably from about 16pt. to about 28pt. (0.028"/~0.7mm). An example of such a substrate is a 27 point (pt.) SBS board (solid bleached sulphate paperboard coated on one side, trade name PrintKote®) or CNK® board (Coated Natural Kraft® -an unbleached kraft paperboard having a clay coating on one side, trade name CarrierKote™) manufactured by WestRock® Company. The paperboard substrate may be a bleached or unbleached board. The board may be coated on at least one side, optionally the side opposite the lamination, with a conventional coating selected for compatibility with the printing method and board composition.

The blanks 10A-B; 110A-D; 210; 310A-F, 410A-C may include a tear resistant layer laminated to the paperboard layer. It optionally includes an adhesive layer between the paperboard substrate and the tear resistant layer. The tear

resistant layer may be disposed over the uncoated side of the paperboard substrate and may be formed of polymeric material and secured to the substrate. The tear resistant layer imparts toughness to the laminate structure. Suitable tear resistant materials may include, but not be limited to, tear resistant laminated sheet material, e.g., NATRALOCK®, which may include a layer of an n-axially oriented film, e.g., MYLAR®, which is a bi-axially oriented polyester, oriented nylon, cross-laminated polyolefin or high-density polyolefin. The orientation and cross-laminated structure of these materials contribute to the tear resistant characteristic. Also, tear resistance may be attributed to the chemical nature of the tear resistant material such as extruded metallocene-catalysed polyethylene (mPE).

Alternatively, the tear resistant layer may be a layer of linear low-density polyethylene (LLDPE). In embodiments where linear low-density polyethylene (LLDPE) or mPE is used, it is not necessary to incorporate an adhesive layer. Other suitable materials having a high level of tear resistance may also be used.

The adhesive layer may be formed of polyolefin material such as a low-density polyethylene (LDPE). The adhesive layer may be placed between the substrate and the tear resistant layer to secure the tear resistant layer to the substrate.

It can be appreciated that various changes may be made within the scope of the present invention. For example, the size and shape of the panels and apertures may be adjusted to accommodate articles of differing size or shape. The shoulder panels may be omitted. The present invention is not limited to cartons of the top-engaging type, the invention may be employed with other carton styles such as, but not limited to, open top crates, lidded or closed top crates.

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

As used herein, the terms “hinged connection” and “fold line” refer to all manner of lines that define hinge features of the blank, facilitate folding portions of the blank with respect to one another, or otherwise indicate optimal panel folding locations for the blank. Any reference to “hinged connection” should not be construed as necessarily referring to a single fold line only; indeed, a hinged connection can be formed from two or more fold lines wherein each of the two or more fold lines may be either straight/linear or curved/curvilinear in shape. When linear fold lines form a hinged connection, they may be disposed parallel with each other or be slightly angled with respect to each other. When curvilinear fold lines form a hinged connection, they may intersect each other to define a shaped panel within the area surrounded by the curvilinear fold lines. A typical example of such a hinged connection may comprise a pair of arched or arcuate fold lines intersecting at two points such that they define an elliptical panel therebetween. A hinged connection may be formed from one or more linear fold lines and one or more curvilinear fold lines. A typical example of such a hinged connection may comprise a combination of a linear fold line and an arched or arcuate fold line which intersect at two points such that they define a half moon-shaped panel therebetween.

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

It should be understood that hinged connections and fold lines can each include elements that are formed in the substrate of the blank including perforations, a line of perforations, a line of short slits, a line of half-cuts, a single half-cut, a cutline, an interrupted cutline, slits, scores, embossed lines, debossed lines, any combination thereof, and the like. The elements can be dimensioned and arranged to provide the desired functionality. For example, a line of perforations can be dimensioned or designed with degrees of weakness to define a fold line and/or a severance line. The line of perforations can be designed to facilitate folding and resist breaking, to facilitate folding and facilitate breaking with more effort, or to facilitate breaking with little effort.

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

CLAIMS

1. An applicator device for separating a plurality of connected blanks into discrete blanks and pressing each a blank onto two or more groups of articles, the applicator comprises a plurality of article receiving orifices each for receiving a respective article and a disconnecting device for breaking frangible connections between adjacently disposed blanks.
2. An applicator device according to claim 1, wherein the applicator comprises at least one stabilisation peg receivable in an opening of a stabilisation device provided in a main panel of each blank, the at least one stabilisation peg being configured to constrain movement of said blank with respect to the applicator.
3. An applicator device according to claim 2, wherein the at least one stabilisation peg is detachably mounted to a plate in which the article receiving orifices are provided.
4. An applicator device according to claim 3, wherein the at least one stabilisation peg is keyed to a given receiving location on the plate.
5. An applicator device according to claim 3, wherein the at least one stabilisation peg is keyed to a given receiving orientation with respect to the plate.
6. An applicator device according to claim 1, wherein the applicator comprises a plate and at least one guide depending therefrom for retaining the groups of articles in a predefined arrangement.
7. An applicator device according to claim 1, wherein the disconnecting device comprises one or more blades mounted to a plate in which the article receiving orifices are provided.
8. An applicator device according to claim 7, wherein the one or more blades is detachably mounted to the plate.
9. An applicator device according to claim 8, wherein the one or more blades comprises at least one detent for engaging a catch in a slot provided in the plate.
10. An applicator device according to claim 7, wherein the plate comprises one or more release openings for enabling release of the detent from the catch.
11. An applicator device according to claim 8, wherein the plate comprises plurality of blade receiving locations and a plurality of blades that can be reconfigured a desired arrangement to accommodate a given configuration of connected blanks.
12. A disconnecting apparatus for separating a plurality of connected article carriers engaged with groups of articles, the disconnecting apparatus comprises a plate having a plurality of article receiving orifices each for receiving a respective article and a plurality of blade receiving locations each capable of detachably mounting a disconnecting blade for breaking frangible connections between adjacently disposed carriers, and a plurality of blades is detachably mounted to the plate, the plurality of blades being reconfigurable to a desired arrangement to accommodate a given configuration of connected carriers.

13. A disconnecting apparatus according to claim 12, wherein the plurality of blades is mountable to the plate in first arrangement to separate a first configuration of connected carriers and is mountable to the plate in second, different, arrangement to separate a second, different, configuration of connected carriers.
14. A plurality of connected blanks for forming a plurality of article carriers, each blank being frangibly connected to at least one adjacent blank by a frangible connection comprising at least one pair of connecting nicks, each blank comprising an engaging panel having at least one article retention device for receiving and suspending an article therefrom, wherein an first article retention device in a first blank and a second article retention device in a second blank define a notional line passing through the centre of each of the first and second article retention devices, the notional line being perpendicular to a frangible connection between the first and second blank, and wherein a pair of connecting nicks are disposed on opposing sides of the notional line, the notional line defining a region of closest proximity between the first and second article retention devices.
15. An apparatus for packaging one or more articles in an article carrier, the apparatus comprises an article engagement tool for engaging an article and conveying the article in a downstream direction, the article engagement tool comprises a reference device for aligning a plurality of connected blanks with two or more groups of articles.
16. An apparatus according to claim 15, wherein the apparatus comprises an applicator for separating the plurality of connected blanks into discrete blanks and pressing each a blank onto the two or more groups of articles, the applicator comprises a plurality of article receiving orifices each for receiving a respective article and a disconnecting device for breaking frangible connections between adjacently disposed blanks.
17. An apparatus according to claim 16, wherein the applicator comprises at least one stabilisation peg receivable in an opening of a stabilisation device provided in a main panel of each blank, the at least one stabilisation peg being configured to constrain movement of said blanks with respect to the applicator.
18. An apparatus according to claim 17, wherein the at least one stabilisation peg prevents or inhibits movement of the blanks with respect to the group of articles in a direction parallel with the direction of flow of the blanks through the apparatus and in a lateral direction perpendicular with respect to the direction of flow of the blanks through the apparatus.
19. An apparatus according to claim 16, wherein the applicator is mounted to an overhead conveyor, in the form of a wheel, such that the applicator applies the blanks to the groups of articles as it is conveyed downstream by the plurality of article engagement tools.
20. An apparatus according to claim 15, wherein the apparatus comprises an overhead conveyor for conveying the plurality of connected blanks onto the one or more articles.
21. An apparatus according to claim 15, wherein the reference device comprises an abutment pin extending upwardly from the article engagement tool beyond the upper extremity of the one or more articles.

22. An apparatus according to claim 15, wherein the article engagement tool comprises a removable head to which the reference device is mounted.
23. An apparatus according to claim 22, wherein the head comprises part of a tool-less attachment system.
24. An apparatus according to claim 23, wherein the tool-less attachment system comprises a bayonet fitting.
25. An apparatus according to claim 15, wherein the apparatus comprises a plurality of article engagement tools each for engaging a respective article, metering and grouping the articles and conveying said articles in a downstream direction as metered groups.
26. An apparatus according to claim 25, wherein each of the plurality of article engagement tools is driven independently about an endless track having a working reach and a return reach.
27. An apparatus according to claim 25, wherein the plurality of article engagement tools comprises at least one leading article engagement tool and at least one trailing article engagement tool.
28. An apparatus according to claim 27, wherein the at least one leading article engagement tool is configured to engage a respective leading registration edge of a blank.
29. An apparatus according to claim 27, wherein the at least one trailing article engagement tool is configured to engage a respective trailing registration edge of the blank.
30. A method of packaging a plurality of articles, the method comprising:

forming at least two groups of articles,

applying a plurality of connected blanks to upper ends of the articles;

engaging reference pins with the plurality of connected blanks and aligning the plurality of connected blanks to the articles;

lowering an applicator with respect to the articles and the plurality of connected blanks so as to insert a stabilisation pin in an opening in each of the blanks;

further lowering the applicator to cleave through frangible connections between adjacently disposed blanks;

bringing a plate of the applicator into contact with each of the discrete blanks;

lowering the applicator further to press the discrete blanks over upper ends of the articles and displacing engaging tabs upwardly out of the plane of the blanks until the tabs engage a flange about the upper ends of the articles.

31. A method of packaging a plurality of articles, the method comprising:

conveying a stream of articles in a downstream direction through a packaging apparatus;

engaging each article with an article engagement tool;

grouping a plurality of groups of articles, and simultaneously

applying a plurality of connected blanks to upper ends of the articles;

engaging at least one leading registration edge of the blank with a reference pin mounted to a leading article engagement tool;

metering the groups of articles; and

engaging a reference pin mounted to a trailing article engagement tool with at least one trailing registration edge of the plurality of connected blanks.

32. A method according to claim 31, wherein the method further comprises;

separating the plurality of connected blanks into discrete blanks and applying said discrete blanks to the groups of articles to engage each article in a respective article retention device provided in a main panel of the blanks.

33. A method according to claim 32, wherein applying the blanks to the groups of articles comprises;

inserting a stabilising peg in an opening of a stabilisation device provided in a main panel of each blank prior to separating the plurality of connected blanks into discrete blanks.

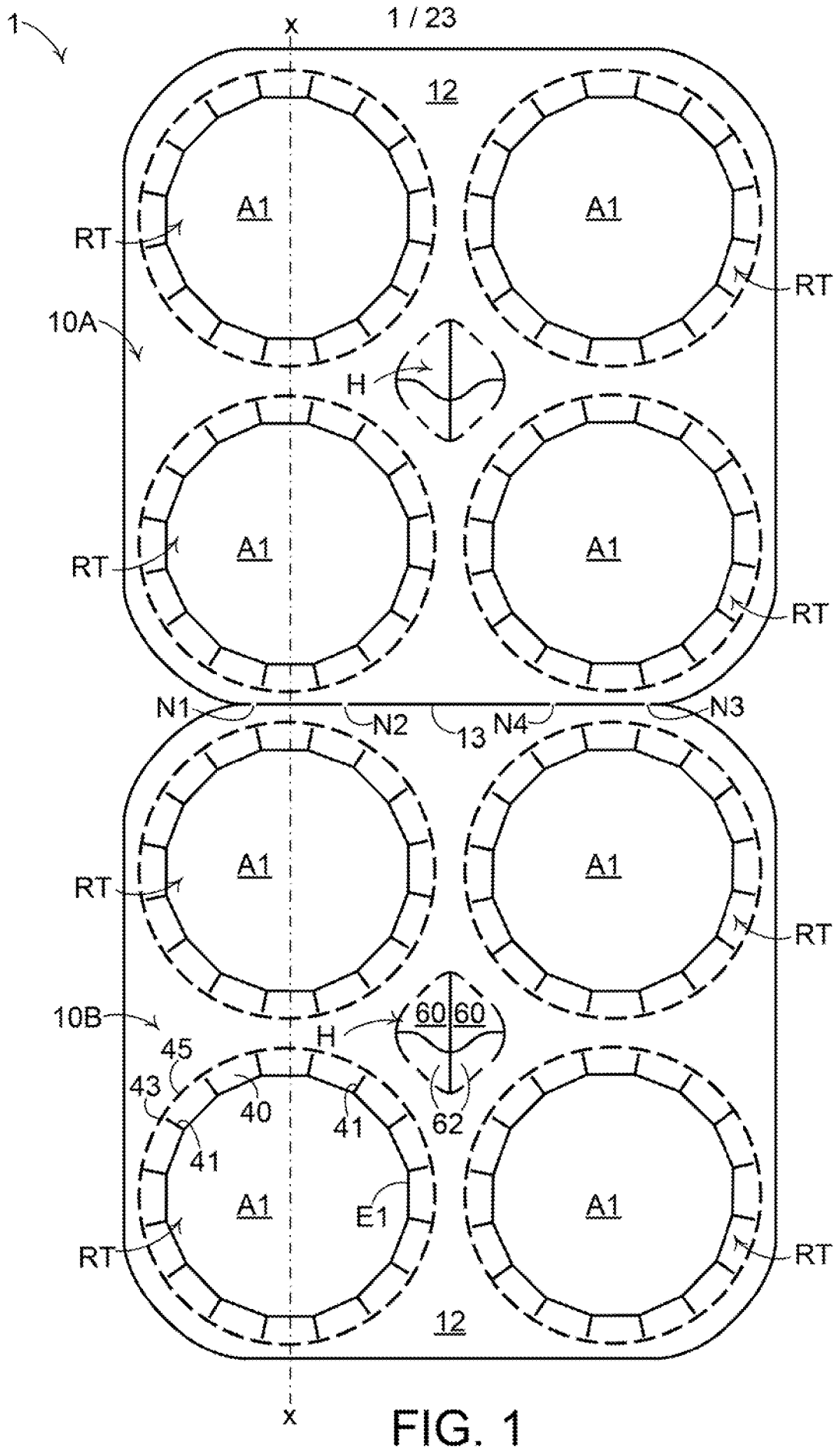


FIG. 1

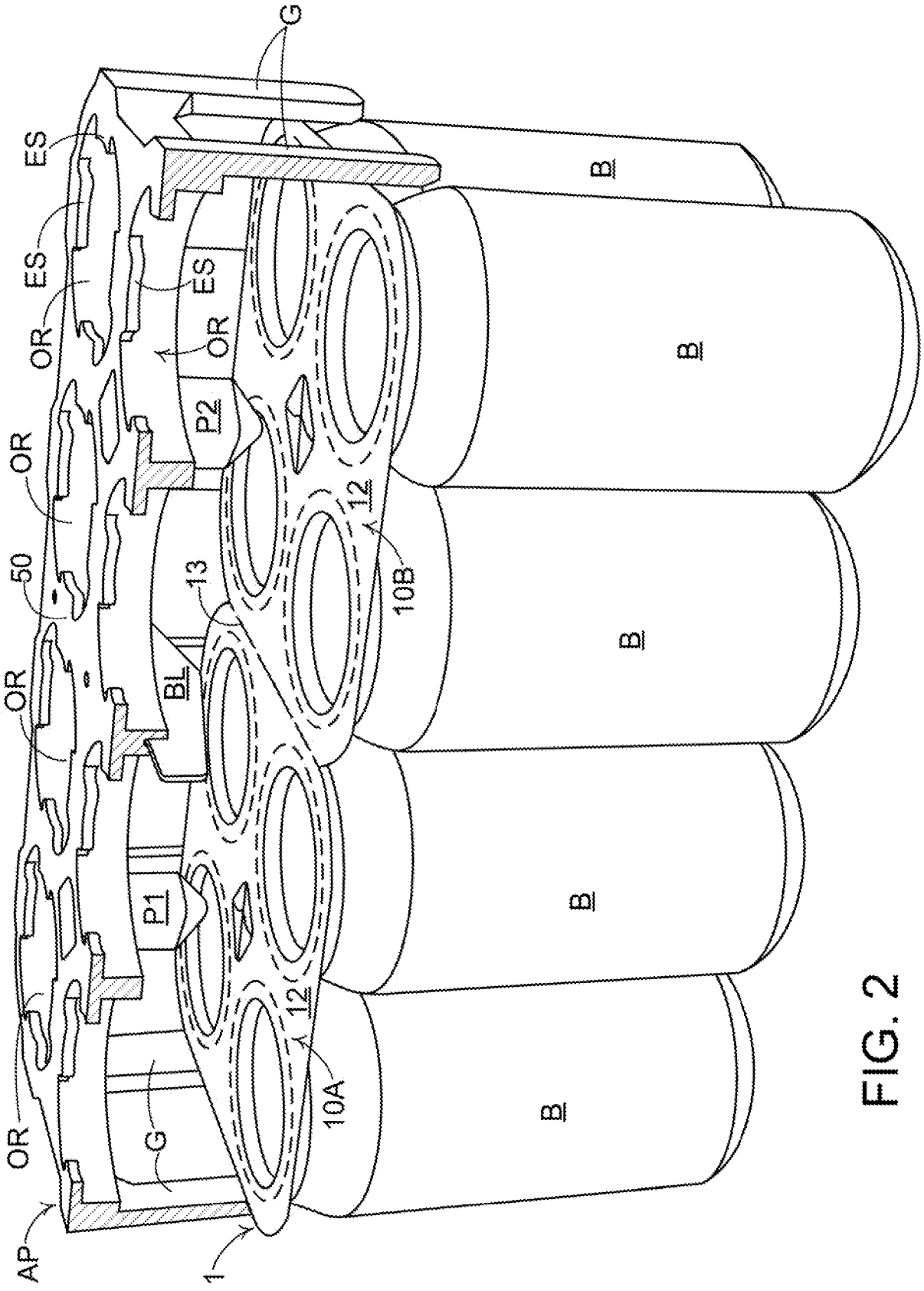


FIG. 2

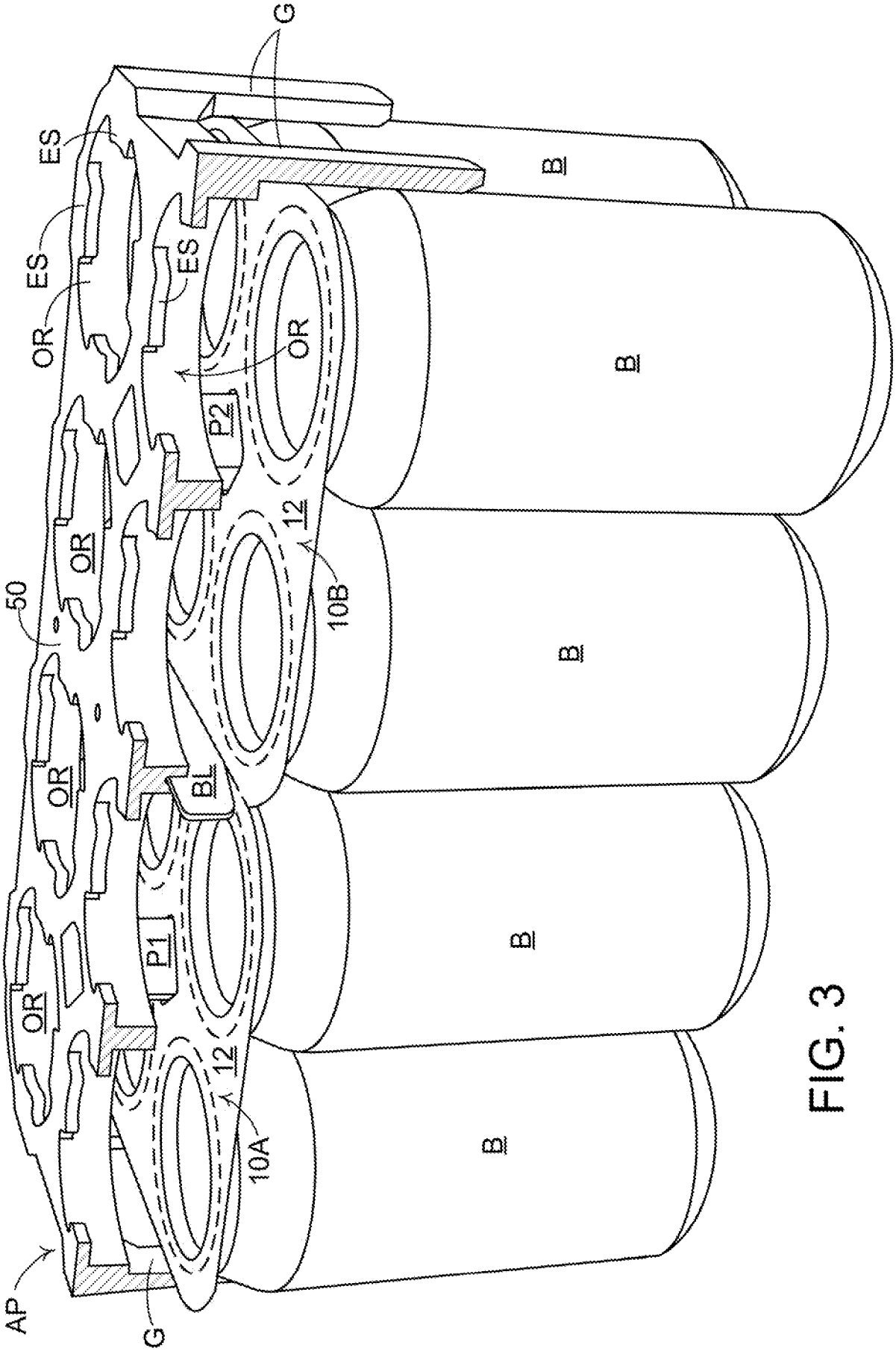


FIG. 3

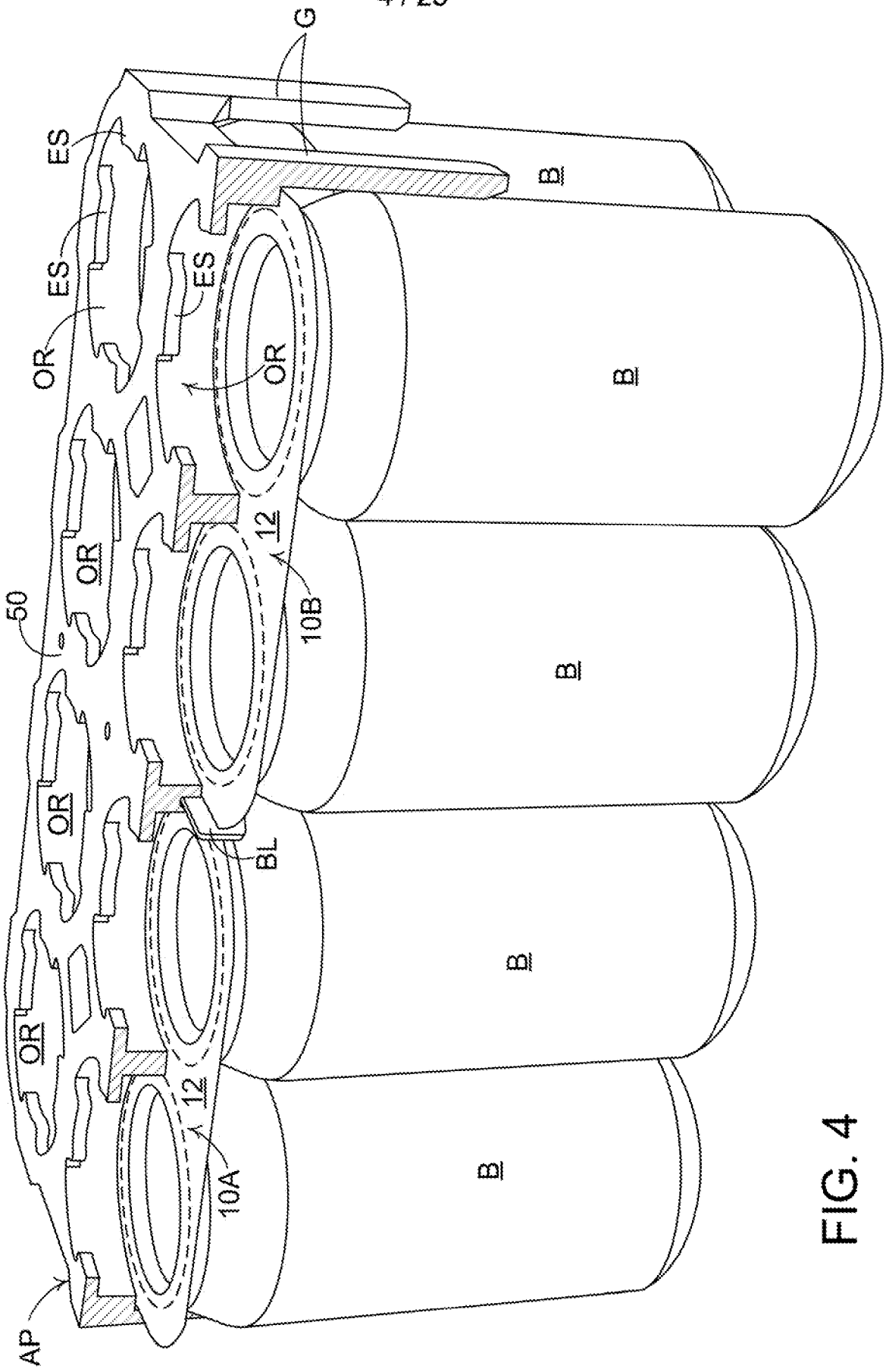


FIG. 4

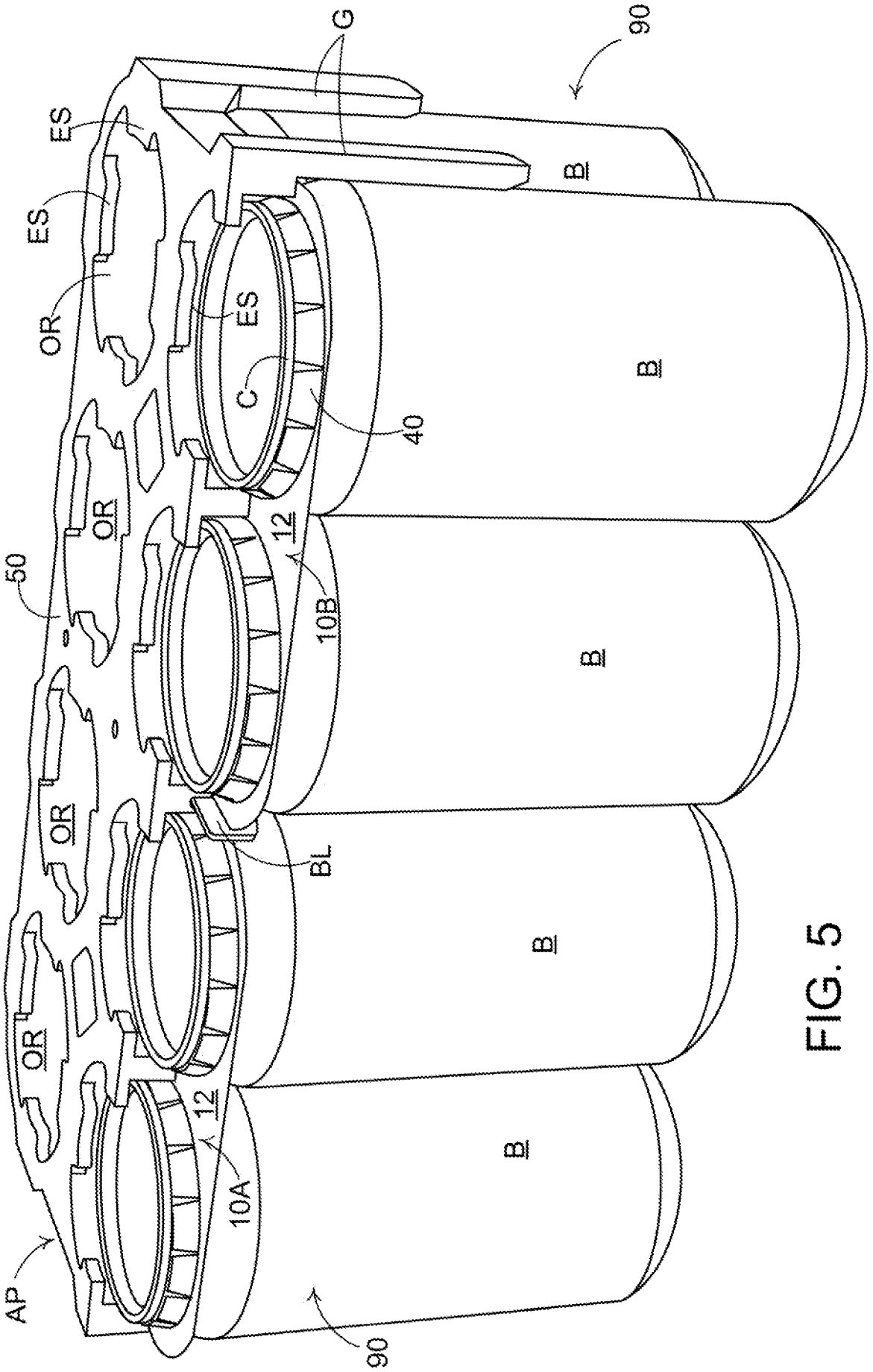


FIG. 5

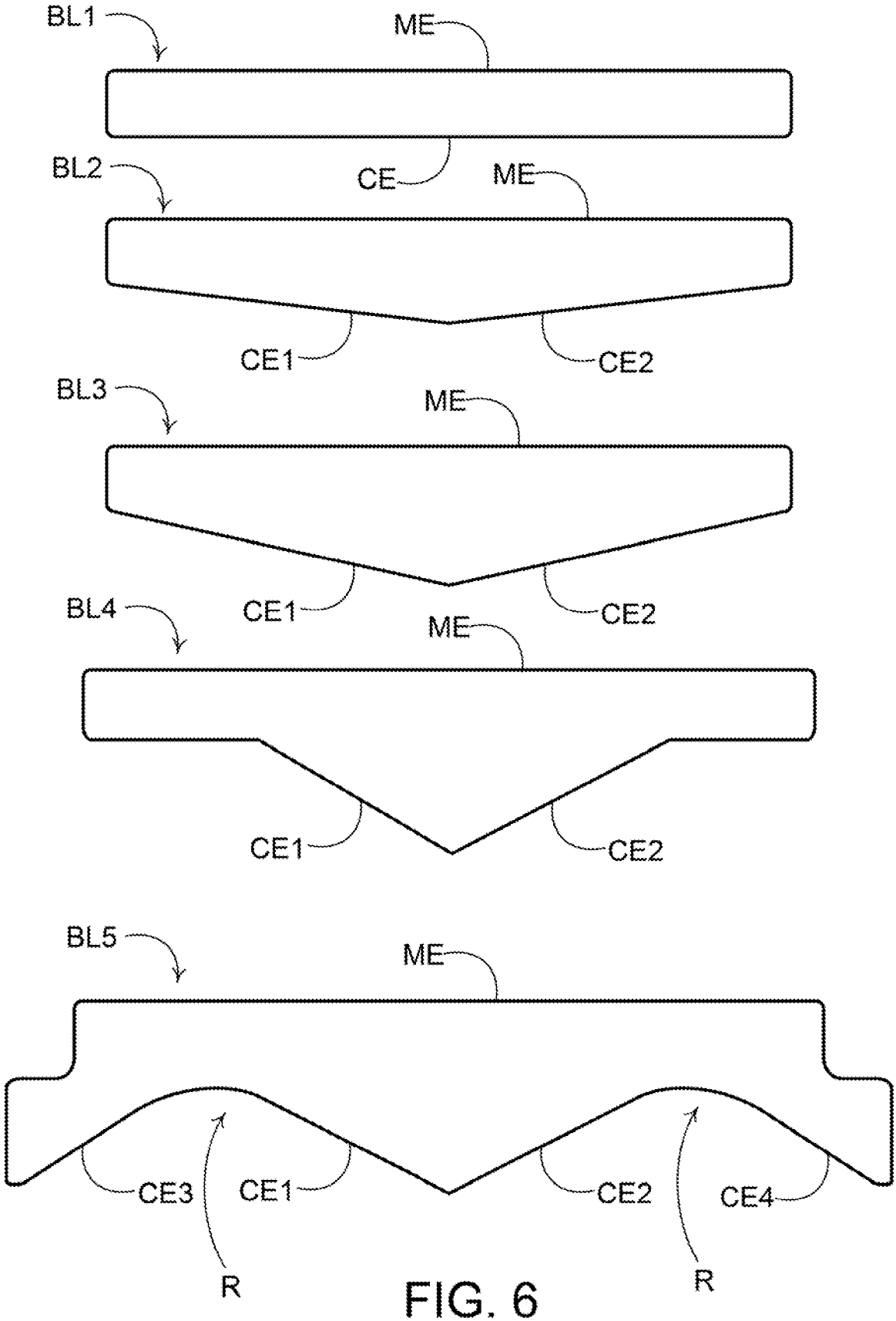

BL1
ME
BL2
CE
ME
CE1
CE2
BL3
ME
CE1
CE2
BL4
ME
CE1
CE2
BL5
ME
CE3
CE1
CE2
CE4
R
R

FIG. 6

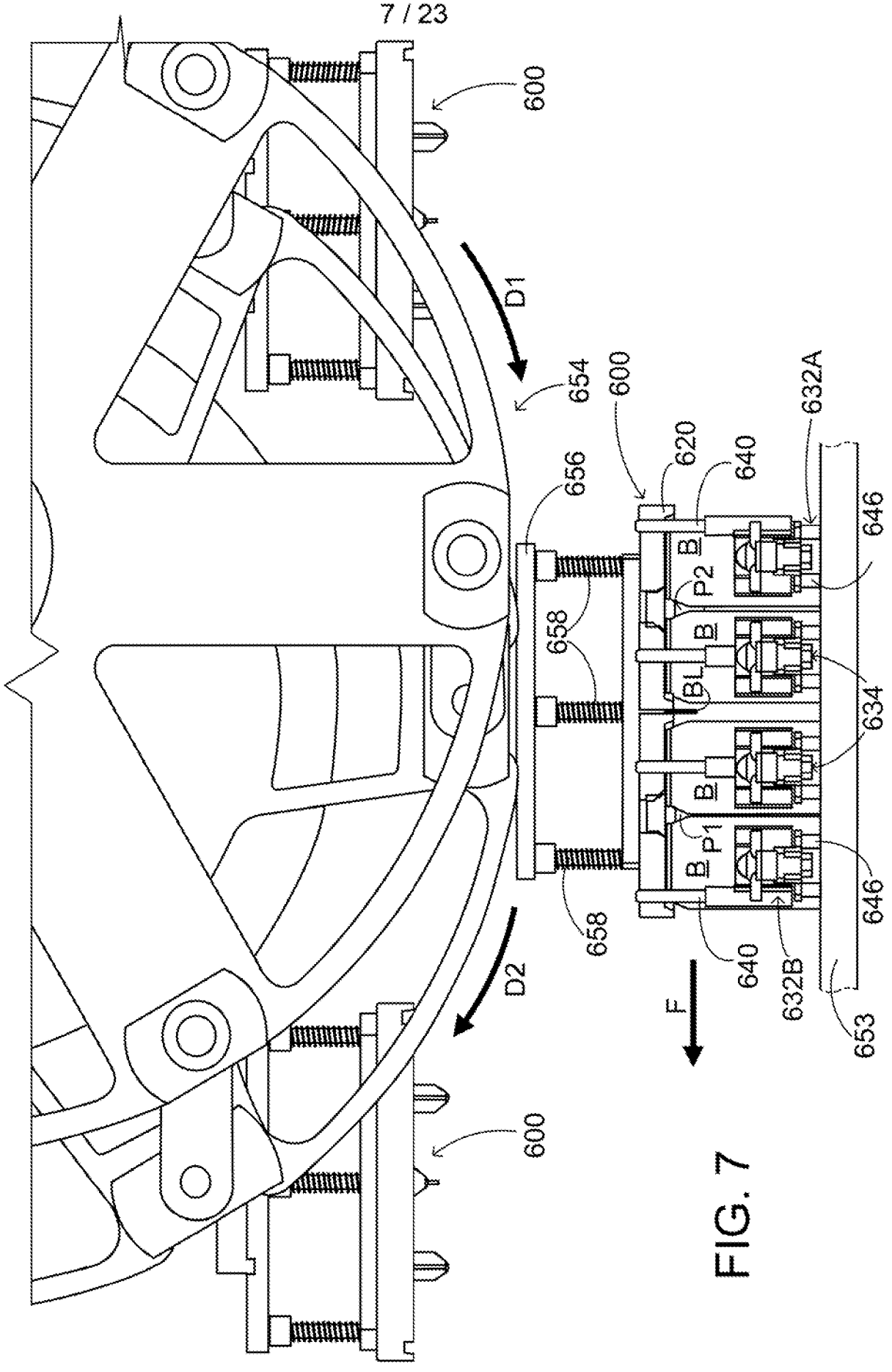

600
D1
654
600
632A
620
640
656
646
B
P2
658
B
BL
634
B
P1
B
646
658
640
632B
F
653
D2
600

FIG. 7

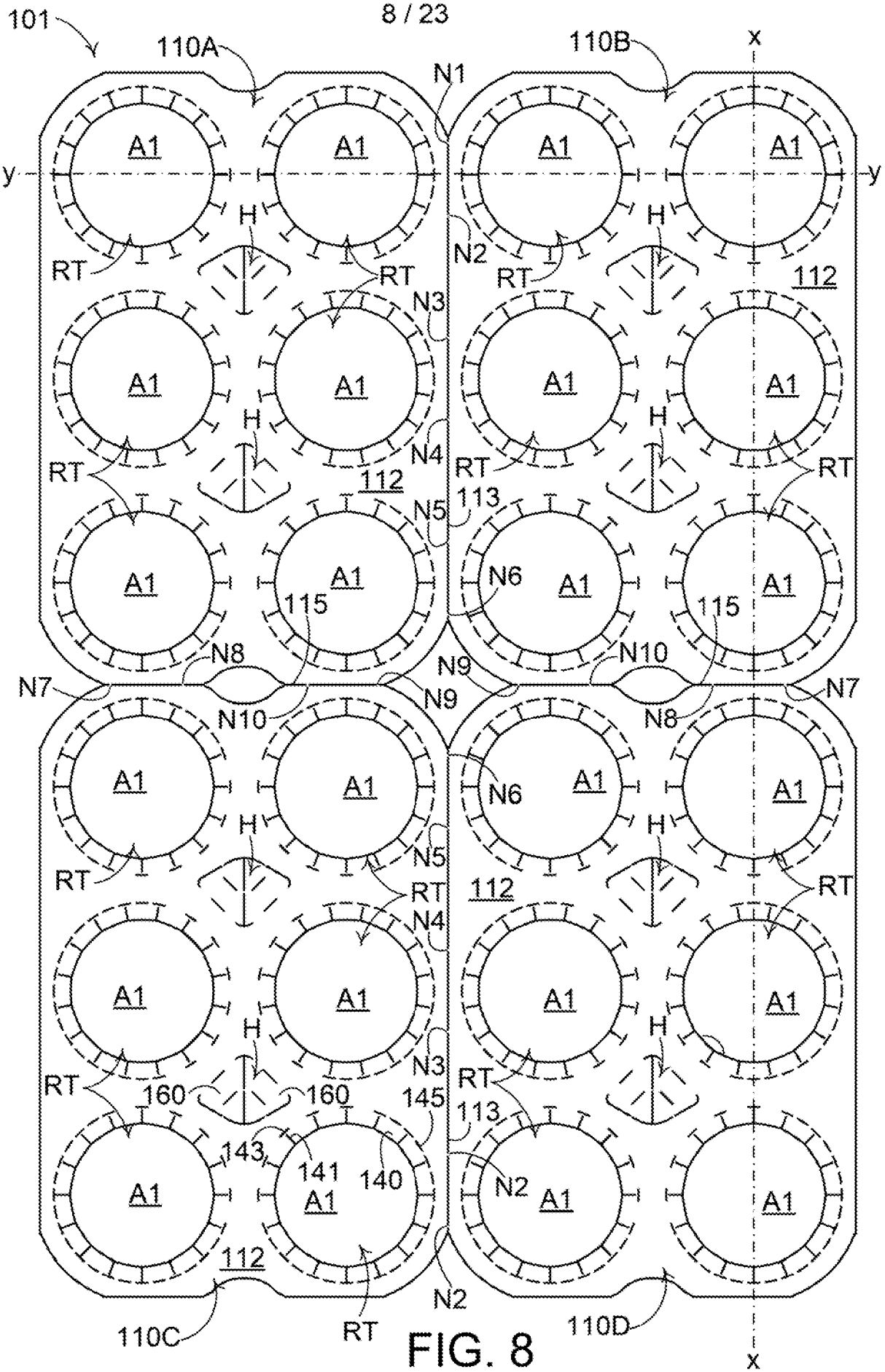

101
110A
110B
110C
110D
N1
N2
N3
N4
N5
N6
N7
N8
N9
N10
A1
H
RT
112
113
115
160
140
141
143
145
x
y

FIG. 8

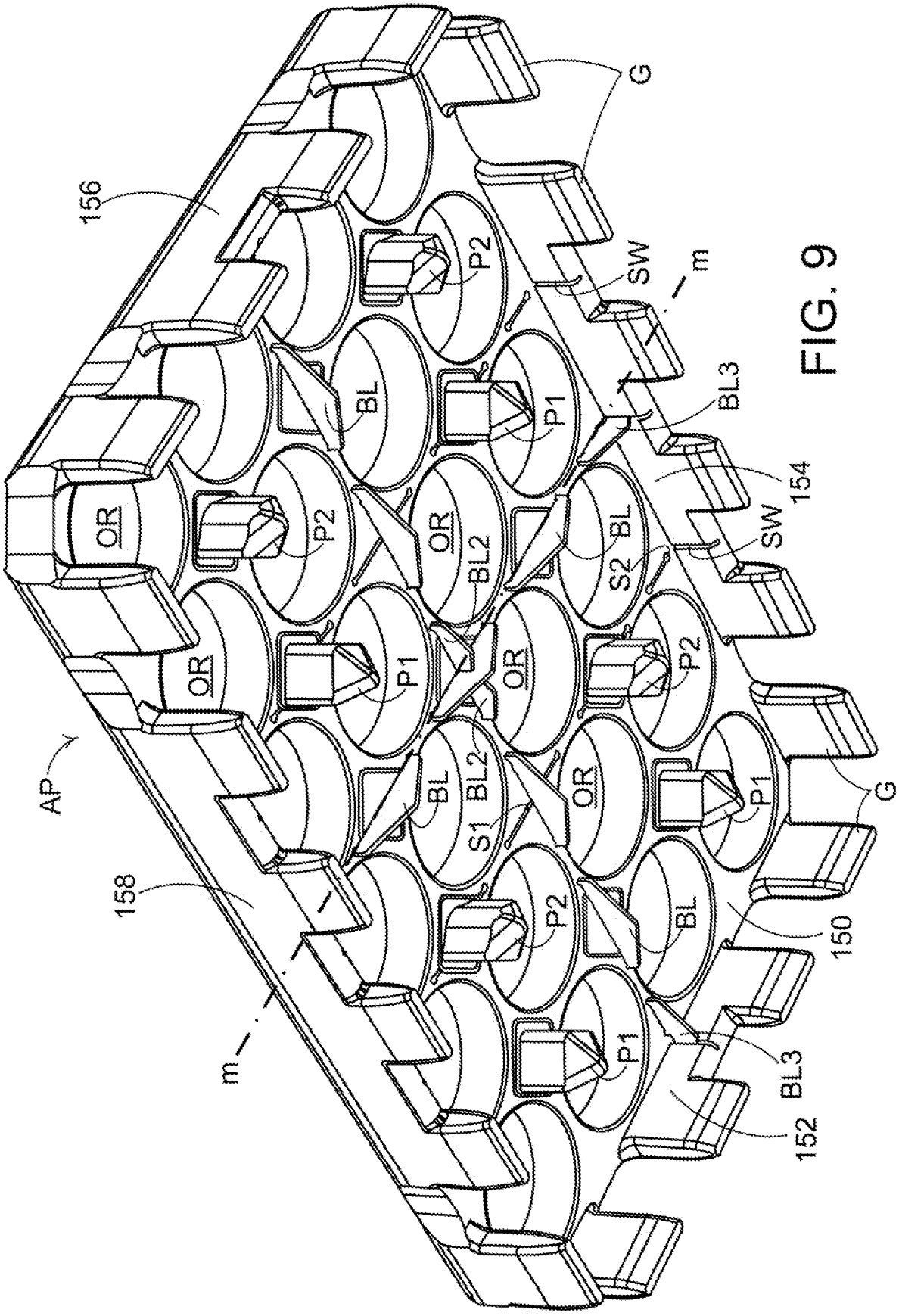

156
G
P2
SW
m
BL3
BL
P1
154
OR
P2
OR
BL2
S2
BL
SW
OR
P1
OR
P2
AP
BL
S1
BL2
OR
P1
G
158
P2
BL
150
m
P1
BL3
152

FIG. 9

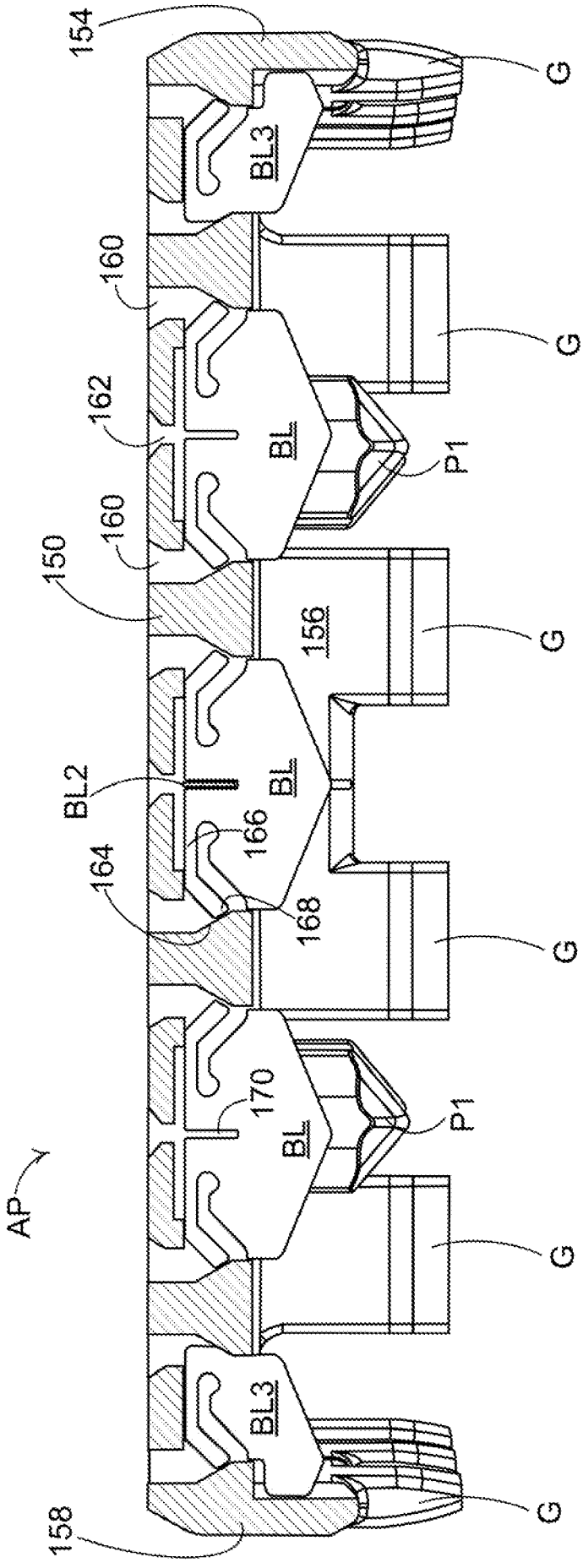

154
G
BL3
160
G
162
BL
P1
160
150
156
G
BL2
BL
166
164
168
G
170
BL
P1
AP
G
BL3
158
G

FIG. 10

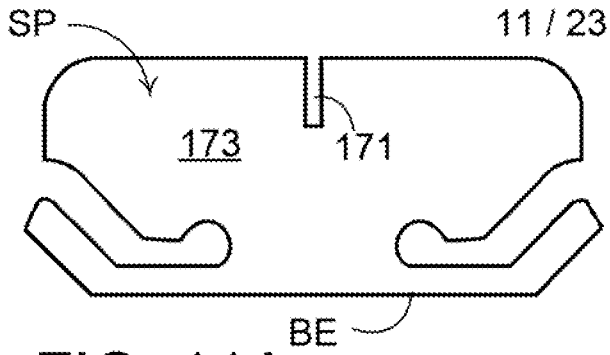


FIG. 11A

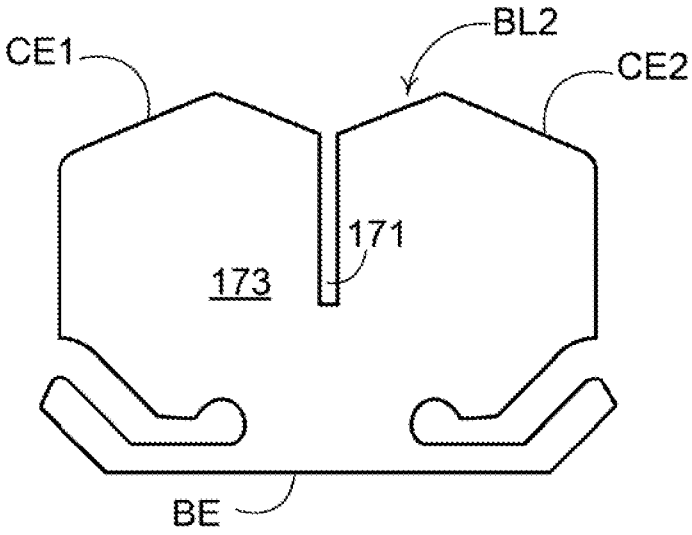


FIG. 11B

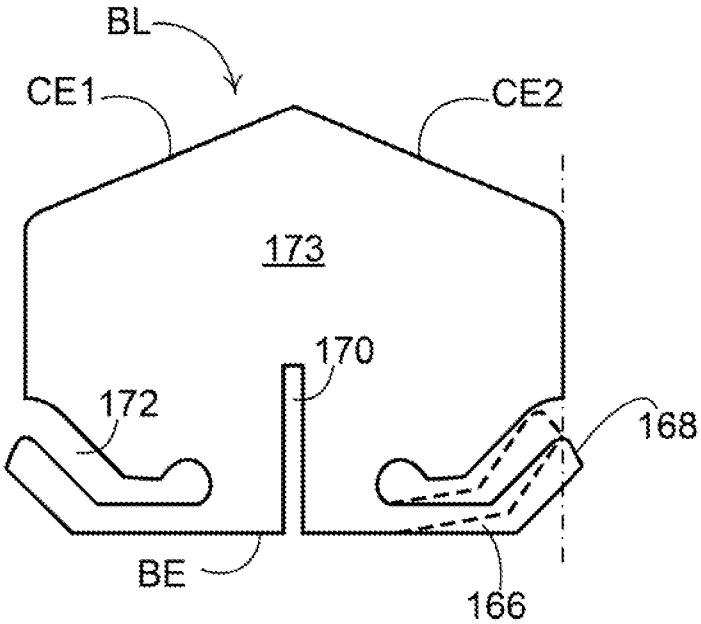


FIG. 11C

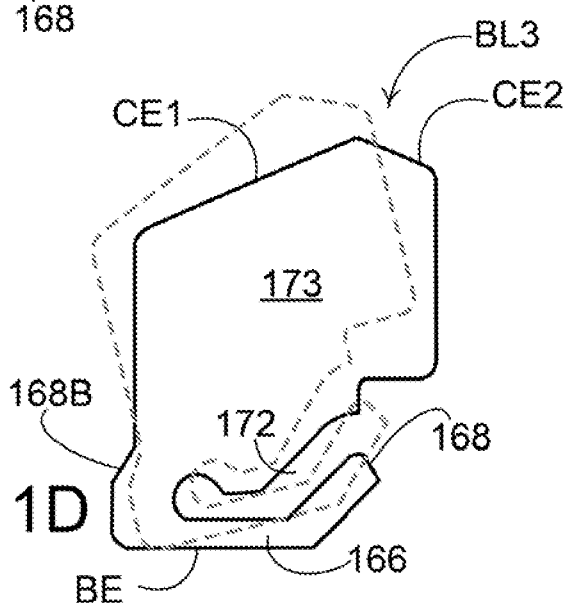


FIG. 11D

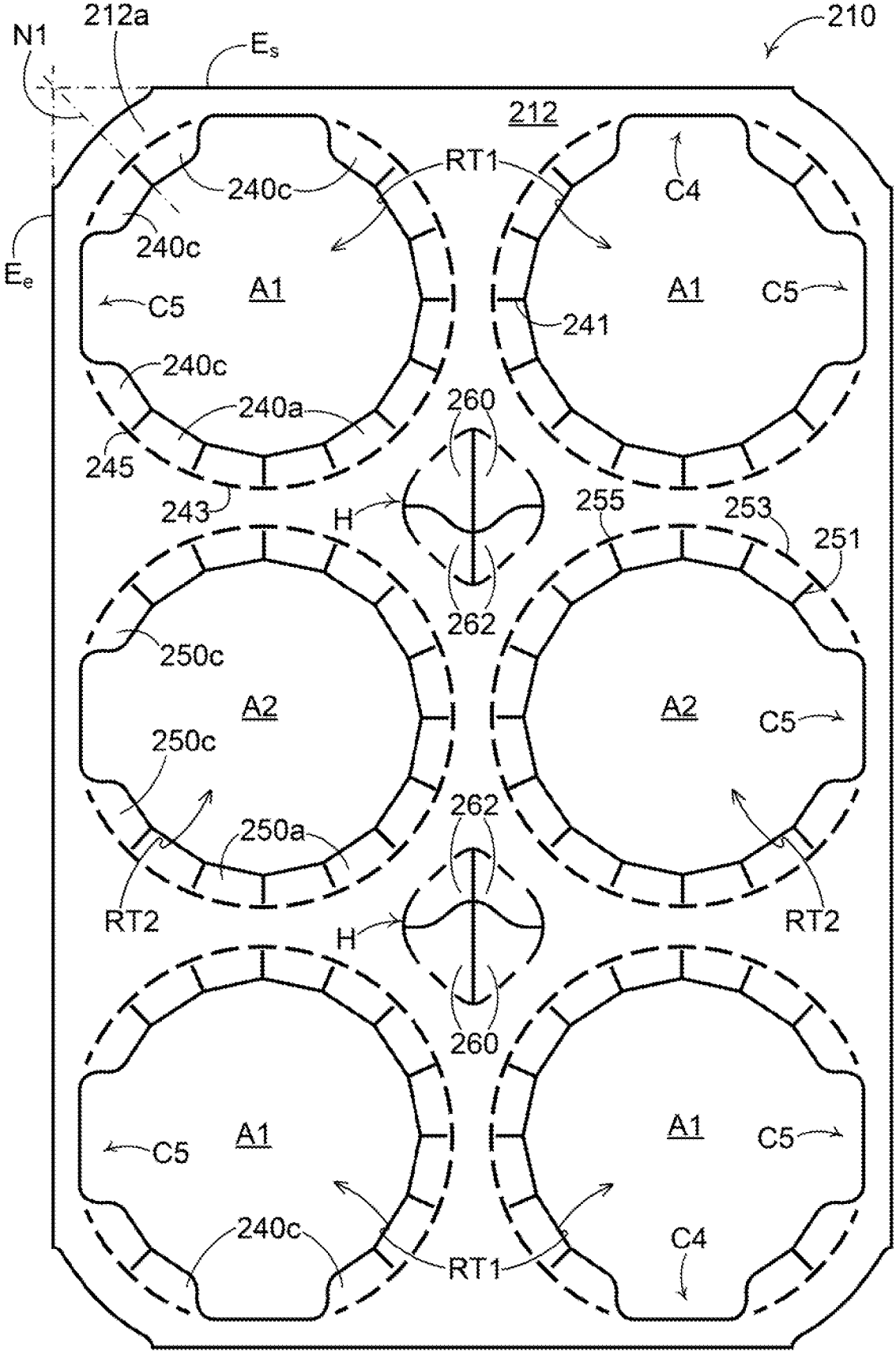

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212a
E_s
210
212
RT1
240c
C4
240c
E_e
A1
C5
A1
C5
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240c
240a
260
245
243
H
255
253
251
262
250c
A2
A2
C5
250c
262
250a
RT2
RT2
H
260
C5
A1
A1
C5
240c
RT1
C4

FIG. 12

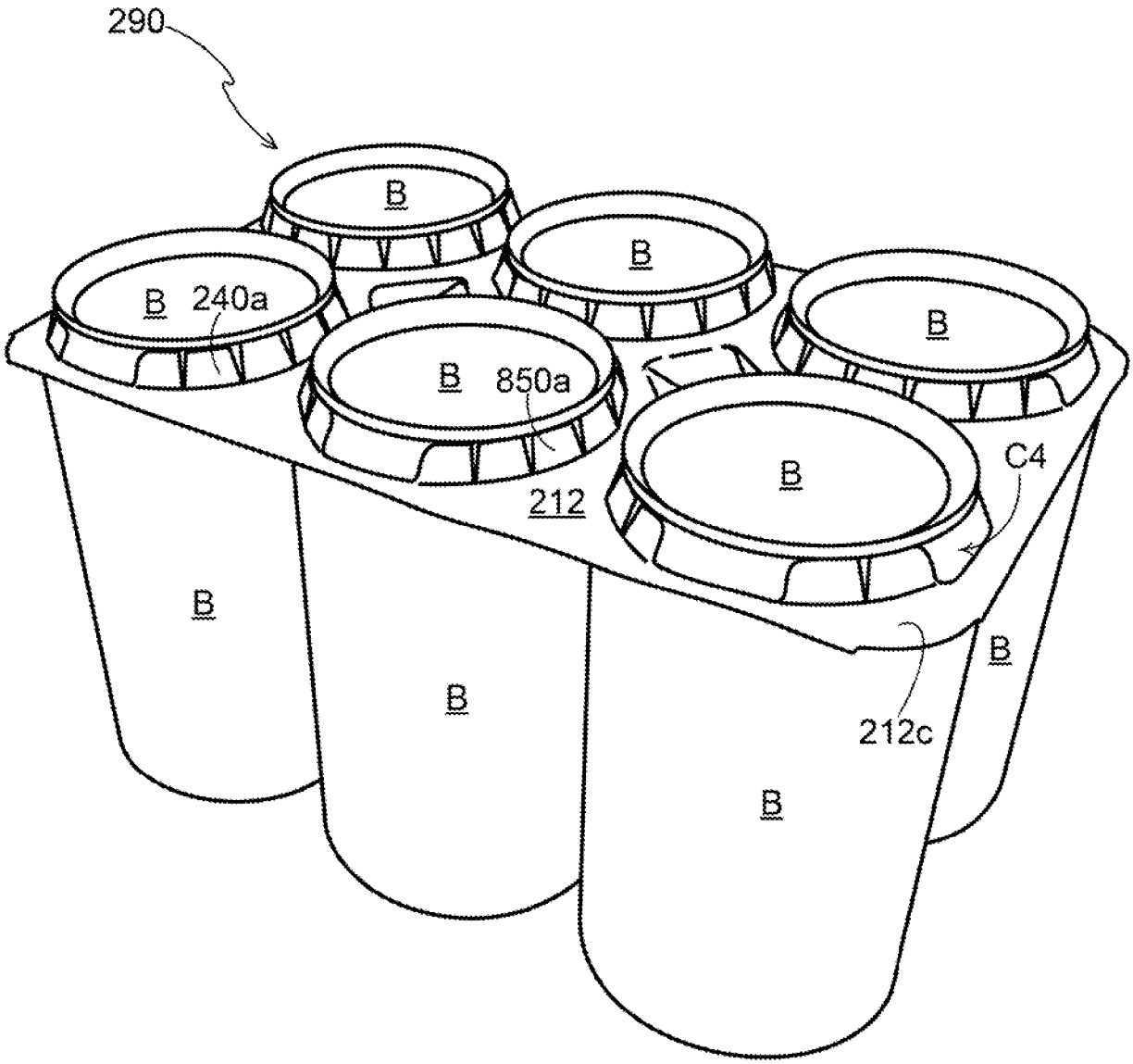


FIG. 13

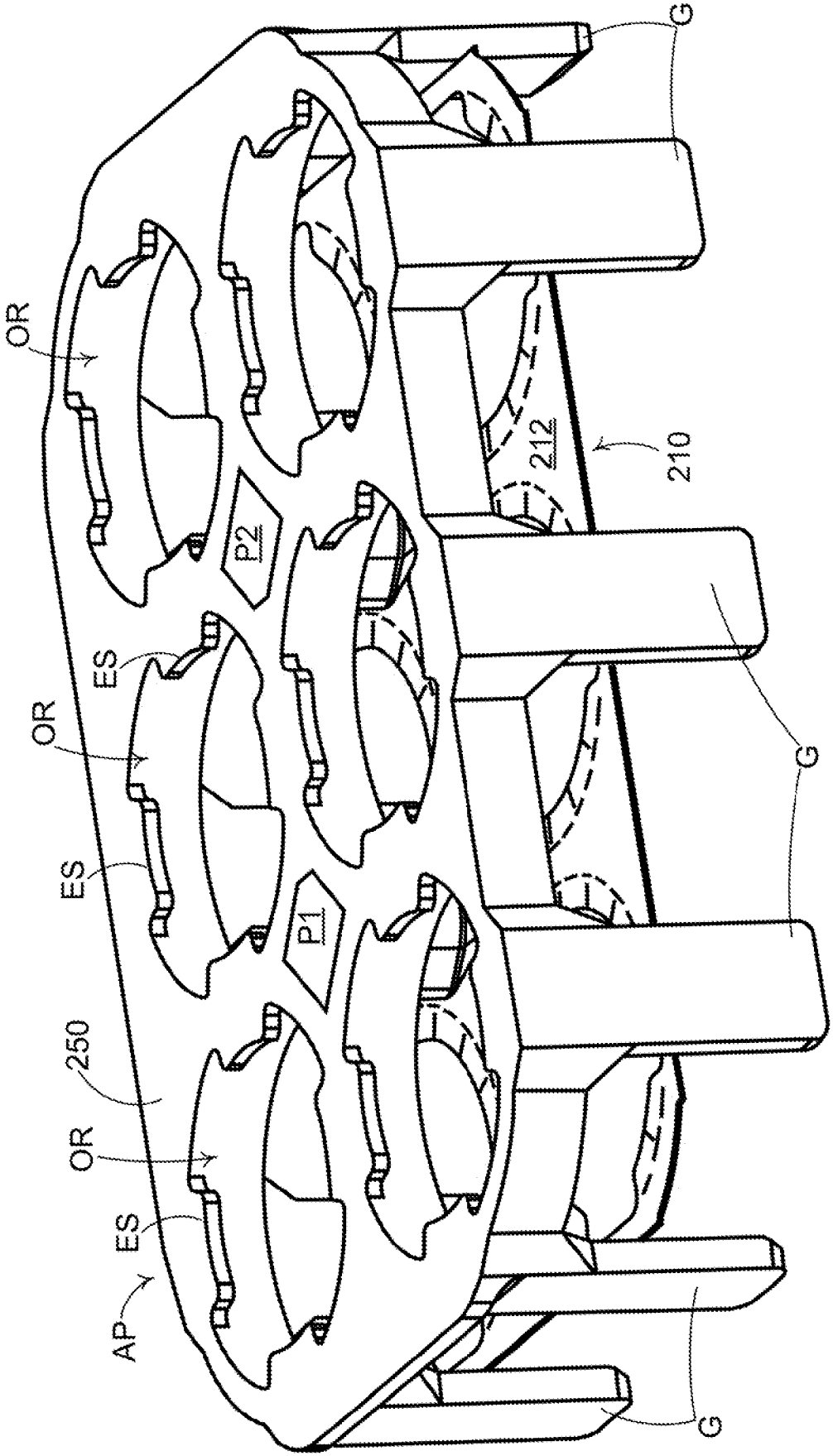


FIG. 14

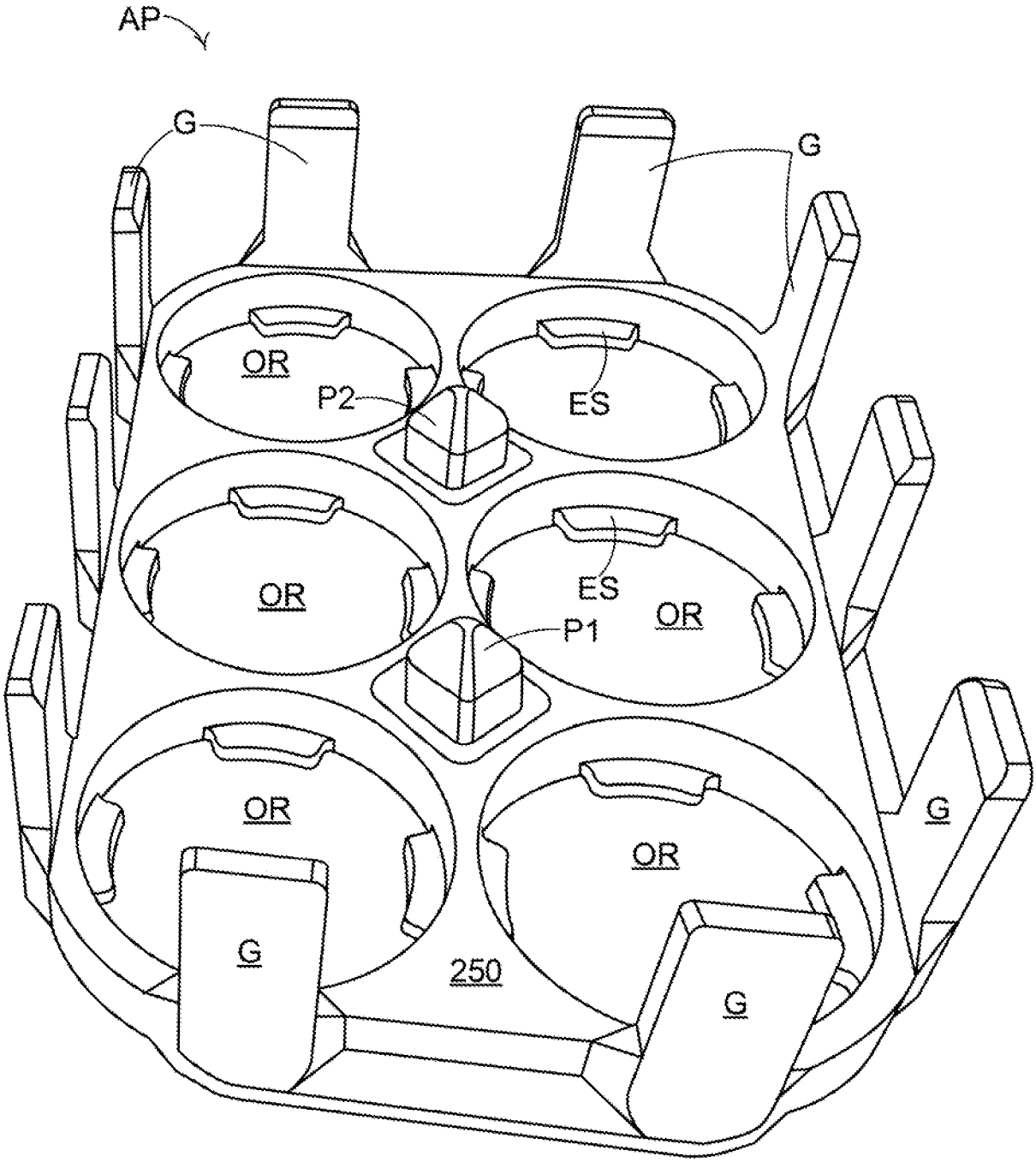


FIG. 14B

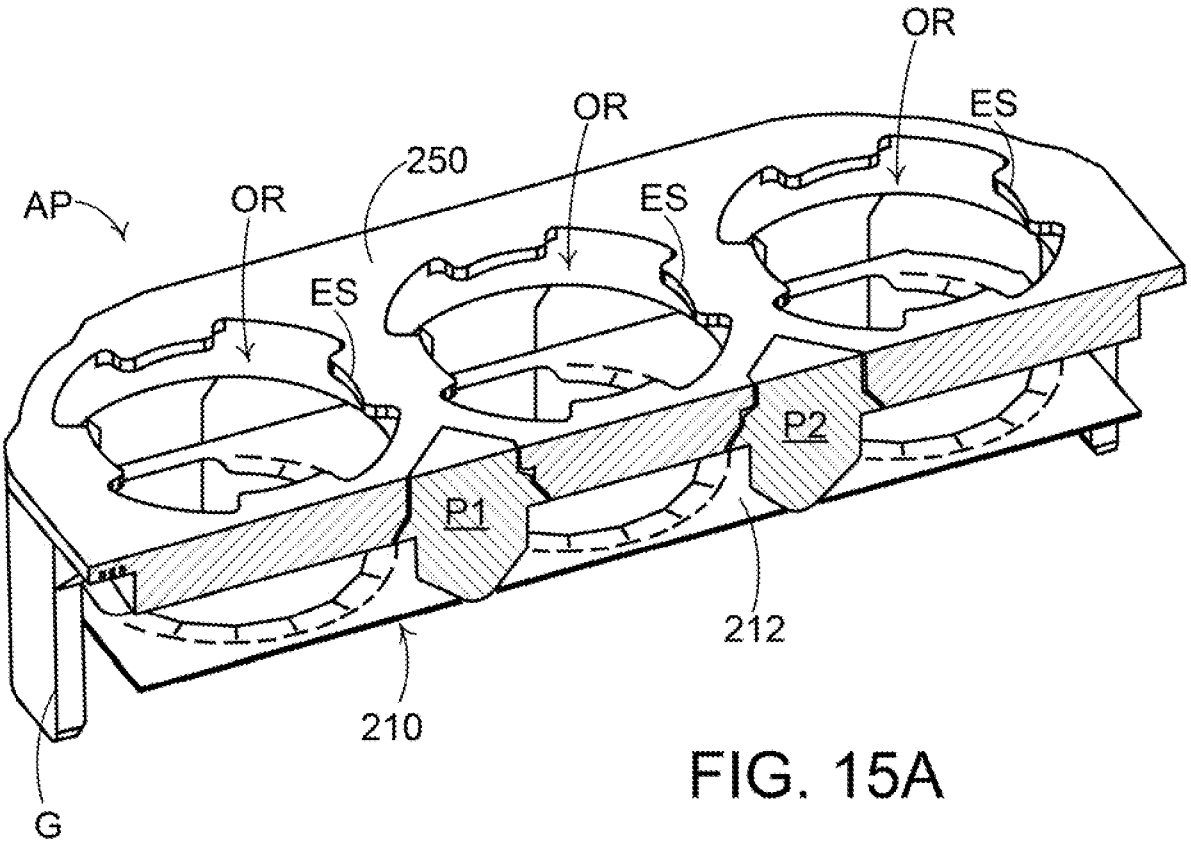


FIG. 15A

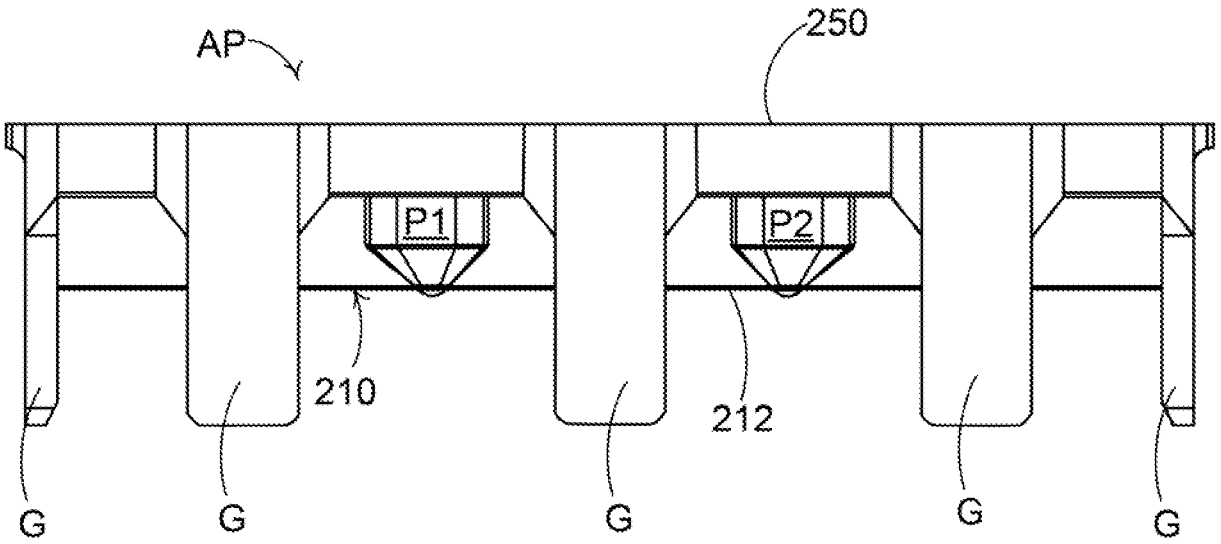


FIG. 15B

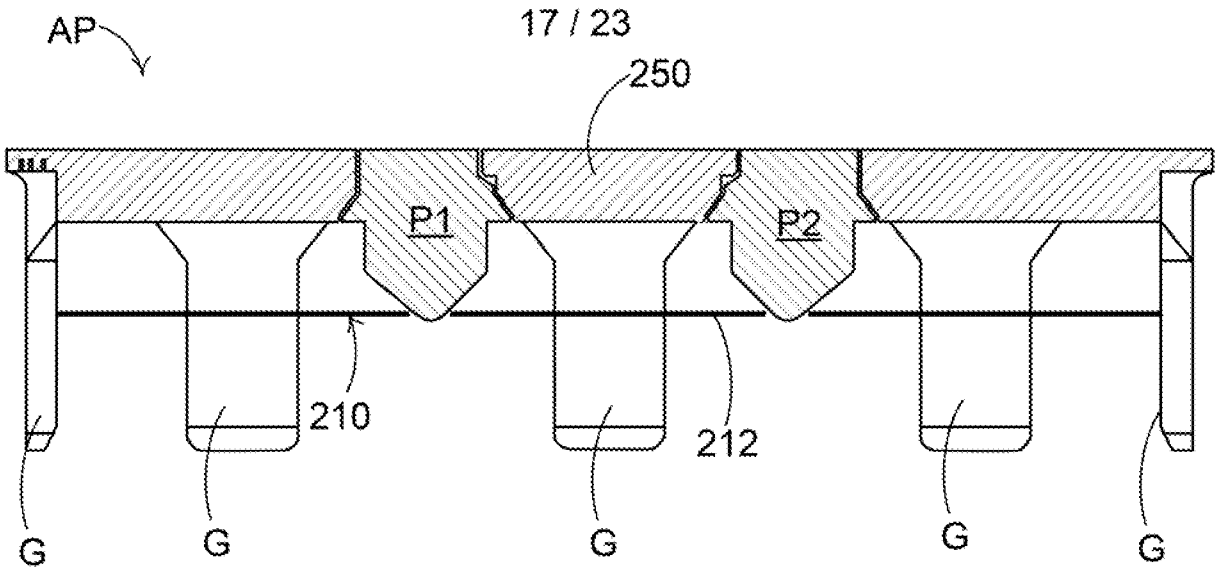


FIG. 16A

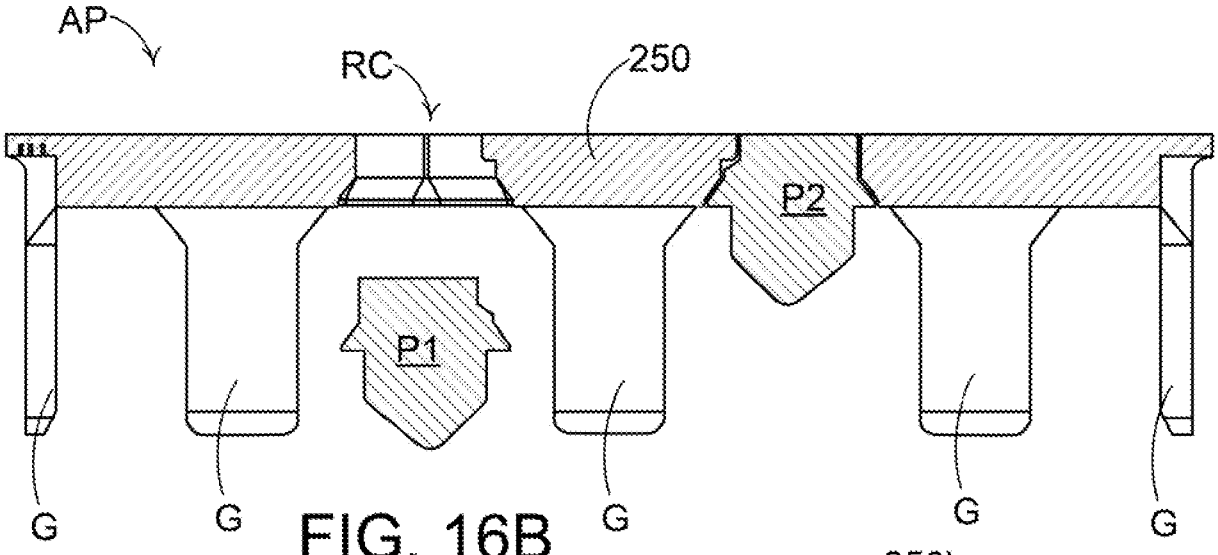


FIG. 16B

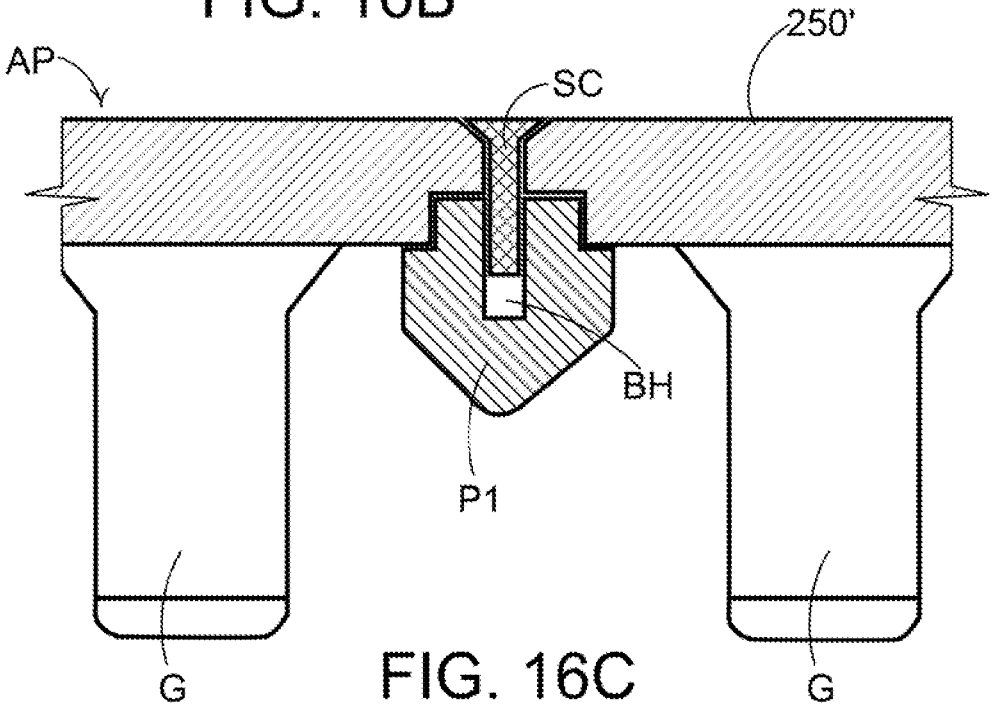


FIG. 16C

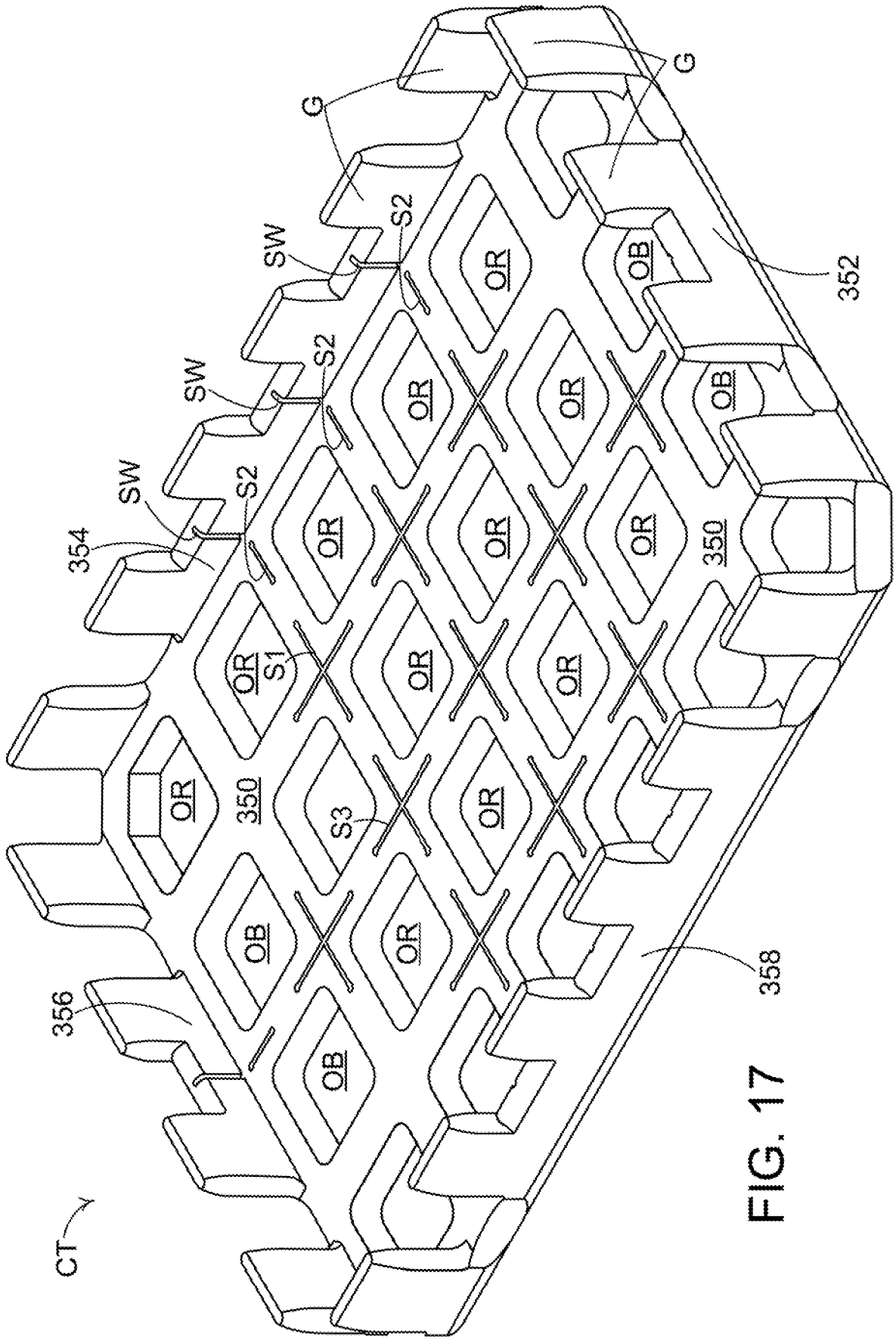

G
G
SW
S2
SW
S2
SW
S2
354
OR
OR
OR
OR
OR
OR
OR
OR
OR
OR
OR
OR
OR
OR
OR
OB
OB
OB
OB
OB
S1
S3
350
350
352
356
358
CT

FIG. 17

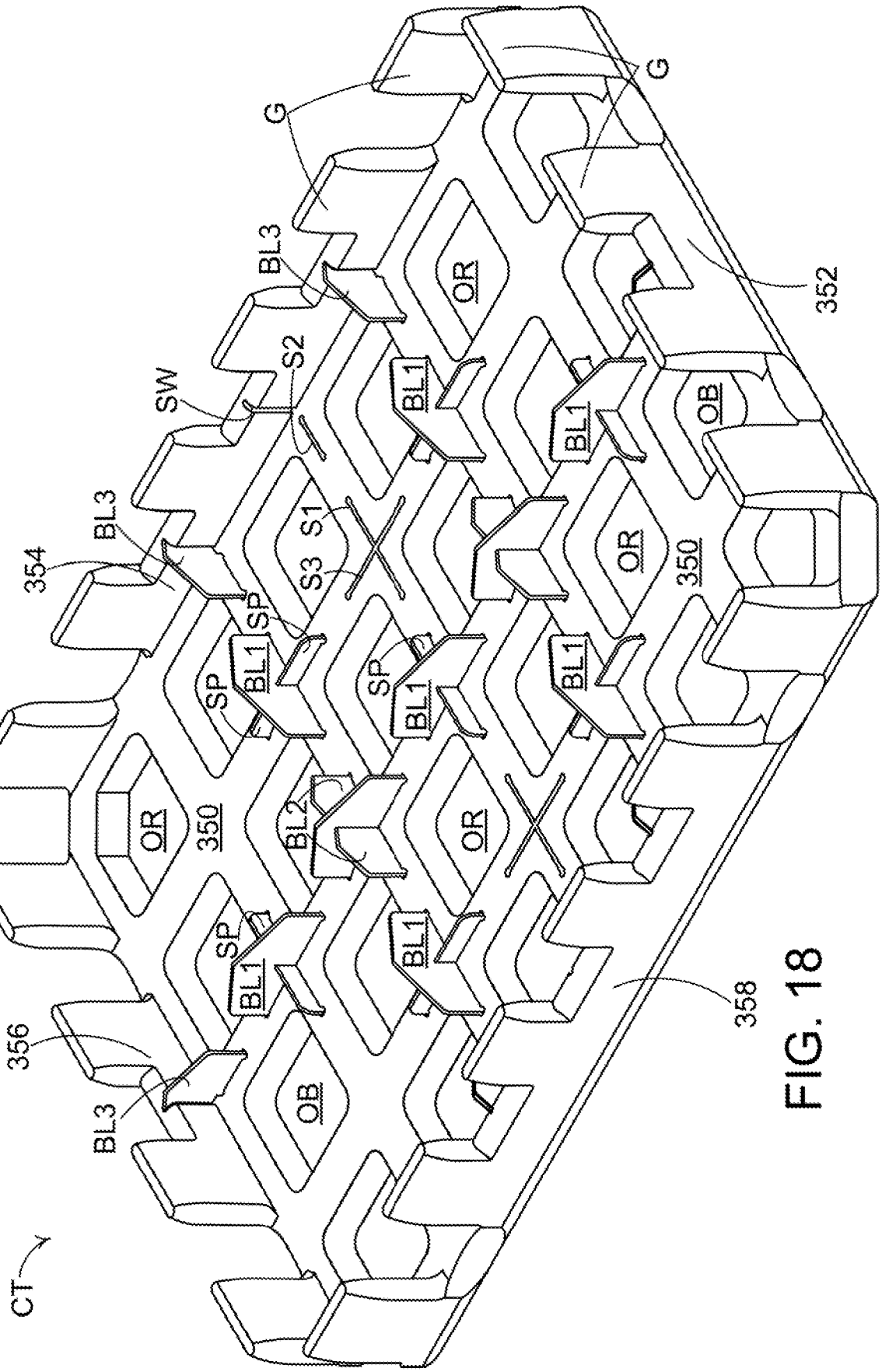


FIG. 18

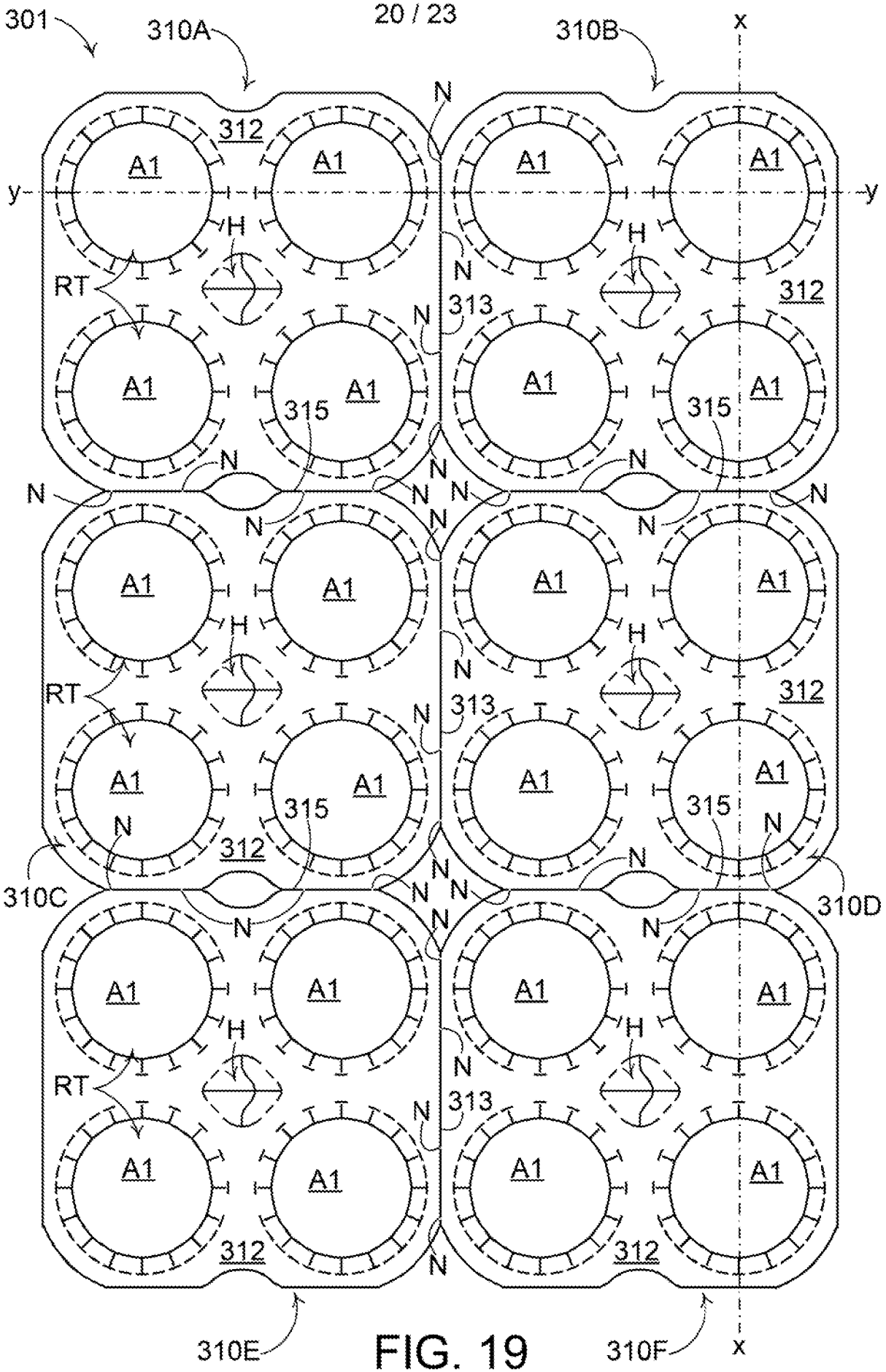


FIG. 19

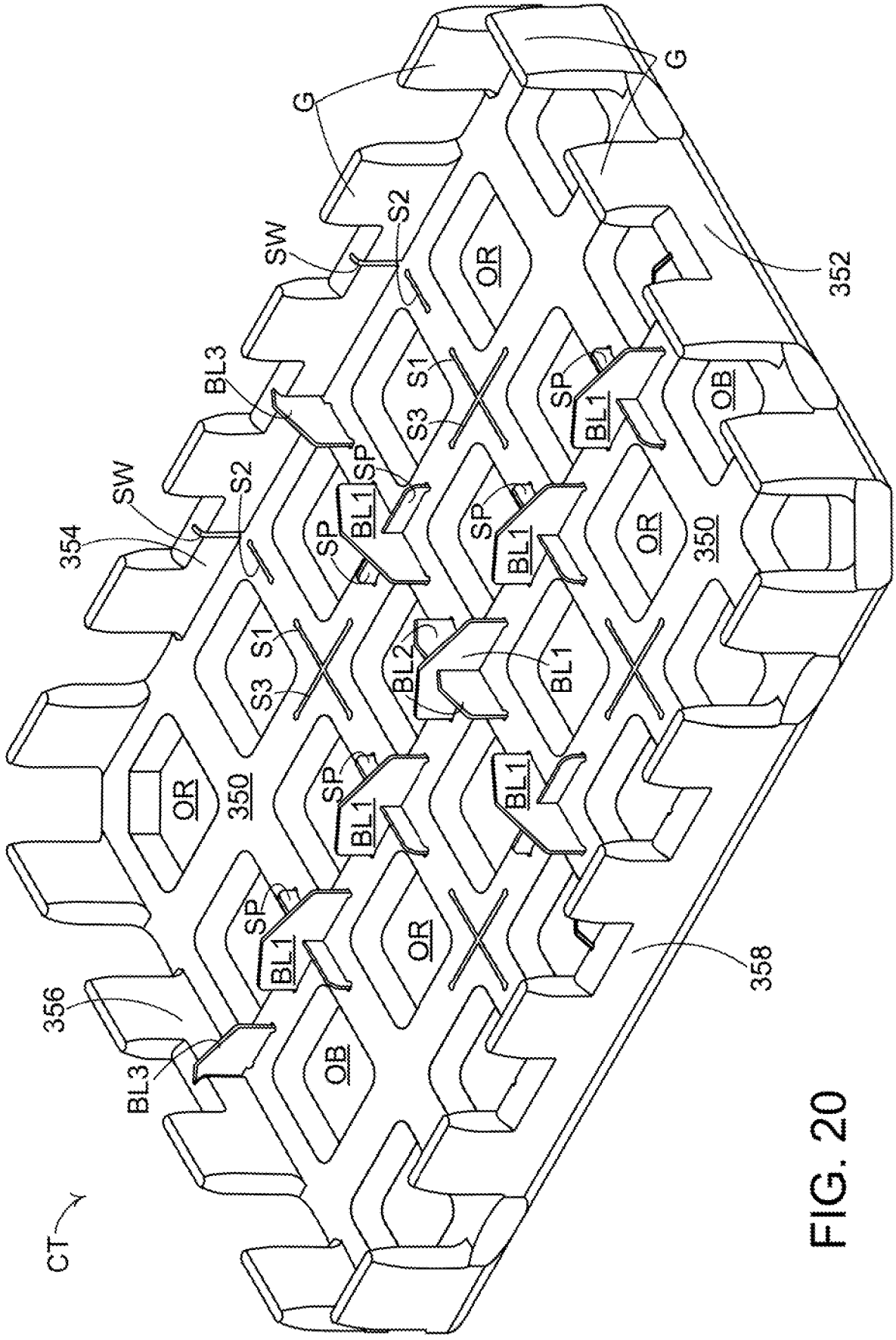

G
G
SW
S2
OR
352
BL3
S3
S1
SP
BL1
OB
SW
S2
354
SP
BL1
SP
S3
S1
SP
BL1
OR
350
S1
S3
BL2
BL1
OR
350
SP
BL1
BL1
SP
BL1
OR
356
BL3
OB
358
CT
Y

FIG. 20

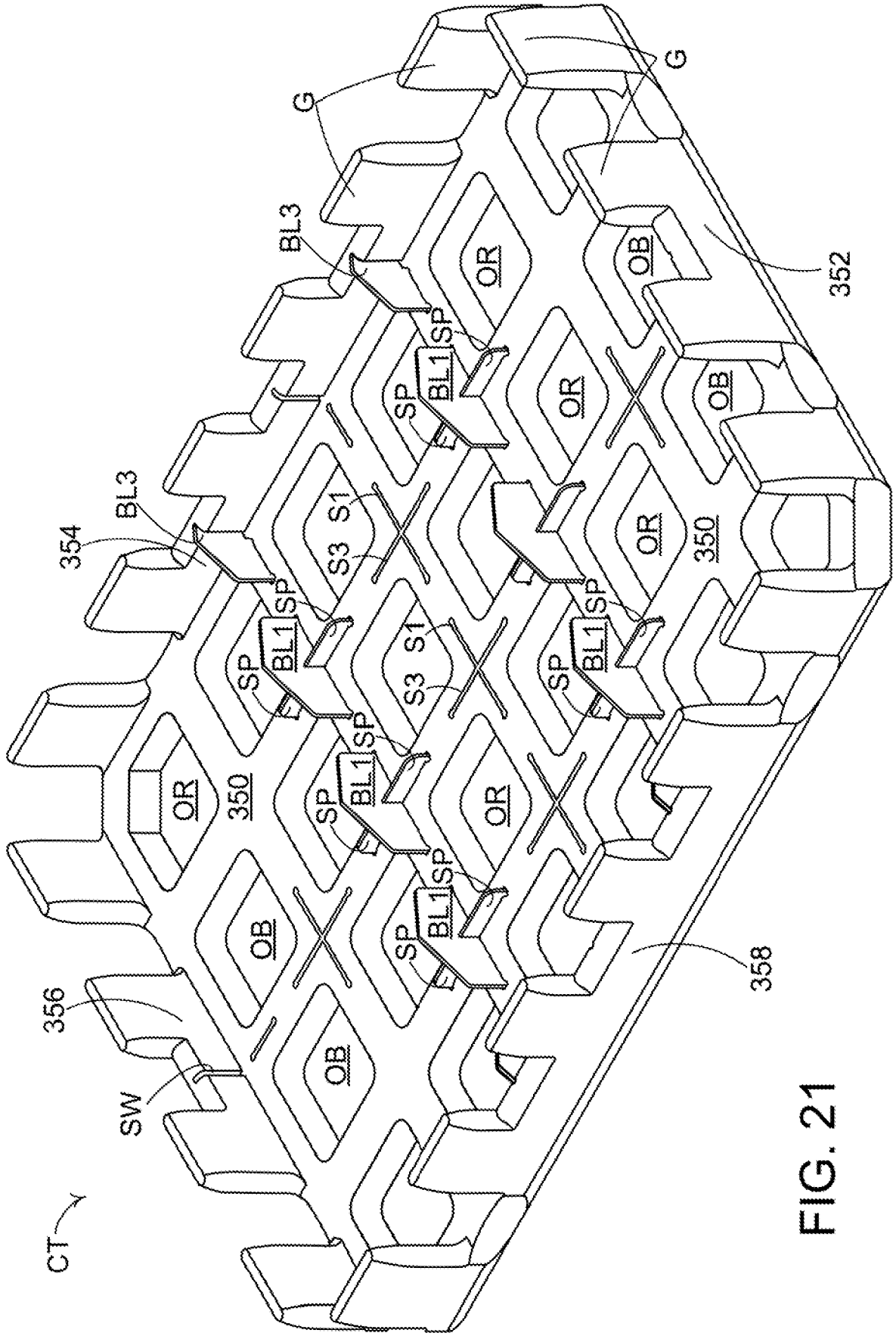


FIG. 21

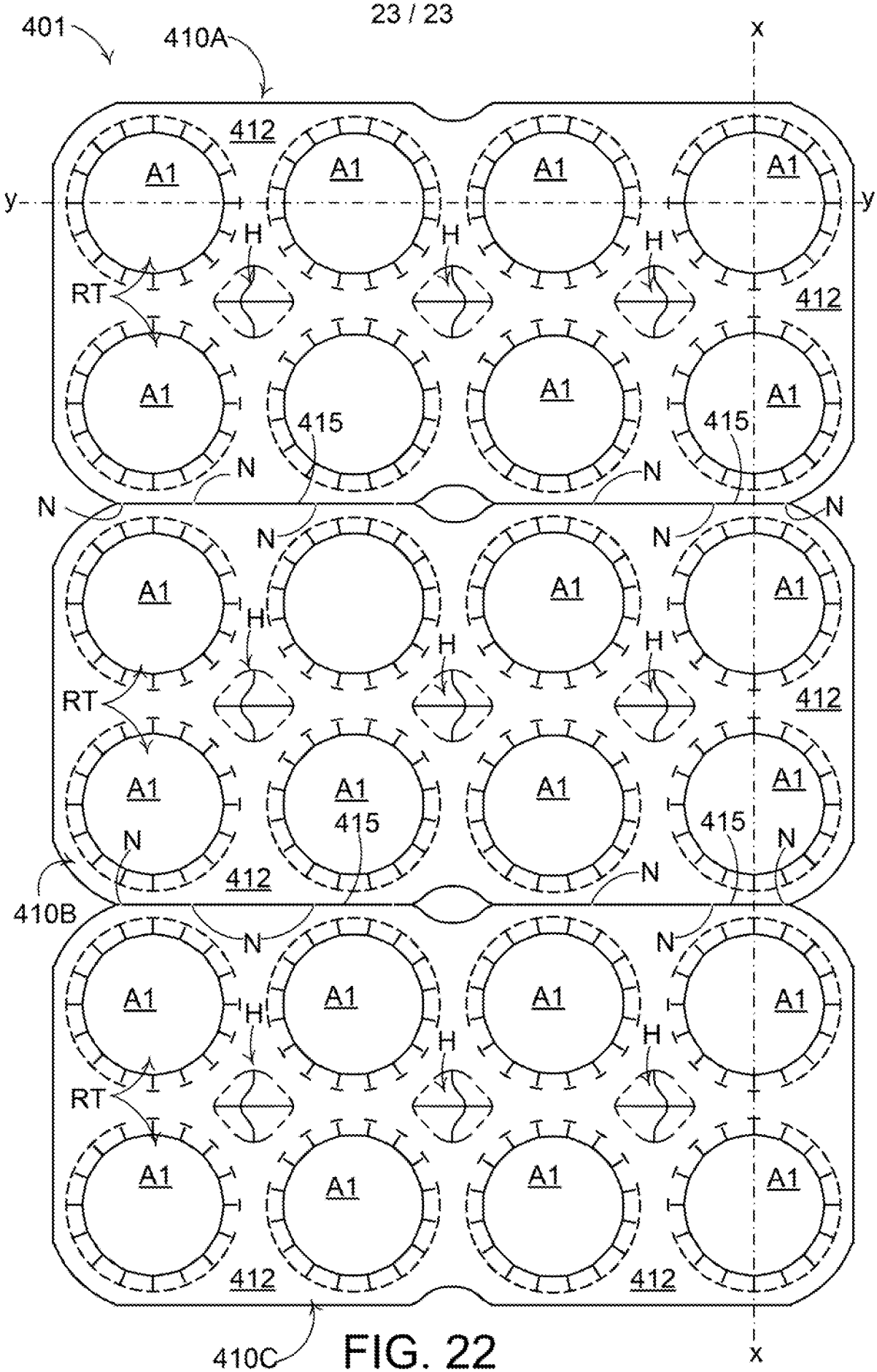


FIG. 22