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(54) **SEMI-RIGID SHIPPING CONTAINER WITH PEEL-RESEAL CLOSURE**

HALBSTARRER FRACHTCONTAINER MIT WIEDERVERSIEGELBAREM ABLÖSEVERSCHLUSS

CONTENEUR D'EXPÉDITION SEMI-RIGIDE À FERMETURE À DÉCOLLEMENT-RECOLLEMENT

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Description

Cross-Reference to Related Applications

[0001] The present application claims priority to U.S. provisional application no. 61/946,654, filed February 28, 2014, entitled "Semi-Rigid Shipping Container with Peel-Reseal Closure.

Technical Field

[0002] The present disclosure relates to packaging and more particularly to a sustainable packaging system including a carton and a sealed liner assembly for shipping liquid, viscous, or particulate products.

Background

[0003] Substantially rigid plastic containers with replaceable covers, e.g., bucket-type containers, are commonly used to package and ship selected liquid and viscous materials in the nature of foods and food preparation materials, cosmetic preparations, detergents, and the like (cf. e.g. WO 2011062969 A2). Such containers are sturdy, typically having a wall thickness in the range of about 1,905 mm to about 2,286 mm, and have a large mouth that renders them well suited for storing and dispensing a variety of viscous liquids, e.g., syrups, mustard, and cosmetic preparations. A typical 20 liter empty bucket may weigh approximately 1,021 kg.

[0004] Another mode of shipping liquid products is the "bag & box" assembly in which a bag, made of flexible single or double ply plastic film and provided with a fitment for discharge of the bag's contents, is stored in a box made of corrugated cardboard. The latter type of packaging system is well suited for free-flowing liquids such as vinegar, wine, detergents, and the like. However, it is not well suited for viscous materials for a number of reasons. For example, it is difficult to remove all of the contents from the bag, due to the inability to scrape out the residual contents from the bag. Additionally, in the case of a material that consists of several ingredients that tend to separate from one another on standing, it is not possible to introduce a stirring implement into the bag for the purpose of mixing the contents to obtain a homogenous material.

[0005] Further limitations stem from plastic recycling requirements and food packaging regulations. Environmental regulations require containers with a volume of 18,93 l or less to be made of a recyclable material. Additionally, governmental regulations require that plastic containers for foodstuffs be made of a virgin plastic material. The substantially rigid plastic containers comprise a relatively large amount of plastic in comparison to the flexible bags used in the "bag & box" packaging system, thereby increasing the amount of plastic that has to be disposed of or recycled. Making such containers of virgin plastic is costly and hence discourages their use for con-

taining foodstuffs. The "bag & box" system employs less plastic, but the bags are not as sturdy as the substantially stiff containers and also cannot be used where it is essential to access all of the contents or where it is desired to mix the contents in situ.

Summary

[0006] The present disclosure relates to a packaging system and more particularly to a sustainable packaging system including a carton and a sealed liner assembly for shipping liquid, viscous, or particulate products. The present invention as defined in claim 1, relates to a packaging assembly for holding liquids, viscous material, or particulate material. The packaging assembly includes a self-supporting plastic liner for insertion into a carton. The liner has a closed bottom end being a bottom wall formed integral with the side wall, and an open top end having an outwardly-projecting rim.

[0007] The packaging assembly further comprises a peel-reseal lidding assembly including first and second layers and a lidding material as specified in claim 1.

[0008] The present disclosure will become apparent to those skilled in the art from the following detailed description, which shows and describes examples according to the prior art in combination with illustrative embodiments of the present invention. As will be realized, the various embodiments of the present disclosure are capable of modifications in various obvious aspects, all without necessarily departing from the scope of the present invention as defined by the claims. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

Brief Description of the Drawings

[0009] While the specification concludes with claims defining the scope of the invention, it is believed that the disclosure will be better understood from the following description taken in conjunction with the accompanying Figures, in which:

Fig. 1A is an exploded perspective view of the components of a packaging system according to the prior art.

Fig. 1B is a top, end, and side view of a round cylindrical liner according to the prior art.

Fig. 1C is a top and side view of a packaging system with a round cylindrical liner according to another prior art example.

Fig. 1D is a top and side view of a packaging system with a round cylindrical liner according to another prior art example.

Fig. 1E is a top, end, and side view of a packaging system with a round cylindrical liner according to yet another prior art example.

Fig. 1F is a top, end, and side view of a oval cylindrical liner according to the prior art.

Fig 1G is a top and side view of a packaging system with an oval cylindrical liner according to another prior art example.

Fig 1H is a top and side view of a packaging system with an oval cylindrical liner according to another prior art example.

Fig 1I is a top, end, and side view of a packaging system with an oval cylindrical liner according to yet another prior art example.

Fig. 2 is an enlarged fragmentary sectional view illustrating the components of a packaging system according to the prior art.

Fig. 3 is a perspective view of an assembled packaging system.

Fig 4A is an enlarged fragmentary sectional view illustrating the components of a packaging system according to the prior art.

Fig 4B is a perspective view of a carton lid according to the prior art.

Fig. 5A is a perspective view of traditional packing buckets skidded on a pallet.

Fig. 5B is a perspective view of another prior art example skidded on a pallet with 36 packaging assemblies.

Fig. 5C is a perspective view of another example skidded on a pallet with 48 packaging assemblies.

Fig. 6 is a perspective view of the bottom wall of a carton with four round liner access points, according to the prior art.

Fig. 7 is a flow diagram illustrating a method for packaging and holding liquid, viscous, and particulate materials, according the prior art.

Fig. 8 is an exploded perspective view of the components of a packaging system according to one example of the present disclosure.

Fig. 9 is a perspective view of one example of the assembled packaging system of Fig. 8.

Fig. 10 is a partially opened packaging system according to one example of the present disclosure.

Fig. 11 is an exemplary flow diagram illustrating a method of using a packaging system according to one example of the present disclosure.

Fig. 12 is a perspective assembly view of a packaging system, according to one embodiment of the present disclosure.

Fig. 13A is a perspective view of the lidding material, according to one embodiment of the present disclosure.

Fig. 13B is a top view of the lidding material in a closed position, according to one embodiment of the present disclosure.

Fig. 13C is a top view of the lidding material in an open position, according to one embodiment of the present disclosure.

Fig. 13D is a top view of the lidding material in a rolled open position, according to one embodiment of the present disclosure.

Fig. 13E is a bottom perspective view of the lidding

material, according to one embodiment of the present disclosure.

Fig. 13F is schematic of various detached edge profiles, according to one embodiment of the present disclosure.

Fig. 13G is schematic of edge terminations, according to one embodiment of the present disclosure.

Fig. 14A is a perspective view of the liner, according to one embodiment of the present disclosure.

Fig. 14B is a top view of the liner, according to one embodiment of the present disclosure.

Fig. 14C is a bottom view of the liner, according to one embodiment of the present disclosure.

Fig. 14D is a front view of the liner, according to one embodiment of the present disclosure.

Fig. 14E is a perspective view of the liner, according to one embodiment of the present disclosure.

Figs. 15 and 16 show a schematic of a manufacturing facility for forming and filling the cartons, and an exemplary flow diagram illustrating a method of layering the lidding

Detailed Description

[0010] The present disclosure relates to a novel and advantageous sustainable packaging system that may be used to ship liquid or viscous products or particulate matter. Traditionally, liquid products, for example thick viscous products such as thick paints and inks, cosmetic compounds, food glazes and fillings, drywall mud, thick roof sealants, powders and flakes, or like products have been packed for shipping or sale in pails or buckets made of materials such as steel or thick plastic. A single traditional 20 liter bucket of this type may weigh approximately 1,021 kg empty, which adds a considerable amount of weight to a truckload of product. Buckets or pails are also typically cylindrically shaped, making them inefficient for skidding or shipping because there is a substantial amount of unused space between one bucket and the next bucket. Further, due to the rigidity of the buckets, they may take up a significant amount of space after use, but before disposal. Additionally, the buckets may be difficult or costly to dispose of or recycle.

[0011] The packaging system of the present disclosure generally includes an outer container or carton box, and an inner liner. The inner liner may be sealed after the liner is filled with product. A liner cover may be placed over the sealed liner and/or a carton box cover may be placed over the cardboard box containing the sealed and filled inner liner. The square or rectangular shape of the packaging system allows one box to be placed directly next to and/or on top of another box, effectively maximizing the amount of product that can be stored or shipped in a limited space. For shipping purposes, the more units that can be loaded per truck reduces inbound transportation costs.

[0012] In addition to the advantageous shape of the packaging system of the present disclosure, a single

empty packaging system, in one embodiment, may weigh approximately 151 g, compared to the approximately 1,021 kg for a traditional pail of similar volume. This weight difference results in a 7 ½ to 1 ratio in weight savings for the packaging system of the present disclosure over the traditional pail. The lighter weight packaging system of the present disclosure may be easier to move, be less costly to ship, require less energy to produce, and be easier to recycle, and easier to store prior to recycling than traditional pails.

[0013] Fig. 1A shows a packaging system 100 according to the prior art. The packaging system 100 may include a carton 102, an optional pad or liner 180, a plastic liner 120, a lidding material 140 that may be sealed to the plastic liner 120, and a plastic lid 150. The carton 102 may be a conventional cardboard box constructed of, for instance, corrugated cardboard and a stiff paperboard that may be 100% recyclable, although, other light and/or recyclable materials may be used for the carton. The carton 102 may have a generally square or rectangular cross-sectional shape. Carton 102 may have a sidewall including four square or rectangular panels 104, a bottom wall 106, and in some embodiments, an open top without any flaps that need to be closed and/or sealed.

[0014] In one example, the liner 120 may be made of plastic and be relatively semi-rigid and thin, approximately in the range of about 0,203 mm to about 0,762 mm thick. However, it is recognized that the liner thickness could vary and could be outside the range of about 0,203 mm to about 0,762 mm, and in some examples, may depend on the desired use or application of the liner 120. The liner 120 may be made by any means known in the art, such as, but not limited to vacuum forming, blow molding, or injection molding. The liner 120 may be made, for example, of a 100% recyclable material, such as, but not limited to high-density polyethylene (HDPE) or linear low density polyethylene (LLDPE). Unlike the plastic film bags used in the bag & box assembly described above, the liner 120 may be self-supporting. However, the relative thinness of the liner may make the liner easily collapsible, which may significantly reduce the volume and cost of disposal as compared to traditional pails. Due to the thinness and/or the weight of the carton 102 and/or the liner 120, more, and in some cases significantly more, liners may be shipped via truck than traditional rigid buckets. For instance, the liner may be shipped in truckloads of approximately 28,000 units compared to only 3,412 traditional buckets per truck. Increasing the number of liners that may be shipped in a single truck load can advantageously result in less truck loads needed to ship the packaging system of the present disclosure and therefore less greenhouse gases being produced.

[0015] The liner 120 may have a cross-sectional shape similar to the carton 102, e.g., square or rectangular cross-sectional shape. Alternately, the liner may have any other shape, such as, but not limited to an oval or round cylindrical shape, as described in more detail below. In any case, the liner 120 can be sized to fit within

the carton 102. In the illustrated embodiment, the liner 120 has a substantially square cross-sectional configuration and comprises a bottom wall 124 and a side wall including four sides or panels 122 that can be substantially similar in shape to panels 104 of carton 102. When the plastic liner 120 is inside the carton 102, the plastic liner 120 may rest on and be supported by the bottom wall 106 of the carton 102. Panels 122 may typically be generally slightly smaller than panels 104 of carton so as to

permit the liner 120 to fit inside the carton 102. In one example, panels 122 of the plastic liner 120 may lie substantially close to the side walls 104 of the carton 102 when the liner is placed in the carton. The top end of the liner 120 can be open but may be formed with a rim 126. As can best be seen in Fig. 2, the rim 126 of the liner 120 may include a radially extending flange portion 210 and a depending skirt portion 212. The rim 126 may extend fully around the perimeter of the liner 120, being an integral extension of the upper end of the panels 122. In another example, the rim may extend partly around the perimeter of the liner. When the liner 120 is placed in the carton, the top edge of the carton sidewall 104 can be positioned underneath the rim 126 of the liner 120 as can be seen in Fig. 2, with the top edge of the sidewall 104 between the sidewall of the liner 120 and the skirt portion 212.

[0016] As stated above, the liner may have any other suitable shape. For example, as shown in Fig. 1B, a liner 152 may have a substantially circular cross-sectional shape, sized to fit within the carton 102. The top of the liner 152, in one embodiment, may retain a square or rectangular shaped rim 154, such that the rim may extend fully around the perimeter of the liner 152, being an integral extension of the upper end of the liner. In a further example, the rim may extend partly around the perimeter of the liner.

[0017] In another example of a liner having a substantially circular cross-sectional shape, sized to fit within the carton 102, as shown in Fig 1C, a liner 162 may be designed to fit generally within the carton 102. The carton 102 may include additional inner side panels 164. The inner side panels 164 may extend substantially around the entire inner perimeter of the sidewall panels 104, or they may extend around only a portion of the inner perimeter of the sidewall panels 104. Although not necessary, the inner side panels 164, in some embodiments, may be slightly taller than the outer panels 104. The liner 162 may retain a square or rectangular shaped rim 166, which may extend fully or partly around the perimeter of the liner, and may rest upon an upper edge of the inner side panels 164. The liner 162 may be positioned with the rim 166 over a top edge of the inner side panels 164 entirely within the carton sidewall panels 104 or in addition to being over a top edge of the sidewall panels 104.

[0018] In yet another example of a liner having a substantially circular cross-sectional shape, sized to fit within the carton 102, as shown in Fig. 1D, a liner 172 may be

designed to fit generally within the carton 102. The carton 102 may include additional inner side panels 174, providing an internal octagonal geometry, or other suitable polygonal geometry. The inner side panels 174 may extend substantially around the entire inner perimeter of the sidewall panels 104, or they may extend around only a portion of the inner perimeter of the sidewall panels 104, such as but not limited to, only extending across the corners of the carton sidewall panels 104. Although not necessary, the inner side panels 174, in some embodiments, may be slightly taller than the outer panels 104. The liner 172 may have a relatively smaller generally polygonal shaped rim 176, or the rim may be a substantially circular shaped rim, which may extend fully or partly around the perimeter of the liner. The octagonal inner side panels 174 at the corners of the carton sidewall panels 104 may include cutouts for the liner to pass through, thereby supporting the liner by way of the interface between the cutouts of the corner inner side panels and the substantially circular shaped rim 176.

[0019] In still another example of a liner having a substantially circular cross-sectional shape, sized to fit within the carton 102, as shown in Fig. 1E, a liner 182 may be designed to fit generally within the carton 102. The carton 102 may include additional inner side pads 184, which may be adhered to the carton sidewall panels 104, for example with adhesive. The inner side pads 184 need not be designed to extend the full height of the carton sidewall panels 104, but rather may be designed to be significantly shorter. The inner side pads 184 may extend substantially around the entire inner perimeter of the sidewall panels 104, or they may extend around only a portion of the inner perimeter of the sidewall panels 104. The liner 182 may retain a square or rectangular shaped rim 186, which may extend fully or partly around the perimeter of the liner, and may rest upon an upper edge of the inner side pads 184. The liner 182 may be positioned with the rim 186 over a top edge of the inner side pads 184 entirely within the carton sidewall panels 104 or in addition to being over a top edge of the sidewall panels 104.

[0020] In yet another example, as shown in Fig. 1F, a liner 232 may have a substantially oval cross-sectional shape, sized to fit within the carton 102. The top of the liner 232, in one embodiment, may retain a square or rectangular shaped rim 234, such that the rim may extend fully around the perimeter of the liner 232, being an integral extension of the upper end of the liner. In a further embodiment, the rim may extend partly around the perimeter of the liner.

[0021] In another example of a liner having a substantially oval cross-sectional shape, sized to fit within the carton 102, as shown in Fig. 1G, a liner 242 may be designed to fit generally within the carton 102. The carton 102 may include additional inner side panels 244. The inner side panels 164 may extend substantially around the entire inner perimeter of the sidewall panels 104, or they may extend around only a portion of the inner pe-

rimeter of the sidewall panels 104. Although not necessary, the inner side panels 244, in some examples, may be slightly taller than the outer panels 104. The liner 242 may retain a square or rectangular shaped rim 246, which may extend fully or partly around the perimeter of the liner, and may rest upon an upper edge of the inner side panels 244. The liner 242 may be positioned with the rim 246 over a top edge of the inner side panels 244 entirely within the carton sidewall panels 104 or in addition to being over a top edge of the sidewall panels 104.

[0022] In yet another example of a liner having a substantially oval cross-sectional shape, sized to fit within the carton 102, as shown in Fig. 1H, a liner 252 may be designed to fit generally within the carton 102. The carton 102 may include additional inner side panels 254, providing an internal octagonal geometry, or other suitable polygonal geometry. The inner side panels 254 may extend substantially around the entire inner perimeter of the sidewall panels 104, or they may extend around only a portion of the inner perimeter of the sidewall panels 104, such as but not limited to, only extending across the corners of the carton sidewall panels 104. Although not necessary, the inner side panels 254, in some embodiments, may be slightly taller than the outer panels 104. The liner 252 may have a relatively smaller generally polygonal shaped rim 256, or the rim may be a substantially oval shaped rim, which may extend fully or partly around the perimeter of the liner. The octagonal inner side panels 254 at the corners of the carton sidewall panels 104 may include cutouts for the liner to pass through, thereby supporting the liner by way of the interface between the cutouts of the corner inner side panels and the substantially oval shaped rim 256.

[0023] In still another example of a liner having a substantially oval cross-sectional shape, sized to fit within the carton 102, as shown in Fig. 1I, a liner 262 may be designed to fit generally within the carton 102. The carton 102 may include additional inner side pads 264, which may be adhered to the carton sidewall panels 104. The inner side pads 264 need not be designed to extend the full height of the carton sidewall panels 104, but rather may be designed to be significantly shorter. The inner side pads 264 may extend substantially around the entire inner perimeter of the sidewall panels 104, or they may extend around only a portion of the inner perimeter of the sidewall panels 104. The liner 262 may retain a square or rectangular shaped rim 266, which may extend fully or partly around the perimeter of the liner, and may rest upon an upper edge of the inner side pads 264. The liner 262 may be positioned with the rim 266 over a top edge of the inner side pads 264 entirely within the carton sidewall panels 104 or in addition to being over a top edge of the sidewall panels 104.

[0024] Other options for supporting substantially circular or oval shaped liners within a carton having a square or rectangular cross-sectional shape are within the scope of the present disclosure. Although features may be generally described with reference herein to liner 120, it is

understood that such features may also be equally applied to other liner examples, such as those described above.

[0025] A lidding material 140 may be sealed over the top of the liner 120 in order to contain the product within the liner 120. The lidding material 140 can be advantageous when the contents of the liner must be protected against moisture, air, bacteria, or other materials that may have a deleterious effect on the contents. The lidding material 140 may be, for example, a thin film plastic material or a thin metal foil that may be sealed to the liner 120 by any means, for example by hermetically heat-sealing the lidding material 140 to the liner 120. In other examples, the lidding material may be manufactured from any material suitable for sealing the liner from one or more of moisture, air, bacteria, or other materials that may have a deleterious effect on the contents. In some embodiments, the lidding material may be made of a 100% recyclable material. The lidding material may also be secured to the liner by adhesive or other methods of sealing now known or developed in the future. As can be seen in Fig. 2, the lidding material 140 may cover the entire open area 214 of the liner 120 and may be sealed to the radially extending flange 210 which runs along the perimeter of the sidewall 122 of the liner 120.

[0026] In some examples, a packaging system may not contain a lidding material, but may contain a plastic lid, a carton lid, or both a plastic lid and a carton lid, as will be described in detail below.

[0027] The packaging system 100 illustrated in Fig. 1A shows a plastic lid 150 that may fit over both the liner 120 and the carton 104 when the liner is placed inside the carton. Fig. 2 shows the plastic lid 150 secured over the rim 126 of the liner 120. The plastic lid 150 may be made of a resilient plastic or other suitable resilient material and be shaped to generally fit over the opening of the liner 120. By way of example but not limitation, the plastic lid may be made of the same material as the liner or some other material, and may have the same or different thickness. The plastic lid 150 may include a rim 216 that is designed to substantially interlock or otherwise removably couple with the rim 126 of the liner 120. As can best be seen in Fig. 2, the plastic lid 150 has a center portion 218 that may cover the lidding material 140 of the liner 120. In alternative examples, the center portion 218 or portions thereof, of the lid 150 may be eliminated. The rim 216 of the plastic lid 150 may include a skirt portion 220 that fits over, and in some cases snugly over, the skirt portion 212 of the liner 120. The interlocking skirt portions 212, 220 of the liner 120 and plastic lid 150 may be of any configuration that permits a generally snug fit between the liner skirt portion 212 and the plastic lid skirt portion 220. In the embodiment shown in Fig. 2 the skirt portions 212, 220 are generally C-shaped, bulging outward, away from the boxing system, at the top of the skirt portion, then curving inward toward the boxing system, and then curving outward again forming a lip 213, 222 around the perimeter of both the liner and the plastic lid.

However, it is recognized that any suitable interlocking or coupling mechanism or means may be used to removably couple the lid 150 to the liner 120.

[0028] The plastic lid 150 may be attached to the liner 120 by pressing it down over the rim 126 of the liner 120. The pressing down action can result in the bottom end of the skirt portion 220 of the plastic lid 150 being forced outwardly far enough to snap over the skirt portion 212 of the liner 120. The inherent resilience of the plastic of which the plastic lid 150 is made can cause its rim 216 to engage, or tightly engage, with the liner rim 126 as shown in Fig. 2, thereby removably locking the plastic lid 150 to the liner 120. The plastic lid 150 may be removed by urging it upwardly away from the liner 120, with the skirt portion 220 of the plastic lid flexing outwardly to release the plastic lid from the liner. Fig. 3 shows a carton 102 with a plastic lid 150 secured to a liner that is inside of the carton 102.

[0029] In another example, the packaging system may have a carton lid in addition to or instead of a plastic lid. FIG. 4A shows a cross-section of an embodiment including both a plastic lid 150 and a carton lid 400. As shown in Fig. 4B, the carton lid 400 may be made of, for instance, corrugated cardboard and a stiff paperboard that may be 100% recyclable. By way of example, but not limitation, the carton lid 400 may be made of the same material as the carton 102 or some other material, and may have the same or different thickness. The carton lid 400 can be made to fit generally over the carton 102 and liner 120. Fig. 4b illustrates a carton lid 400 with an inner portion 402 and four side walls 404. The carton lid 400 can have substantially the same shaped cross-section as the carton it will cover, except that the carton lid may be slightly bigger than the carton so that the carton lid may fit over, and in some cases securely over, the carton 102 and the liner 120. Thus, like the carton itself, the carton lid may be either square-shaped or rectangular-shaped.

[0030] In a further example, a carton lid 400 may be generally integral with the carton 102 and at least partially separable from the carton along a corrugated tear strip, pull string, or perforation. Although not required, this type of carton lid may be preferably used with embodiments of liners that fit entirely within the sidewall panels 104 of the carton. The tear strip may be removed (or the pull string can be pulled, or the perforated line separated) so as to allow the carton lid 400 to at least partially separate from the carton 102. In some examples, the tear strip may extend entirely around the carton 102, so as to allow the carton lid 400 to be fully removed from the carton to expose the liner within. In other embodiments, the tear strip may extend only partially around, for example around three sides of the carton, so as to allow the carton lid 400 to be partially removed from the carton to expose the liner within. In either embodiment, the carton lid 400 may be reusable to reseal or re-cover the carton once access to the liner within is no longer desired. In further embodiments, the tear strip may be located at any suitable position to allow a portion of the carton to open for

access to the liner within.

[0031] In still another example, the carton lid may be generally integral with the carton 102 and comprise one or more flaps, which may be folded over the carton opening to close the carton. The flaps may also include one or more tear strips to secure the flaps in a closed position until the carton is opened for the first time.

[0032] At any rate, in some examples, the packaging system may include a carton 102, a liner 120, a lidding material 140, and a carton lid 400 without a plastic lid 150. In yet another embodiment the packaging system may include a carton 102, a liner 120, a plastic lid 150, and a carton lid 400 without a lidding material. In any event, the packaging system may be designed to include one, two, or each of the lidding material 140, plastic lid 150, and carton lid 400. For example, in some embodiments, the packaging system may include only the lidding material 140 without a plastic lid 150 or carton lid 400.

[0033] Because traditional pails or buckets that are used to ship viscous materials are typically cylindrical, a significant amount of space may be wasted during shipping because one bucket cannot line up directly next to another bucket as can be seen in Fig. 5A. Further, because traditional pails are so thick, each bucket takes up more space, and in some cases significantly more space, than the packaging system of the present disclosure. This can best be seen in Figs. 5A and 5B which show how the same quantity of product would be skidded in the present disclosure 520 and in the traditional bucket system 510. As can be seen, each skid 510, 520 contains 36 units, however, the height of the skidded present disclosure 520 is considerably less than the height of the skidded traditional bucket 510. In fact, adding another layer of the packaging system of the present disclosure to the skid 520 may only increase the height of the skid by a small amount, such as a couple inches, compared to the traditional bucket system 510 as shown in Figs. 5A and 5C. Adding this additional layer can result in more product per skid, and in some cases up to 33% or more product. In addition to being able to store and/or ship more, and in some cases significantly more, product by means of the present disclosure, the same quantity of product weighs less, and in some cases significantly less, when packaged using the present disclosure rather than the traditional buckets. This may make product packaged using the present disclosure easier to move, and in some cases less costly to ship.

[0034] In practice, the liner of the present disclosure may be filled with a liquid, viscous material or particulate material before the liner is placed in the carton, or while the liner is in the carton. In existing conventional packaging systems, a liner might also be filled before being placed inside a box, or after being placed in a box. However, if a sealing member was going to be applied to the liner, the liner would have to be filled before being placed in the box. In that case, a sleeve or support member would need to be placed around the liner to stabilize the liner. Alternately, in conventional packaging systems, the

liner could be placed inside the box and then filled with material, but in that case, the liner could not be sealed with a lidding material. One such existing packaging system is described in U.S. Patent Number 6,892,933. One novel and advantageous aspect of some embodiments of the present disclosure, however, is that the liner may be filled when it is in the carton, and the lidding material may be sealed to the liner after the liner has been filled, and while the liner is still in the carton.

[0035] A further example of the prior art illustrated in Fig. 6 shows the bottom wall 606 of a carton 602. In this embodiment, the bottom wall 606 may contain liner access points 610. While four liner access points 610 are shown, it is recognized that fewer or greater liner access points 610 may be used as suitable or desirable for the intended application. In the embodiment shown, the liner access points 610 are round, but they may be any shape, such as but not limited to square, rectangular, triangular, oblong, etc. The liner access points 610 are areas that are cut out or otherwise removed from the bottom wall 602 creating openings in the bottom wall 602, such that when the liner 120 is inside the carton 602, the liner may be accessed and pushed up from the bottom of the carton 602. During the packing process, the liner 120 may be placed in the carton 602 in order to fill the liner 120 with material. Prior to sealing the lidding material 140 on the liner 120, the liner 120 may be pushed up, for example, approximately $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches, or any other suitable amount, in order to seal the lidding material 140 on the liner 120. The liner 120 may be raised for sealing by pushing up on the liner 120 through the liner access points 610 in the bottom wall 606 of the carton 602.

[0036] In some examples, a liner pad 180, as shown in Figs. 1 and 6, may be removeably placed inside of the carton 602 prior to placing the liner in the carton. The pad 180 may rest between the bottom wall 606 of the carton 602 and the bottom of the liner. When the liner is pushed up for sealing through the liner access points 610, the pad 180 may equalize the pressure applied to the liner and help stabilize the liner, allowing the filled liner to keep its shape as it is pushed upward. The pad 180 may be made of corrugated cardboard. In other embodiments, the pad may be made of another paper material, plastic, wood, metal, or any other suitable material, or combination of materials. In one example, the pad 180 may be of any desirable thickness. For instance, a relatively thin pad may be used with liners that are not intended to be very heavy when filled, whereas a thicker pad may be desirable when the filled liner is expected to be heavy. In other examples, a pad may not be used at all. In some embodiments, the pad 180 may be square or rectangular in shape and sized to fit snugly within the perimeter of the square or rectangular panels 104 of the sidewall of the carton 602. In alternative examples, the pad 180 may be shaped other than as a square or rectangular, such as but not limited to circular, triangular, ovoid, etc. Similarly, the pad 180 need not be sized to fit snugly within the perimeter of the square or rectangular panels 104 of

the sidewall of the carton 602, and in some examples the pad 180 may be sized such that the pad 180 covers at least a portion of one or more of the liner access points 610. Liner access points and liner pads may be suitably used with any liner of the present disclosure, and may further be applied to existing packaging system, such as but not limited to, those described in U.S. Patent Number 6,892,933.

[0037] Once the filled liner has been covered with a lidding material, a plastic lid may be applied to the liner. Additionally, a carton lid may cover the plastic lid. In other embodiments, as mentioned previously, only a carton lid may cover the lidding material of the liner. The packaging system may then be shrink-wrapped or banded for skidding and shipping.

[0038] A further prior art example of the present disclosure is a method for packaging and holding liquids, viscous, or particulate materials as illustrated in Fig. 7. In one example, a plastic liner may be placed inside of a carton 710, either with the rim of the liner extending over the top edge of the carton or positioned entirely within the exterior walls of the carton. Once the liner is inside of the carton, the liner may be filled with a liquid, viscous, or particulate material, or any combination thereof 712. After the liner has been filled, in some embodiments, a plastic lid may be snap fit onto the plastic liner to secure the contents of the liner within 714. In some embodiments a carton lid may be secured over the plastic lid. 716.

[0039] In another example, a lidding material is affixed to the plastic liner after the plastic liner has been filled with product. In some embodiments, the affixing of the lidding material may be facilitated by pushing the plastic liner up and away from the carton so as to more easily access and seal the lidding material onto the rim of the plastic liner. The plastic liner may be pushed up through liner access points in the bottom of the carton, as described above.

[0040] Another advantage of the present disclosure is that the system may be integrated into already existing single and multi-head filling lines. Furthermore, the carton 102 may be assembled using standard equipment. The liner 120 may be installed, and the carton 102 and liner 120 may be conveyed to the existing filler. Once the liner 120 has been filled with product, a lidding material 140 may be heat sealed in place to protect the product. A plastic lid 150 may, or may not be, installed over the liner 120. A secondary or tertiary carton lid 400 may, or may not be, installed over the packaging system to protect the package during shipping. Then the packaging system may be shrink-wrapped or banded for skidding and shipping.

[0041] Figs. 8-10 illustrate another exemplary example of a packaging system 300 in which the plastic liner 302 has a peel and reseal lidding assembly 304. It is appreciated that the packaging system 300 shown and described in Figs. 8-10 can include the features described in the other embodiments described herein. For example, the packaging system 300 can include a carton 303, plas-

tic liner 302 having a rim 305, plastic lid 309, and carton lid (not shown).

[0042] As illustrated in Fig. 8, the peel and reseal lidding assembly 304 includes a lidding material 306 and a peel-reseal lidding material 308. The lidding material 306 may be similar to or include features of the lidding material 140 described above. Preferably the lidding material 306 is sealed to the plastic liner 302 and covers the entire open area 317 of the liner 302.

[0043] The lidding material 306 may be hermetically heat sealed or laminated to the plastic liner 300 such as described above. To access the contents within the plastic liner 302, the lidding material 306 can be broken, torn, or pierced through. Preferably, the lidding material 306 can be broken, torn, or pierced through using a sharp object such as a knife, scissors, or the like. In some configurations, an indicator or marking can be provided instructing a user the preferred area to cut.

[0044] Preferably, when the lidding material 306 is sealed to the plastic liner 302, the packaging system 300 has sufficient strength and rigidity such that it passes the appropriate shipping tests under the International Safe Transit Association ("ISTA"). In particular, the sealed packaging system 300 preferably has sufficient strength and rigidity to pass the ISTA-3E shipping test or an equivalent test that challenges the capability of the packaging system and contents therein to withstand transport hazards. The lidding material 306 also preferably acts as a tamper-evident system and can indicate to the user that the packaging system 300 has been tampered with if the lidding material 306 is broken.

[0045] Preferably, the peel-reseal lidding material 308 is heat sealed along its edges 320 to the lidding material 306 and/or plastic liner 302. The peel-reseal lidding material 308 includes at least a first layer 314 and a second layer 324, such as a sealing layer, that are generally co-extensive and adhered to each other. In the preferred embodiment, the second layer 324 is permanently affixed to the first layer 314 and the first layer 314 is positioned so that it faces the interior of the plastic liner 302. The first layer 314 and second layer 324 can be of substantially the same size or in some configurations, the second layer 324 can be smaller than the first layer 314. In the example illustrated in Fig. 8, the liner 302 is substantially rectangular and the lidding material 308 has four edges 320 corresponding to the geometry of the opening of the liner 302. It will be appreciated that other liner geometries can be used, for example and without limitation, the opening of the liner 302 could be circular, or polygonal with more or less than four sides. The first layer 314 includes a center portion 318 and a remaining area 319 adjacent the center portion 318. The center portion 318 is positioned at a predetermined distance from the edge 320 of the peel-reseal lidding material 308.

[0046] The center portion 318 is defined by four edges, in which at least three of the edges are detached edges 322. The detached edges 322 are preferably perforated or a pre-torn slit that separates the three edges of the

center portion 318 from the remaining area 319 of the first layer 314. The fourth or remaining edge of the center portion 318 is preferably affixed to the remaining area 319 to act as a hinge 315 so that the center portion 318 can be pulled back to expose the lidding material 306 thereunder. The center portion 318 of the peel-reseal lidding material 308 can then be resealed to seal the open area 317 of the plastic liner 302 when the lidding material 306 has been broken.

[0047] The second layer 324 preferably includes an adhesive portion 326 that extends beyond the sides of the center portion 318 (as shown in Fig. 10). The adhesive portion 326 includes a resealable adhesive 310 on the bottom surface of the adhesive portion 326 facing the interior of the plastic lid 302. As the user pulls back the center portion 318, the adhesive portion 326 is also pulled back with the center portion 318. The adhesive portion 326 is preferably includes a resealable adhesive material that can seal and resealed multiple times to facilitate re-sealing the center portion 318 against the peel-reseal lidding material 308, for example, against the portion of the first layer 314 adjacent the center portion 318 and edge 320.

[0048] Preferably, the first layer 314 is preferably made of a metallized material or structure, such as polyethylene terephthalate, mono-oriented polypropylene film, or CO-EX NYL/PE or a combination thereof that acts as an oxygen and moisture barrier. The metallized structure also has sufficient hot tack and seal strength such that the packaging system 300 is suitable for packaging both hot and cold materials. The first layer 314 can also be made of an opaque material to reduce the amount of light that enters the interior of the plastic liner 302. In some embodiment, the first layer 314 can be made of material that reflects or reduces ultraviolet light exposure.

[0049] In the preferred example, the peel-reseal lidding material 308 includes a tab 312 that is not adhered to the lidding material 306 such that a user can easily grasp the tab 312 and pull back the center area 318 of the peel-reseal lidding material 308 from the lidding material 306. In some configurations, the tab can be a portion of either the first 314 or second layer 324. In yet other configurations, no tab can be provided.

[0050] Fig. 11 illustrates an exemplary method of using the packing system 300 shown in Figs. 8-10. Contents, such as liquid, powder, solids, and etc., are stored in the plastic liner 300 (step 450). The lidding material 306 and peel-reseal lidding material 208 are heat sealed to the plastic liner 302 (step 452). As shown in Fig. 9, the plastic liner 300 can be optionally stored within a carton 303 with a plastic lid 309 and/or carton lid (not shown). The packaging system 300 is then transported, such as by ground or air transportation, to the user. Once received, the user can access the contents stored within the plastic liner 300 by first removing, if necessary, the plastic lid 309 and/or carton lid (not shown). The user then pulls back the center portion 318 of the peel-reseal lidding material 308 which exposes the lidding material 306 underneath

(step 454). For configurations in which the peel-reseal lidding material 308 includes a tab 312, the user can grasp the tab 312 using, for example, their fingers to facilitate opening the peel-reseal lidding material 308. The user breaks the lidding material 306 to access the contents within the plastic liner 302 (step 456). The user then reseals the contents within the plastic liner 302 by pulling the center portion 318 toward the plastic liner 302 and resealing the adhesive portion 326 against the remaining area 319 of the first layer 314 (step 458). Optionally, the plastic lid 309 and/or carton lid can be placed over the plastic liner 302.

[0051] By having a plastic liner 302 with a peel reseal lidding assembly 304, the contents within the plastic liner 302 can be sufficiently secured and protected during transportation. Further, because the opening of the plastic liner 302 can be resealed, the packaging system 300 can be used to store the contents even after the packaging system 300 has been opened. This saves the additional cost of storing the contents in separate containers.

[0052] Alternatively, the second layer can be a strip of adhesive having a width less than that of the center portion 318 and with one side affixed to the center portion 318 and a second side extending from the sides of the center portion 318 and having the resealable adhesive. In the foregoing description various embodiments of the present disclosure have been presented for the purpose of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise form disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiments were chosen and described to provide the best illustration of the principals of the invention and its practical application, and to enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth they are fairly, legally, and equitably entitled.

[0053] Figs. 12-14D illustrate an exemplary embodiment of a packaging system 1000 in accordance with the present invention in which the plastic liner 1050 has a peel and reseal lidding assembly 1040. It is appreciated that the packaging system 1000 shown and described in Figs. 12-14 can include one or more of the features in any combination described in the other examples described herein, or the packaging system can include none of the previously described features, whereby the scope of the invention is defined by the claims. For example, the packaging system 1000 can include any combination of a carton 1002, plastic liner 1050 having a rim 1005 peel and reseal lidding assembly 1040, and carton lid 1060.

[0054] As illustrated in Fig. 12, carton 1072 having side walls 1074 may receive the liner 1050. The flange and bottom wall of the liner 1050 may support the liner 1050

in the carton 1072. A peel and reseal lidding assembly may be attached to the liner 1050 on the flange 1055. A carton lid 1060 may include the liner 1050 and the peel and reseal lidding assembly within.

[0055] As illustrated in Fig. 13A, the peel and reseal lidding assembly 1040 includes a plurality of layers. A lidding material 1006 and a peel-reseal lidding material 1008. The lidding material 1006 may be similar to or include features of the lidding material 140 or 340 described above. The lidding material 1006 may be sealed to the plastic liner 1050 and cover the entire open area 1017 of the liner 1050. The lidding material 1006 may be a clear layer or an opaque layer or a translucent layer. The lidding material 1006 may be any suitable material used in the applicable industry. For example, coextruded nylon may be used. The lidding material 1006 may have a thickness from 0,0254 -0,508 mm. In one example, the lidding material may have a thickness of 0,1016 mm which, when paired with peel-reseal lidding material 1008, the peel and reseal lidding assembly 1040 may have a suitable rigidity and flexibility. For example, the lidding material 1008 may be sufficiently flexible to be folded over on itself or rolled-up into a roll while open. The lidding material 1008 may be sufficiently rigid to not fall into the opening under its own weight. The lidding material 1006 may be hermetically heat-sealed or laminated to the plastic liner 1050 such as described above.

[0056] The peel-reseal lidding material 1008 comprises a first layer 1014 and a second layer 1024. One layer may be a layer operable to reseal an open container. One layer may be a stiffening layer. The stiffing layer may be operable to limit the peel-reseal lidding material 1008 from folding over on itself under its own weight or small forces. The second layer may remain attached to at least a portion of the first layer. For example there may be multiple portions of the first layer as discussed below. The second layer may detachably connect to one portion of the first layer but remain attached to another portion as the first layer is open and closed along its opening.

[0057] The first layer may be any material that provides support to lidding material 1006 or that provides a suitable oxygen barrier. For example, the first layer 1014 may be a metallized oriented polypropylene (MOPP) layer. Metallized films are polymer films coated with a thin layer of metal, usually aluminum. They offer the glossy metallic appearance of an aluminum foil at a reduced weight and cost. Metallized films are widely used for decorative purposes and food packaging. Metallization is performed using a physical vapor deposition process. Aluminum may be a typical metal used for deposition, but other metals such as nickel or chromium are also used. The metal is heated and evaporated under vacuum. This condenses on the cold polymer film, which is unwound near the metal vapor source. This coating is much thinner than a metal foil (although a metal foil may also be used in various embodiments) could be made, in accordance with various embodiments in the range of 40ga to 100ga. For example, the first layer may be about 70ga MOPP. In

various embodiments, either polypropylene, nylon, polyethylene, cast polypropylene and polyethylene terephthalate (PET) may be used with metallization.

[0058] In accordance with various embodiments, the second layer may be formed from similar material as the first layer. However, the second layer may be formed without metallization. The second layer 1024 may hold the first layer 1014 closed with an adhesive applied to one side. Like the first layer, the second layer may be formed from polypropylene, nylon, polyethylene, cast polypropylene and polyethylene terephthalate (PET). The second layer may be formed from a variety of thicknesses such as 30ga to 90ga. For example, the second layer 1024 may be formed of about 50ga PET.

[0059] In accordance with various embodiments, the peel and reseal lidding assembly 1040 may be comprised of a stack of the second layer 1024 being 48ga PET with ink applied to nonstick areas (such as pull tab, see below) and with an adhesive applied to one side, the first layer 1014 being a 70ga Metallized OPP with an adhesive on both sides, and a lidding material 1006 being a 4Mil CO-EX nylon film adhered to one side of the first layer. This embodiment and similar embodiments may be used to package hot and cold materials. The assembly may have excellent hot tack and seal strength. The Metallized Structure gives the assembly improved oxygen and moisture barrier and good rigidity while maintaining some flexibility in order to keep the center portion 1018 (discussed in more detail below) moveable for opening.

[0060] To access the contents within the plastic liner 1050, the lidding material 1006 can be broken, torn, cut, pierced through, or the like. For example, an X shaped cut may open the lidding material 1006 to provide access into the container. An example cut 1023 through the lidding material is illustrated in Fig. 13D. Preferably, the lidding material 1006 can be broken, torn, or pierced through using a sharp object such as a knife, scissors, or the like. In some configurations, an indicator or marking can be provided instructing a user the preferred area to cut.

[0061] As with other embodiments, the packaging system 1000 has sufficient strength and rigidity such that it passes the appropriate shipping tests under the International Safe Transit Association ("ISTA"). In particular, the sealed packaging system 1000 preferably has sufficient strength and rigidity to pass the ISTA-3E shipping test or an equivalent test that challenges the capability of the packaging system and contents therein to withstand transport hazards. The lidding material 1006 also preferably acts as a tamper-evident system and can indicate to the user that the packaging system 1000 has been tampered with if the lidding material 1006 is broken.

[0062] The peel-reseal lidding material 1008 is heat-sealed along its edges 1002 to the lidding material 1006 and/or plastic liner 1050. The peel-reseal lidding material 1008 includes at least a first layer 1014 and a second layer 1024, such as a sealing layer, that are generally coextensive and adhered to each other. In the preferred

embodiment, the second layer 1024 is permanently affixed to the first layer 1014 and the first layer 1014 is positioned so that it faces the interior of the plastic liner 1050. The first layer 1014 and second layer 1024 can be of substantially the same size or in some configurations, the second layer 1024 can be smaller than the first layer 1014. The lidding material 1008 may be operable to lay flat, peel back flat (e.g. Fig. 13C), and roll up (e.g. Figs. 12 and 13D). The metallized layer may provide suitable rigidity to control the characteristics of the lidding material 1008.

[0063] In accordance with various embodiments, the liner 1050 may have any number of sides or any shape. For example, the liner 1050 may be substantially rectangular and the lidding material 1008 may have four edges 1002 corresponding to the geometry of the opening of the liner 1050. It will be appreciated that other liner geometries can be used, for example and without limitation, the opening of the liner 1050 could be circular, or polygonal with more or less than four sides.

[0064] The first layer 1014 includes a center portion 1018 and a remaining area 1019 adjacent the center portion 1018. The center portion 1018 is positioned at a predetermined distance from the edge 1002 of the peel-reseal lidding material 1008. The center portion 1018 is detached from the remaining portion 1019 along at least one edge 1022 such that the center portion 1018 is movable to expose the lidding material 1006 (which may be considered a second lidding material) thereunder. The lidding material 1006 may be defined by at least one edge 1027. The lidding material 1006 may be sealed to the remaining portion 1019 and the center portion 1018 across the detached edge 1022. The peel-reseal lidding material 1008 is resealable to seal the contents in the plastic liner when the lidding material is broken. The center portion 1018's detached edge 1022 may terminate in an inwardly turning curve 1029. In another example, as illustrated in Fig. 13G, 1022 may terminate in an outwardly turning curve 1031. The curve (inwardly or outwardly curving) turns at least 90°. The curve 1029, 1031 may turn about 180°. The termination points 1033 wraps back around toward where the center portion 1018 opens such that as the center portion opens and folds across a hinge section 1015, stress is reduced on the edge termination because the opening action is not pulled towards the termination but away from it, reducing the likelihood of tearing. Once the center portion 1018 is moved to an open position, the second lidding material 1006 is exposed thereunder.

[0065] In various examples, the center portion 1018 may be defined by the at least one edge 322. The one edge may make a single slit for axis or it may make any of a variety of shapes to create an opening in the first layer 1014. In various examples, the center portion 1018 may be defined by four edges as illustrated in Figs. 13A-G. Although as illustrated in Fig. 13F, the at least one edge can have a variety of forms some of which are illustrated as examples, but a person of skill in the art

would recognize that based on this disclosure any shape may be utilized. In one example, at least three of the edges. The detached edges 1022 may be perforated, cut, or slit that separates the three edges of the center portion 1018 from the remaining area 1019 of the first layer 1014. The fourth or remaining edge of the center portion 1018 is preferably affixed to the remaining area 1019 to act as a hinge 1015 so that the center portion 1018 can be pulled back to expose the lidding material 1006 thereunder. The center portion 1018 of the peel-reseal lidding material 1008 can then be resealed to seal the open area 1017 of the plastic liner 1050 when the lidding material 1006 has been broken. As the first layer is opened via the hinge, the second layer 1024 remains attached to the center portion 1018 while releasing from the remaining edge 1018.

[0066] The reseal is possible because an adhesive portion 1026 overlaps the detached edges 1022 from the center portion 1018 to the remaining area 1019, such that when the adhesive portion 1026 is attached to the remaining area 1019 it is also attached to the center portion 1018, thereby sealing the peel-reseal lidding material 1008. Adhesive portion 1026 may be a distance of D wide as illustrated in Figs. 13B-C. D may be typically be greater than 1/8 of an inch. In various examples, D may be from 1/4 to 1/2 inch wide. The adhesive portion 1026 includes a resealable adhesive 1010 on the bottom surface of the adhesive portion 1026 facing the interior of the plastic lid 1002. As the user pulls back the center portion 1018, the adhesive portion 1026 is also pulled back with the center portion 1018. The adhesive portion 1026 preferably includes a resealable adhesive material that can seal and reseal multiple times to facilitate resealing the center portion 1018 against the peel-reseal lidding material 1008, for example, against the portion of the first layer 1014 adjacent the center portion 1018 and edge 1002. The 1024 also extends across the curve 1029 and termination points 1033.

[0067] As indicated above, the peel-reseal lidding material 1008 includes a tab 1012. The tab 1012 may have similar adhesion to the rest of second layer 1024 or the tab 1012 may have lower adhesion as compared to the rest of the layer 1024. In various embodiments, tab 1012 may not be adhered to the lidding material 1006. This may allow the user to easily grasp the tab 1012 and pull back the center area 1018 of the peel-reseal lidding material 1008 from the lidding material 1006. In some configurations, the tab can be a portion of either the first layer 1014 or second layer 1024. In yet other configurations, no tab can be provided. In one example, the center portion's 1018 detached edge 1022 includes a first edge 1035 and a second edge 1037 (see Fig. 13C). The peel-reseal lidding material 1008 includes a corner tab 1012 that is defined by an area where the first edge 1035 and the second edge 1037 meet at a corner. The tab is operable to extend away from the surface of peel-reseal lidding material 1008 such that it can be gripped and pulled. Tab 2012 may be movable such that it can be

operatively pulled away from the first lidding material 1014. This separation from lidding material 1014 allows for separation between the portion of second layer 1024 and first layer 1014 which is attached along the remaining portion 1019. This attachment may be adjacent the first edge 1035 and the second edge 1037. The second layer 1024 is separable from the remaining portion 1019 starting at a point on either side and proximate to the tab 2012. The separation continues to move along both the first edge 1035 and the second edge 1037 as the tab is further moved from the first lidding material 1014. The separation progresses moving distally away from the tab 1012 as the tab 1012 is separated from the first lidding material 1014. In yet other configurations, the tab can be located at an intermediate length along any edge, or no tab can be provided.

[0068] Fig. 14A-D illustrates various embodiments of liner 1050. With regard to the various embodiments as illustrated in Figs. 14A-E, all other embodiments, features, and examples described with regard to other embodiments may also be combined herein. The liner 1050 may comprise at least one side wall 1052. In the example shown in Figs. 14A-E, the liner 1050 includes four side walls 1052 and a bottom wall 1053. The four side walls 1052 define an open area 1017. At the termination of the side walls 1052 distal to the bottom wall 1053 is a rim 1056. The rim 1056 may include a flange 1055 which extends outwardly (i.e. away from each of the side walls 1052.) The flange 1055 may include a skirt 1057. The skirt 1057 may extend downwardly (i.e. toward a plane defined by the bottom wall but not toward the side walls).

[0069] In accordance with various embodiments, the liner 1050 includes a plurality of positioning features. The liner 1050 is operable to be located inside of a carton 1072. The carton includes walls 1074 that define its perimeter. The liner 1050 and the cavity defined by walls 1074 may nest within each other, such that liner 1050 can be located inside of the interior of carton 1072. The liner 1050 may none-the-less shift within the carton. The packaging assembly 1000 is operable to be used safely and securely with a broad range of contents. As such, in various embodiments a snug fit between carton 1072 and liner 1050 may improve the utility of the packaging assembly 1000. To that end in various embodiments, the package assembly 1000 may include non-movement elements. Non-movement elements may include protrusions that contact the carton 1072. For example, these may include skirt ribs, wall protrusions, specialized corners, or any feature which limits movement between the carton and the liner.

[0070] In various examples, a liner 1050 may rest on the top edge of wall 1074 via the flange portion 1055 which extends from the rim of liner 1050. The skirt 1057 provides a pocket between the side wall 1052 and the interior surface 1059 of skirt 1057 to receive wall 1074 to aid in a more snug fit for the packaging assembly 1000. The skirt may also include a plurality of ribs 1071. The plurality of ribs 1071 may extend from or into the surface

1059 of skirt 1057. The plurality of ribs 1071 extend from the flange portion 1055 down to the end of the skirt. By forming these protrusions into or away from the skirt 1057, the surface 1059 of the skirt is strengthened. The ribs may also act spacers to form a better fit around the wall 1074. For example, ribs 1071 may extend toward side wall 1052 at a plurality of finite points. These finite points could interfere with the wall or merely close the gap toward the wall 1074 when the liner 1050 is installed in a carton 1072 and the wall 1074 extends into the cavity between the skirt 1057 and the side wall 1052. Because the points are spread and friction and pressure are minimized, even if they interfere, they may not prevent the liner 1050 from mating with the carton 1072. The skirt 1057 may also include a flare 1073 that extends away from the side wall. The flare 1073 may also extend around the perimeter. The flare may be operable to help the skirt 1057 receive the wall 1074 when inserting the liner 1050 into the carton 1073. As the flare 1073 extends away from the side wall 1052, the flare 1073 forms a wider entrance for receiving the wall 1074 into the gap between skirt 1057 and the side wall 1052.

[0071] The outer corner for the skirt may be any type of corner. For example, it could be round like the wall 1052 intersection. In another example, the skirt corner could be different than the wall 1052 corner. For example, the skirt corner may be a shape that helps secure the carton 1073. In one example, side walls 1052 may include a rounded corner proximate the side wall and the skirt may include a outer corner proximate the skirt. The outer corner may interface with other elements (see below) or its shape, alone, may improve pressure on the carton with the resultant improved fit.

[0072] The skirt includes a rib 1079 which extends generally parallel with the flange portion on at least one of the outer corners on the side of the skirt. The rib 1079 may be located proximate the flange portion. The rib may form a ledge the aids in grabbing to lift the liner 1050 or the rib may be a stiffening feature.

[0073] In accordance with various embodiments, the side walls 1052 may include features to improve fitment with the carton. For example, on each of the corners of the side walls 1052 a protrusion may be located adjacent the end of the skirt. The protrusion 1075 may be located opposite the skirt and separate from the protrusion 1075 by the flange portion. In this way there is a gap between the end of the skirt and the protrusion. As stated above, the skirt may have a outer corner connection and the corner connection may be located adjacent another feature such as the protrusion 1075, which may also be located on the corners. As such, the carton may even receive a tighter fit when positioned between the outer corner and the protrusion 1075. The protrusion may be located anywhere on the liner 1050 such that it is operable to exert outward pressure when the liner is slid into a carton 1072. However, by placing the protrusion 1075 opposite the skirt 1057, a sandwich is formed, thereby potentially increasing the pressure from both sides on

the wall 1074 and improving the fitment. The protrusion 1075 may be a protrusion that curves out and away from the side wall 1052. The protrusion 1075 may have a smaller curvature than the surface of sidewall 1052 such as the surface at the rounded corner. The smaller curvature may result in improved contact between an outer surface of the protrusion and the carton as compared to an outer surface of the rounded corner. This is because the smaller curvature may make closer and more complete contact with the carton in a place such as a corner. In accordance with various embodiments, the protrusion 1075 may include a rib 1077. The rib 1077 may bisect the protrusion extending from a side of the protrusion 1075 proximate the bottom wall 1053 to a side of the protrusion proximate the flange 1055. The rib 1077 may add strength to the protrusion such that it is able to exert more outward pressure such as on the carton 1072.

[0074] In accordance with an exemplary method 1100 of forming the peel-reseal lidding assembly 1040, the first layer may be obtained (step 1110). The first layer as discussed above may be a metallized OPP layer. This may come on large bulk rolls of material. The center portion may be cut into the first layer (step 1120). As discussed briefly above, the first layer may be cut, torn, perforated or the like to form the detached edge that defines the center portion. Once the first layer is prepped and the center portion is formed, the first layer may be attached to an additional layer. In one embodiment, it may be attached to the second layer which may be the layer that peels and reseals with the first layer. Alternatively, the third layer of material may be attached to the first layer next (step 1140). Either order is contemplated herein. The third layer of material may be the lidding material 106 which may function as the tamper evident seal. The third layer may be heat-sealed to the first layer. The two layers may be cut such that they are coextensive with one another. A finalized product may be formed of a plurality of layers. Each may provide a separate function, e.g. tamper evident, oxygen barrier, peel-reseal characteristics.

[0075] In accordance with an exemplary process, as illustrated in Fig. 16, a system may prepare the packaging assembly 1000 on a production line. The system may receive cartons from a box erector, obtain liners, fill the liner, seal the peel-reseal assembly onto the liner, place the liner into the carton, places a carton lid onto the carton, and then palletizes the final packaging assembly.

[0076] Although various representative embodiments of this invention have been described above with a certain degree of particularity, those skilled in the art could make numerous alterations to the disclosed embodiments without departing from the scope of the inventive subject matter set forth in the claims. All directional references (e.g., upper, lower, upward, downward, left, right, leftward, rightward, top, bottom, above, below, vertical, horizontal, clockwise, and counterclockwise) are only used for identification purposes to aid the reader's understanding of the embodiments of the present invention, and do not

create limitations, particularly as to the position, orientation, or use of the invention unless specifically set forth in the claims. Joinder references (e.g., attached, coupled, connected, and the like) are to be construed broadly and may include intermediate members between a connection of elements and relative movement between elements. As such, joinder references do not necessarily infer that two elements are directly connected and in fixed relation to each other.

[0077] In some instances, components are described with reference to "ends" having a particular characteristic and/or being connected with another part. However, those skilled in the art will recognize that the present invention is not limited to components which terminate immediately beyond their points of connection with other parts. Thus, the term "end" should be interpreted broadly, in a manner that includes areas adjacent, rearward, forward of, or otherwise near the terminus of a particular element, link, component, part, member or the like. In methodologies directly or indirectly set forth herein, various steps and operations are described in one possible order of operation, but those skilled in the art will recognize that steps and operations may be rearranged, replaced, or eliminated without necessarily departing from the scope of the present invention. It is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative only and not limiting. Changes in detail or structure may be made without departing from the scope of the invention as defined in the appended claims.

Claims

1. A packaging assembly for holding contents, comprising:

a self-supporting plastic liner (1050) for holding contents and having a side wall (1052), a closed bottom end being a bottom wall (1053) formed integral with the side wall (1052), and an open top end (1017) having an outwardly-projecting rim (1005), said rim (1005) comprising a flange portion (1055); and

a peel-reseal lidding assembly (1040) being characterized by including:

a first layer (1014) defined by at least one edge, wherein the first layer (1014) is heat-sealed to the plastic liner (1050) at the at least one edge at the open top end (1017) operably sealing the contents therein, wherein a center portion (1018) of the first layer (1014) is detached from a remaining portion (1019) along at least one edge (1022) such that the center portion (1018) is movable to expose a lidding material (1006) thereunder; and

- a second layer (1024) defined by at least one edge that is sealed to the remaining portion (1019) and the center portion (1018) across the detached edge (1022), wherein the second layer (1024) is resealable to seal the contents in the plastic liner (1050) when the lidding material (1006) is broken.
2. The packaging assembly of claim 1, wherein the center portion's at least one edge (1022) terminates in one of at least an inwardly turning curve (1029) or an outwardly turning curve (1031) either one of which turns at least 90° such that stress is reduced on the edge termination when the center portion (1018) is moved exposing the lidding material (1006) thereunder.
 3. The packaging assembly of claim 1, wherein the second layer (1024) extends across the center portion's surface area and edge termination, wherein the second layer (1024) extends off the center portion's surface area, past the at least one edge (1022) by more than 3,175mm.
 4. The packaging assembly of claim 2, wherein the center portion's at least one edge (1022) is a first side edge and a second side edge connected by a front edge, wherein the side edges terminate as mirror images of one another.
 5. The packaging assembly of claim 3, wherein the center portion's at least one edge (1022) is at least a first edge and a second edge, wherein the second layer (1024) includes a corner tab (1012) defined by an area where the first edge and the second edge meet at a corner; the tab (1012) being operable to be gripped and pulled, wherein as the corner tab (1012) is movable away from the first layer (1014) such that the portion of the second layer (1024) attached to the remaining portion (1019), that is adjacent the first edge and the second edge, is separable from the remaining portion (1019) starting at a point proximate to the tab (1012) and progressing distally from the tab (1012) as the tab (1012) is moved away from the first layer (1014).
 6. The packaging assembly of claim 1, wherein the first layer (1014) is one of at least a metallized or a layer of thin metal which provides stiffness to the peel-reseal lidding assembly (1040) sufficient to reduce the area that force is applied to reseal the second layer (1024) to the remaining portion (1019).
 7. The packaging assembly of claim 1, wherein the second layer (1024) and the center portion (1018) are shaped such they can be rolled and attached to one of at least the peel-reseal lidding assembly (1040), the plastic liner (1050), or a carton (1072) in which the plastic liner (1050) is located.
 8. The packaging assembly of claim 1, wherein the second layer (1024) is coextensive with the first layer (1014).
 9. The packaging assembly of claim 1, wherein a skirt portion (1057) may extend from the flange portion (1055), wherein when the self-supporting plastic liner (1050) is inside of a carton (1072), the flange portion (1055) rests generally on a top edge of the carton (1072) and the skirt portion (1057) rests along a side wall of the carton (1072).
 10. The packaging assembly according to claim 3, wherein the plastic liner (1050) rests on and is supported by a bottom wall of the carton (1072).
 11. The packaging assembly of claim 3, further comprising a carton lid (1060) fitting over the carton (1072), the peel-reseal lidding assembly (1040), and plastic liner (1050).
 12. A packaging assembly according to claim 1, wherein the plastic liner (1050) is made of recyclable high-density polyethylene.
 13. A packaging assembly according to claim 1, wherein the first layer (1014) is affixed to the entire perimeter of the flange (1055) of the plastic liner (1050).
 14. A packaging assembly according to claim 1, wherein a skirt portion (1057) extends at a downward angle away from the flange portion (1055), wherein the flange portion (1055), the side wall (1052), or the skirt portion (1057) includes a plurality of positioning features defined by surface features, and wherein the peel-reseal lidding assembly (1040) is attached to the flange portion (1055).
- Patentansprüche**
1. Verpackungsanordnung zum Aufbewahren von Inhalten, die Folgendes umfasst:
 - eine selbsttragende Kunststoff-Auskleidung (1050) zum Aufbewahren von Inhalten, die eine Seitenwand (1052) und ein geschlossenes Bodenende umfasst, welches durch eine Bodenwand (1053) gebildet wird, die integral mit der Seitenwand (1052) ausgebildet ist, und ein offenes oberes Ende (1017), das einen nach außen vorstehenden Rahmen (1005) hat, wobei der Rahmen (1005) einen Flanschabschnitt (1055) umfasst; und
 - eine abziehbare wiederverschließbare (peel-reseal) Deckelanordnung (1040), die **dadurch ge-**

kennzeichnet ist, dass sie Folgendes umfasst:

- eine erste Schicht (1014), die durch mindestens einen Rand definiert ist, wobei die erste Schicht (1014) an dem mindestens einen Rand an dem offenen oberen Ende (1017) mit der Kunststoff-Auskleidung (1050) verschweißt ist, um die darin enthaltenen Inhalte dicht einzuschließen, wobei ein mittlerer Abschnitt (1018) der ersten Schicht (1014) entlang mindestens eines Randes (1022) von einem verbleibenden Abschnitt (1019) getrennt ist, so dass der mittlere Abschnitt (1018) bewegbar ist, um ein darunter befindliches Deckelmaterial (1006) freizulegen; und
- eine zweite Schicht (1024), die durch mindestens einen Rand definiert ist, der mit dem verbleibenden Abschnitt (1019) und dem mittleren Abschnitt (1018) über den gelösten Rand (1022) dicht verbunden ist, wobei die zweite Schicht (1024) wiederverschließbar ist, um die Inhalte in der Kunststoff-Auskleidung (1050) zu verschließen, wenn das Deckelmaterial (1006) aufgebrochen ist.
2. Verpackungsanordnung nach Anspruch 1, wobei der mindestens eine Rand (1022) des mittleren Abschnitts in mindestens einer nach innen gekrümmten Kurve (1029) oder einer nach außen gekrümmten Kurve (1031) endet, die jeweils um mindestens 90° gekrümmt ist, so dass eine Belastung an dem Randende verringert ist, wenn der mittlere Abschnitt (1018) bewegt wird, um das darunterliegende Deckelmaterial (1006) freizulegen.
 3. Verpackungsanordnung nach Anspruch 1, wobei die zweite Schicht (1024) sich über den Flächenbereich des mittleren Abschnitts und den Randabschluss erstreckt, wobei die zweite Schicht (1024) sich von dem Flächenbereich des mittleren Abschnitts, über den mindestens einen Rand (1022) hinaus, um mehr als 3,175 mm erstreckt.
 4. Verpackungsanordnung nach Anspruch 2, wobei der mindestens eine Rand (1022) des mittleren Abschnitts ein erster Seitenrand und ein zweiter Seitenrand ist, die durch einen vorderen Rand verbunden sind, wobei die Seitenränder als Spiegelbilder voneinander enden.
 5. Verpackungsanordnung nach Anspruch 3, wobei der mindestens eine Rand (1022) des mittleren Abschnitts mindestens ein erster Rand und ein zweiter Rand ist, wobei die zweite Schicht (1024) ein Eckenstück (1012) umfasst, welches durch einen Bereich definiert wird, in dem der erste Rand und der zweite Rand sich an einer Ecke treffen; wobei das Eckenstück (1012) betätigbar ist, indem es gegriffen und gezogen wird, wobei das Eckenstück (1012) von der ersten Schicht (1014) fortbewegbar ist, so dass der an dem verbleibenden Abschnitt (1019) befestigte Abschnitt der zweiten Schicht (1024), die an den ersten Rand und den zweiten Rand angrenzt, von dem verbleibenden Abschnitt (1019) beginnend an einem Punkt in der Nähe des Eckenstücks (1012) und zunehmend distal von dem Eckenstück (1012) trennbar ist, während das Eckenstück (1012) von der ersten Schicht (1014) fortbewegt wird.
 6. Verpackungsanordnung nach Anspruch 1, wobei die erste Schicht (1014) eine metallisierte Schicht oder eine Schicht aus dünnem Metall ist, die der abziehbaren und wiederverschließbaren Deckelanordnung (1040) ausreichend Steifigkeit verleiht, um die Fläche zu verringern, auf die eine Kraft ausgeübt wird, um die zweite Schicht (1024) zum Wiederverschließen mit dem verbleibenden Abschnitt (1019) zu verbinden.
 7. Verpackungsanordnung nach Anspruch 1, wobei die zweite Schicht (1024) und die mittlere Schicht (1080) so geformt sind, dass sie aufgerollt werden können und an der abziehbaren und wiederverschließbaren Deckelanordnung (1040), der Kunststoff-Auskleidung (1050) oder einem Karton (1072), in dem die Kunststoff-Auskleidung (1050) angeordnet ist, befestigt werden können.
 8. Verpackungsanordnung nach Anspruch 1, wobei sich die zweite Schicht (1024) gemeinsam mit der ersten Schicht (1014) erstreckt.
 9. Verpackungsanordnung nach Anspruch 1, wobei ein Schürzenabschnitt (1057) sich von dem Flanschabschnitt (1055) erstrecken kann, wobei wenn sich die selbsttragende Kunststoff-Auskleidung (1050) innerhalb eines Kartons (1072) befindet, der Flanschabschnitt (1055) im Wesentlichen auf einem oberen Rand des Kartons (1072) ruht und der Schürzenabschnitt (1057) entlang einer Seitenwand des Kartons (1072) ruht.
 10. Verpackungsanordnung nach Anspruch 3, wobei die Kunststoff-Auskleidung (1050) auf einer Bodenwand des Kartons (1072) ruht und von diesem gestützt wird.
 11. Verpackungsanordnung nach Anspruch 3, die ferner einen Kartondeckel (1060) umfasst, der über den Karton (1072), die abziehbare und wiederverschließbare Deckelanordnung (1040) und die Kunststoff-Auskleidung (1050) passt.

12. Verpackungsanordnung nach Anspruch 1, wobei die Kunststoff-Auskleidung (1050) aus recyclebarem Polyethylen hoher Dichte besteht.
13. Verpackungsanordnung nach Anspruch 1, wobei die erste Schicht (1014) an dem gesamten Umfang des Flansches (1055) der Kunststoff-Auskleidung (1050) befestigt ist.
14. Verpackungsanordnung nach Anspruch 1, wobei ein Schürzenabschnitt (1057) sich in einem nach unten geneigten Winkel von dem Flanschabschnitt (1055) fort erstreckt, wobei der Flanschabschnitt (1055), die Seitenwand (1052) oder der Schürzenabschnitt (1057) eine Mehrzahl von Positionierungsmerkmalen umfasst, die durch Oberflächenmerkmale definiert sind, und wobei die abziehbare und wiederver-schließbare Deckelanordnung (1040) an dem Flanschabschnitt (1055) befestigt ist.

Revendications

1. Ensemble d'emballage destiné à renfermer un contenu et comprenant :

un revêtement interne en plastique autoportant (1050) destiné à renfermer un contenu et présentant une paroi latérale (1052), une extrémité inférieure fermée qui est une paroi inférieure (1053) solidaire de la paroi latérale (1052), et une extrémité supérieure ouverte (1017) présentant un rebord faisant saillie vers l'extérieur (1005), ledit rebord (1005) comprenant une partie bride (1055) ; et

un ensemble d'opercule pelable et refermable (1040) étant **caractérisé en ce qu'il** comporte :

une première couche (1014) définie par au moins un bord, dans lequel la première couche (1014) est thermoscellée sur le revêtement interne en plastique (1050) au niveau de l'au moins un bord à l'extrémité supérieure ouverte (1017), scellant fonctionnellement le contenu à l'intérieur de celui-ci, dans lequel une partie centrale (1018) de la première couche (1014) est détachée d'une partie restante (1019) le long d'au moins un bord (1022) de sorte que la partie centrale (1018) est mobile pour exposer un matériau d'opercule (1006) sous celle-ci ; et une seconde couche (1024) définie par au moins un bord qui est scellée sur la partie restante (1019) et la partie centrale (1018) sur tout le bord détaché (1022), dans lequel la seconde couche (1024) est refermable pour sceller le contenu dans le revêtement

interne en plastique (1050) en cas de rupture du matériau d'opercule (1006).

2. Ensemble d'emballage selon la revendication 1, dans lequel l'au moins un bord (1022) de la partie centrale se termine au moins soit par une courbe tournée vers l'intérieur (1029), soit par une courbe tournée vers l'extérieur (1031), l'une ou l'autre desquelles tourne d'au moins 90° de sorte que les contraintes sont réduites sur la partie terminale du bord lorsque la partie centrale (1018) est déplacée et expose le matériau d'opercule (1006) sous celle-ci.
3. Ensemble d'emballage selon la revendication 1, dans lequel la seconde couche (1024) s'étend sur toute la surface de la partie centrale et la partie terminale du bord, dans lequel la seconde couche (1024) s'étend hors de la surface de la partie centrale, dépassant l'au moins un bord (1022) de plus de 3.175 mm.
4. Ensemble d'emballage selon la revendication 2, dans lequel l'au moins un bord (1022) de la partie centrale est un premier bord latéral et un second bord latéral reliés par un bord avant, dans lequel les bords latéraux se terminent par des images-miroirs l'un de l'autre.
5. Ensemble d'emballage selon la revendication 3, dans lequel l'au moins un bord (1022) de la partie centrale est au moins un premier bord et un second bord, dans lequel la seconde couche (1024) comporte une languette de coin (1012) définie par une zone où le premier bord et le second bord se rejoignent dans un coin ; la languette (1012) étant conçue pour être saisie et tirée, dans lequel la languette de coin (1012) peut être écartée de la première couche (1014) de sorte que la partie de la seconde couche (1024) fixée à la partie restante (1019), qui est adjacente au premier bord et au second bord, est séparable de la partie restante (1019) en partant d'un point situé à proximité de la languette (1012) et en avançant distalement par rapport la languette (1012) au fur et à mesure que la languette (1012) s'écarte de la première couche (1014).
6. Ensemble d'emballage selon la revendication 1, dans lequel la première couche (1014) est au moins soit une couche métallisée, soit une couche de métal mince qui confère à l'ensemble d'opercule pelable et refermable (1040) une rigidité suffisante pour réduire la zone où une force est appliquée pour sceller à nouveau la seconde couche (1024) sur la partie restante (1019).
7. Ensemble d'emballage selon la revendication 1, dans lequel la seconde couche (1024) et la partie centrale (1018) ont une forme qui leur permet d'être

laminées et fixées à au moins soit l'ensemble d'operculage pelable et refermable (1040), soit le revêtement interne en plastique (1050), soit une boîte en carton (1072) dans laquelle se trouve le revêtement interne en plastique (1050).

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8. Ensemble d'emballage selon la revendication 1, dans lequel la seconde couche (1024) coïncide avec la première couche (1014).

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9. Ensemble d'emballage selon la revendication 1, dans lequel une partie jupe (1057) peut s'étendre à partir de la partie bride (1055), dans lequel lorsque le revêtement interne en plastique autoportant (1050) se trouve à l'intérieur d'une boîte en carton (1072), la partie bride (1055) repose généralement sur un bord supérieur de la boîte en carton (1072) et la partie jupe (1057) repose le long d'une paroi latérale de la boîte en carton (1072).

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10. Ensemble d'emballage selon la revendication 3, dans lequel le revêtement interne en plastique (1050) repose sur une paroi inférieure de la boîte en carton (1072) et est en appui sur celle-ci.

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11. Ensemble d'emballage selon la revendication 3, comprenant en outre un couvercle de boîte en carton (1060) s'adaptant sur la boîte en carton (1072), l'ensemble d'operculage pelable et refermable (1040), et un revêtement interne en plastique (1050).

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12. Ensemble d'emballage selon la revendication 1, dans lequel le revêtement interne en plastique (1050) est constitué de polyéthylène haute densité recyclable.

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13. Ensemble d'emballage selon la revendication 1, dans lequel la première couche (1014) est fixée sur tout le périmètre de la bride (1055) du revêtement interne en plastique (1050).

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14. Ensemble d'emballage selon la revendication 1, dans lequel une partie jupe (1057) s'étend selon un angle descendant en s'écartant de la partie bride (1055), dans lequel la partie bride (1055), la paroi latérale (1052) ou la partie jupe (1057) comporte une pluralité d'éléments de positionnement définis par des éléments de surface, et dans lequel l'ensemble d'operculage pelable et refermable (1040) est fixé à la partie bride (1055).

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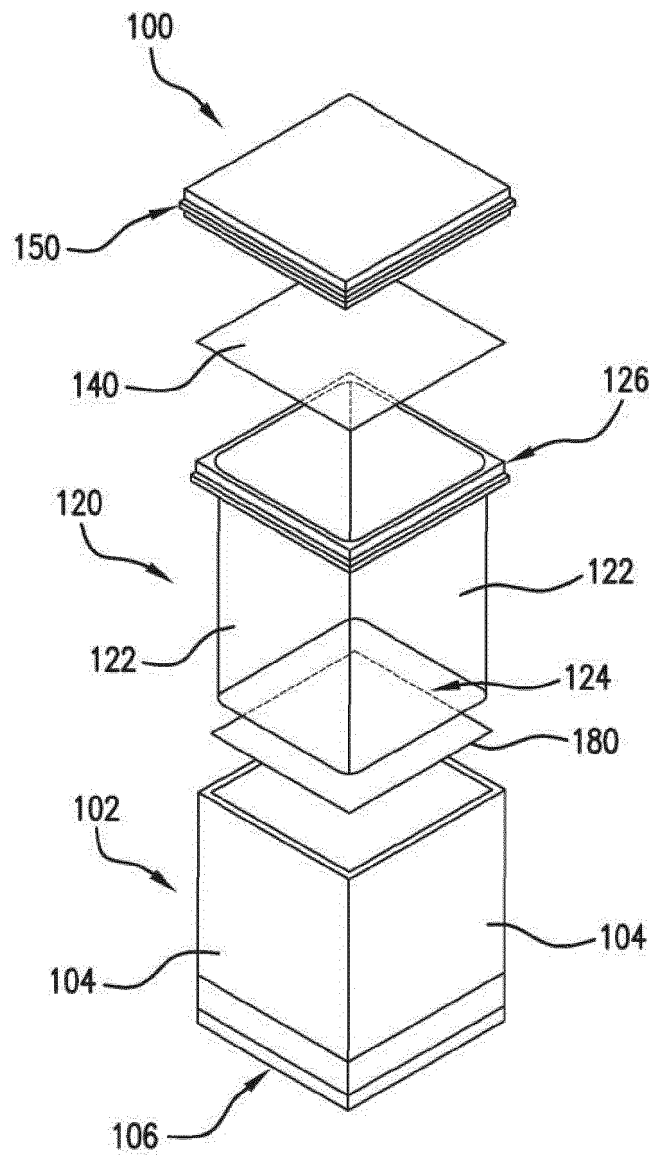


FIG. 1A
(PRIOR ART)

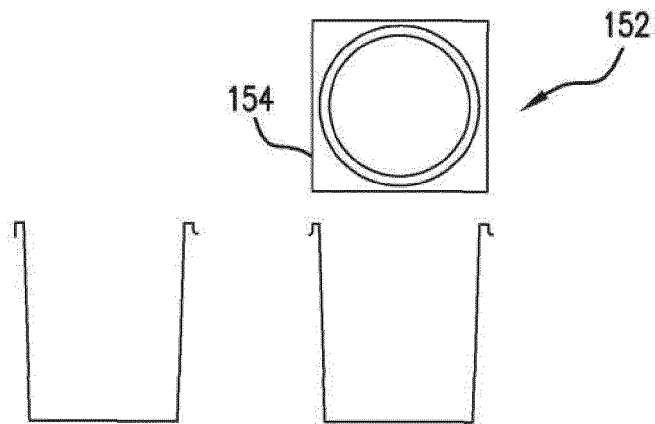


FIG. 1B
(PRIOR ART)

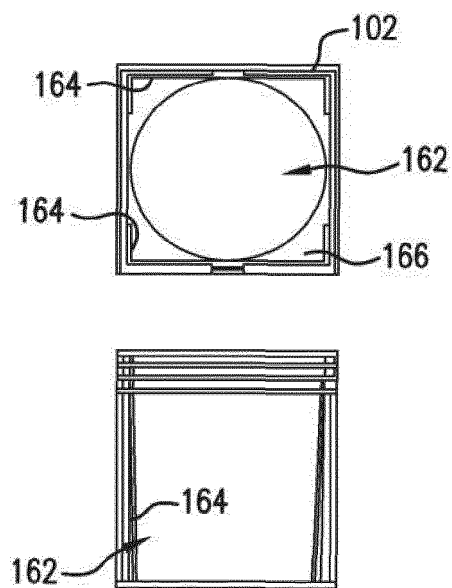


FIG. 1C
(PRIOR ART)

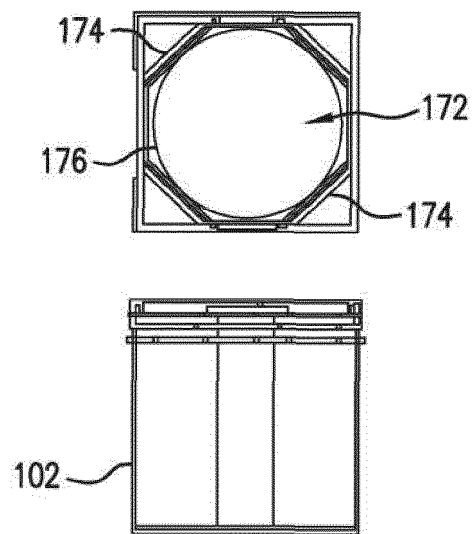


FIG. 1D
(PRIOR ART)

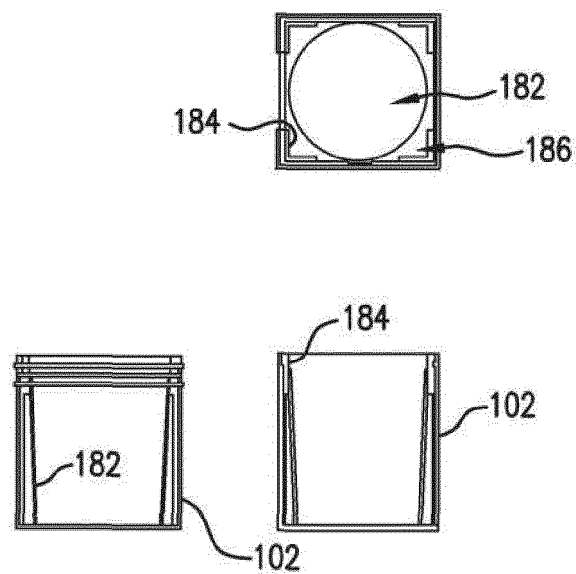


FIG. 1E
(PRIOR ART)

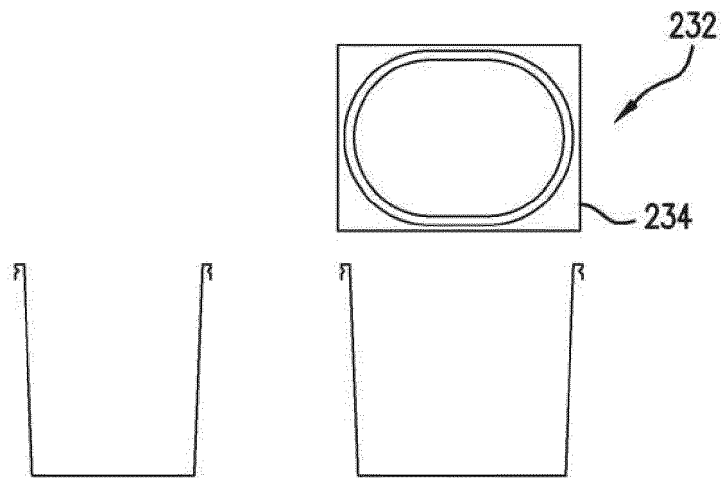


FIG. 1F
(PRIOR ART)

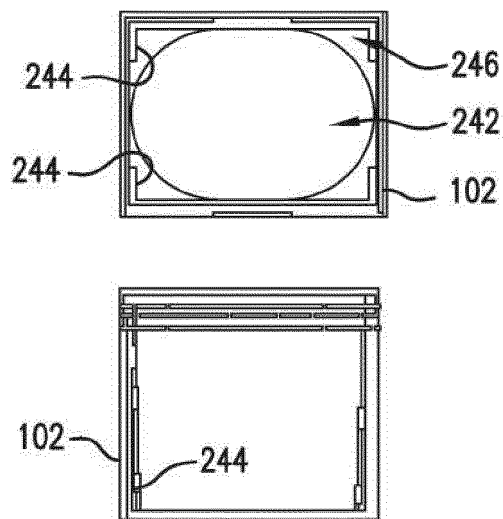


FIG. 1G
(PRIOR ART)

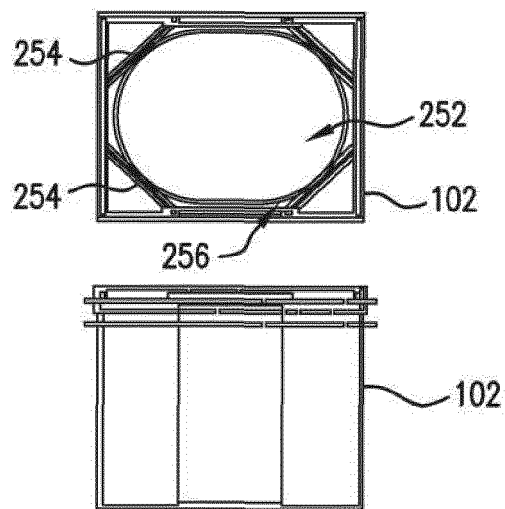


FIG. 1H
(PRIOR ART)

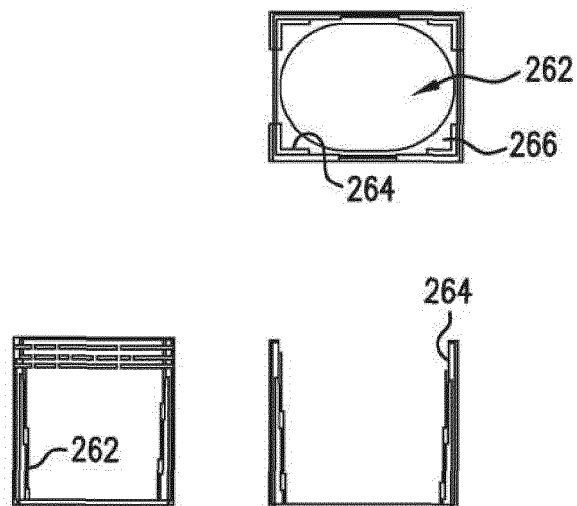


FIG. 1I
(PRIOR ART)

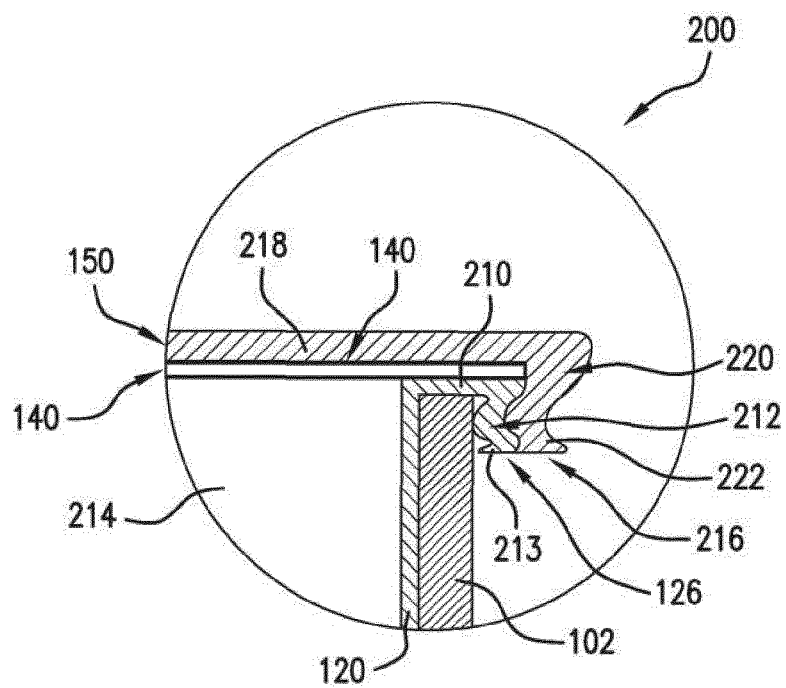


FIG. 2
(PRIOR ART)

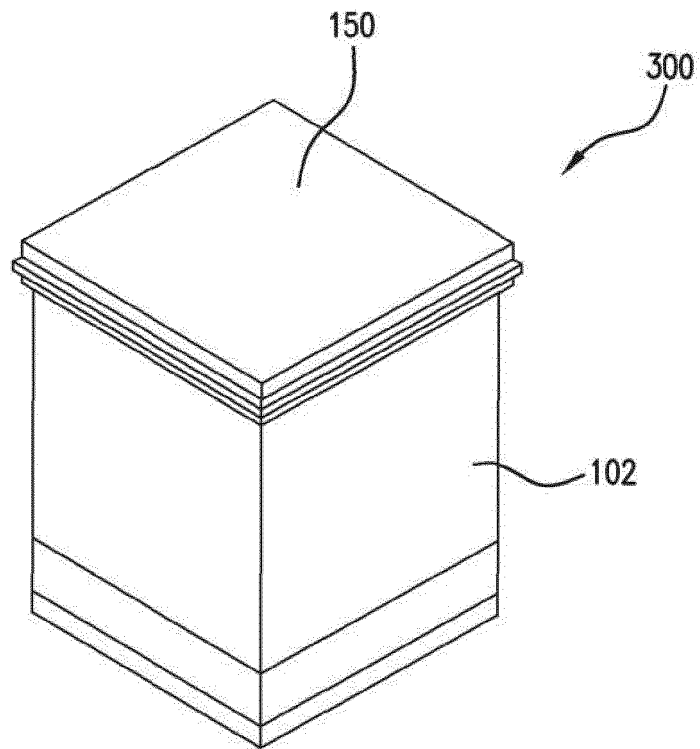


FIG. 3
(PRIOR ART)

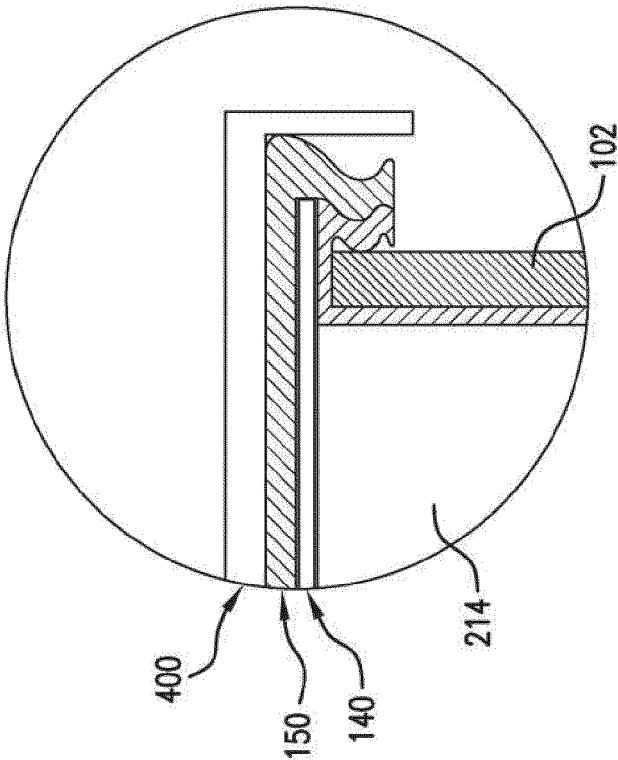


FIG. 4A
(PRIOR ART)

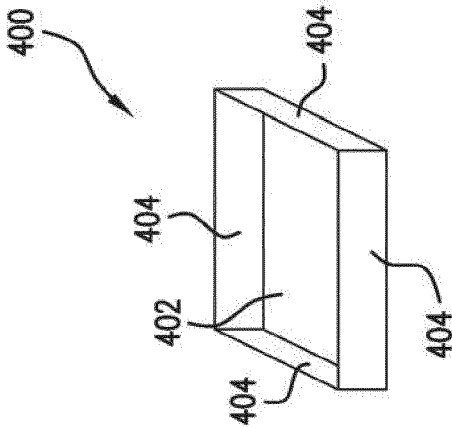


FIG. 4B
(PRIOR ART)

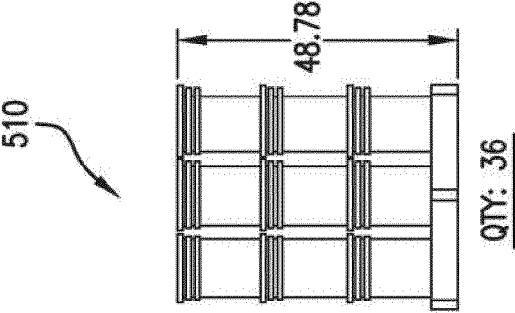


FIG. 5A
(PRIOR ART)

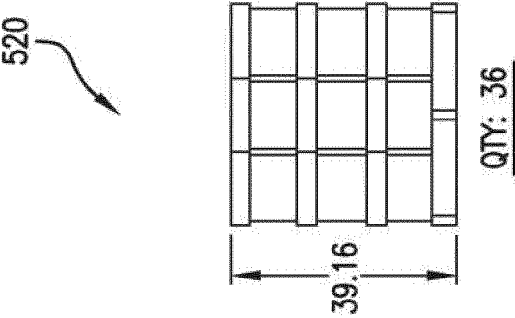


FIG. 5B
(PRIOR ART)

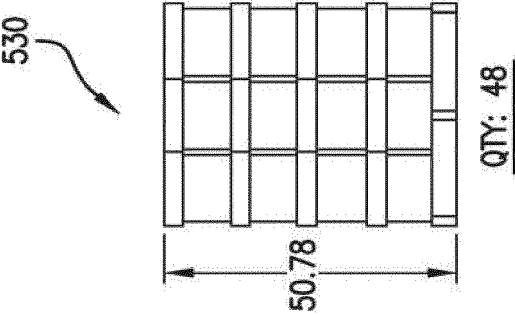


FIG. 5C
(PRIOR ART)

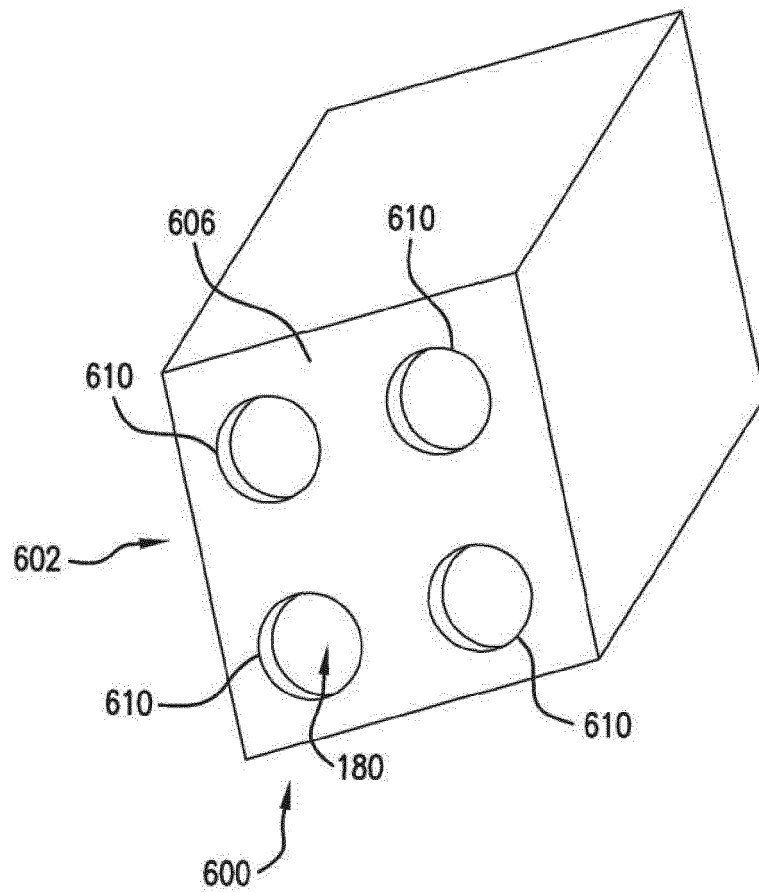


FIG. 6
(PRIOR ART)

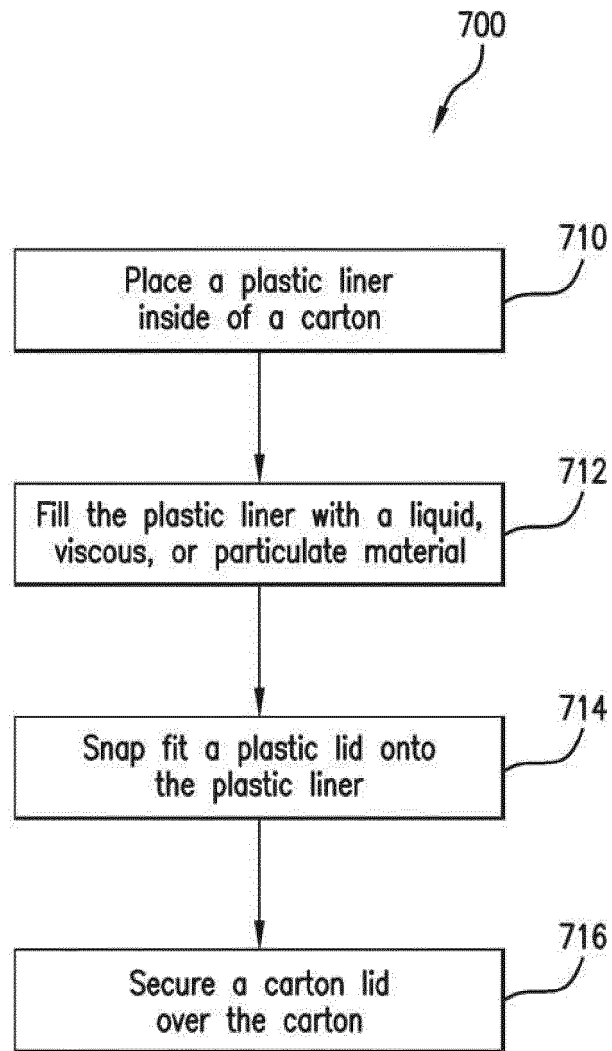


FIG. 7
(PRIOR ART)

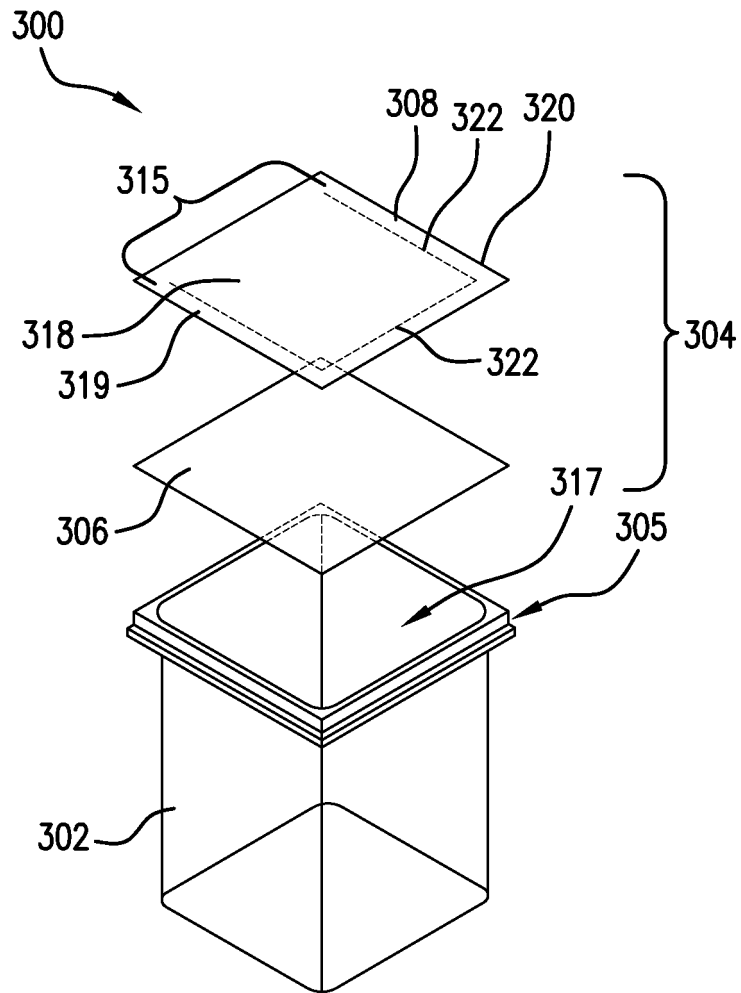


FIG. 8

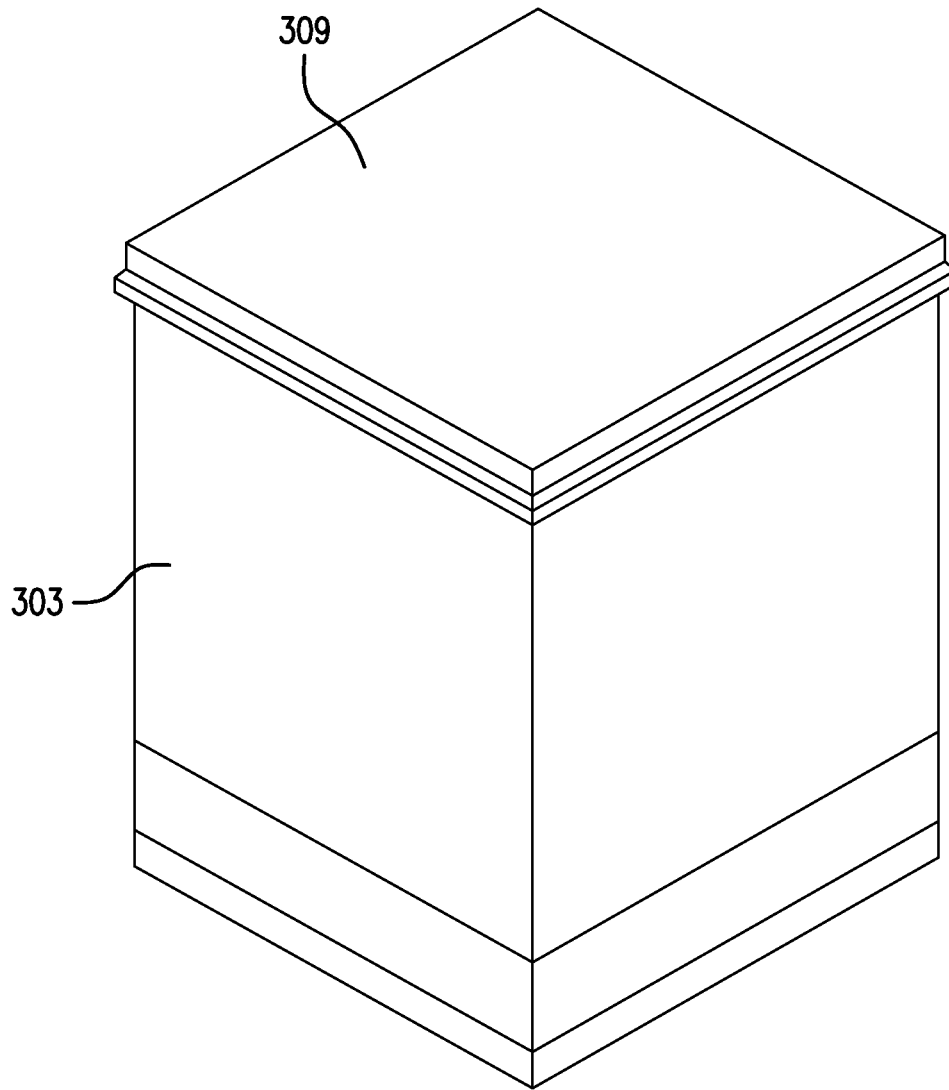


FIG.9

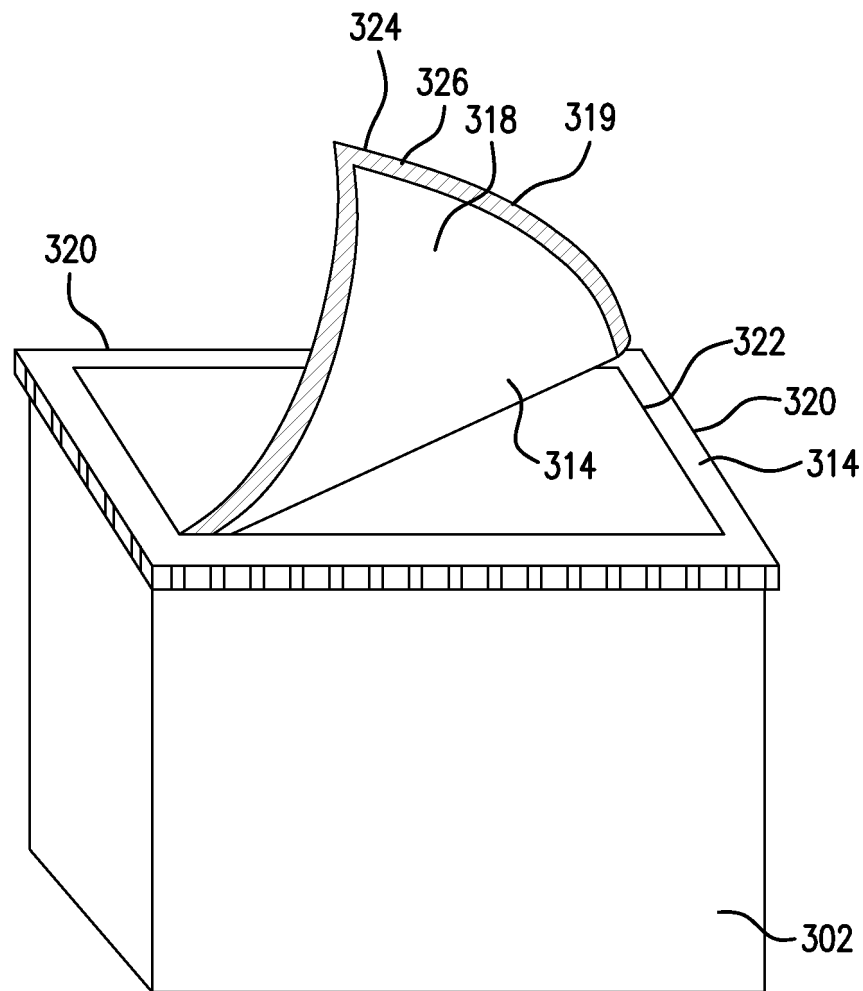


FIG.10

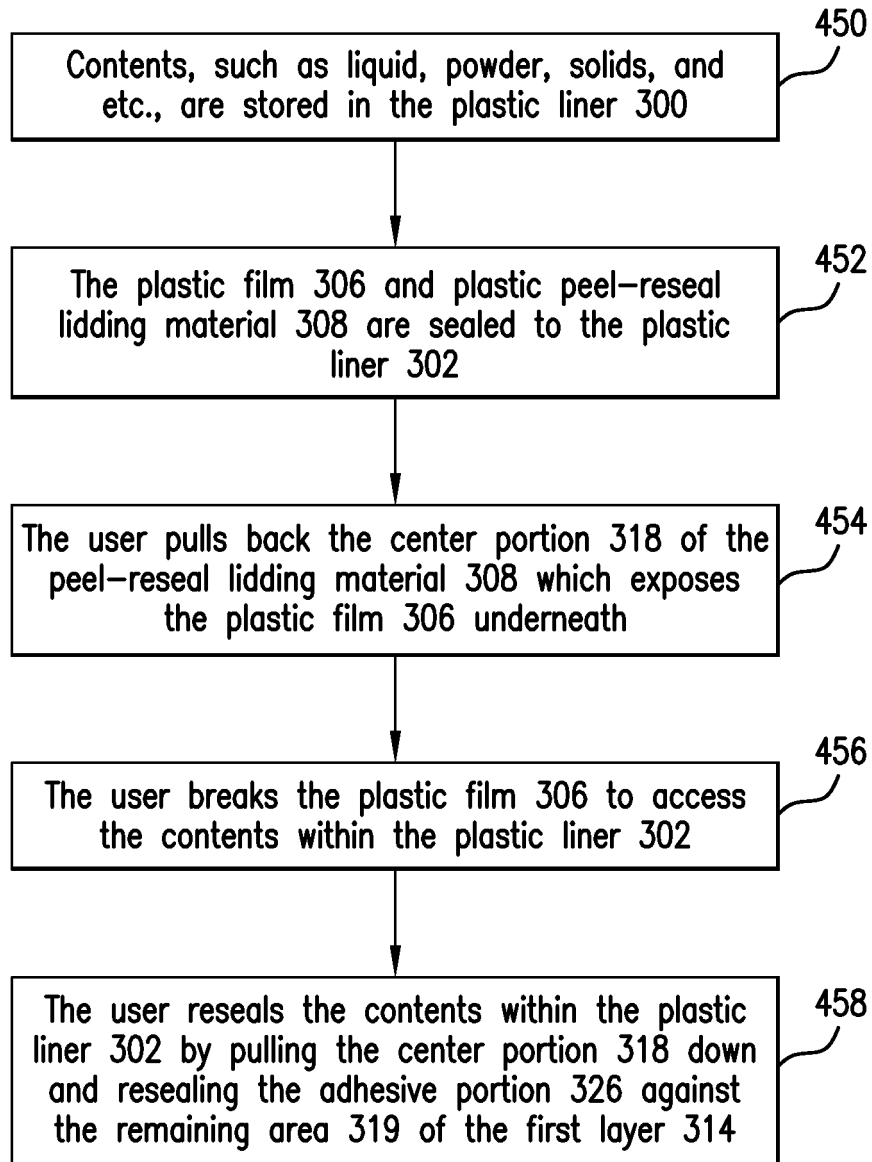


FIG. 11

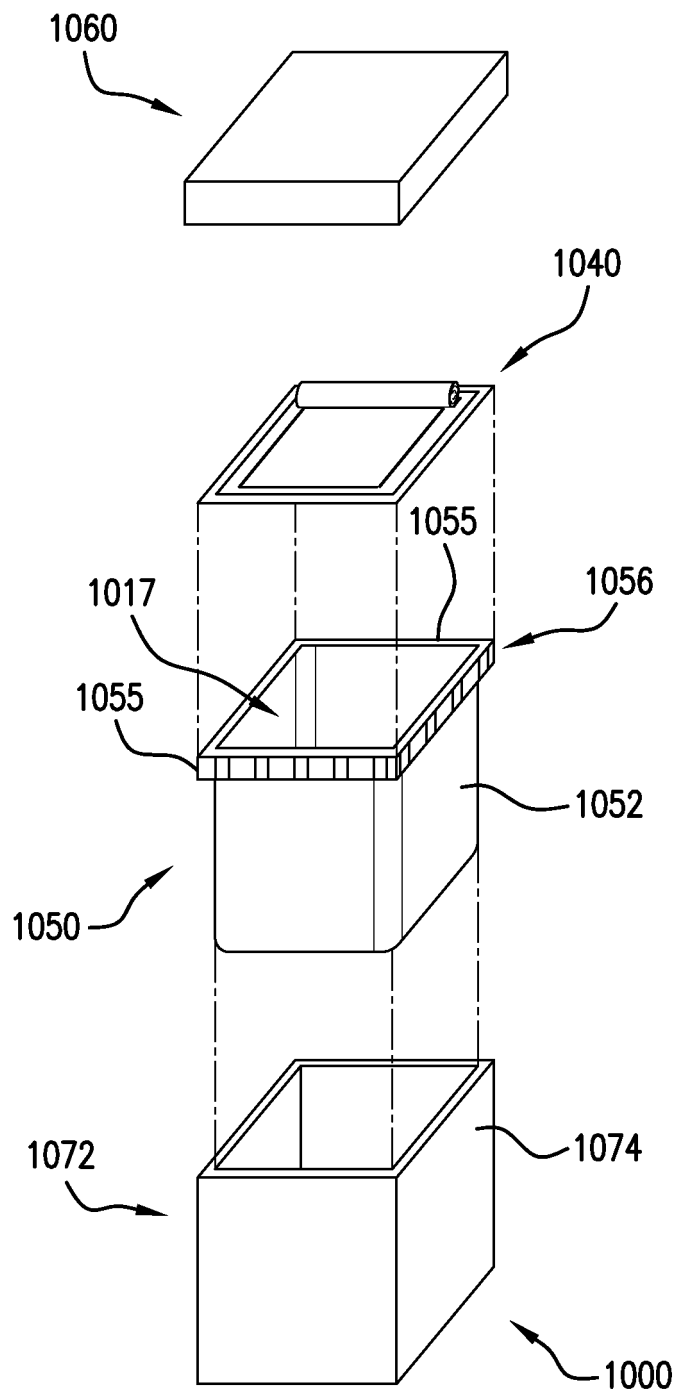


FIG.12

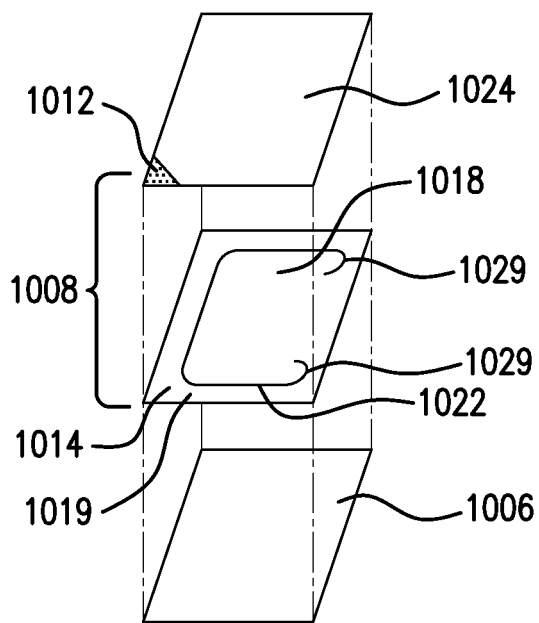


FIG. 13A

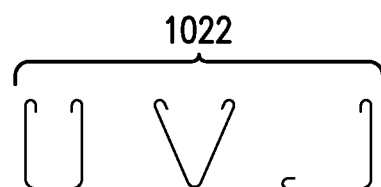


FIG. 13F

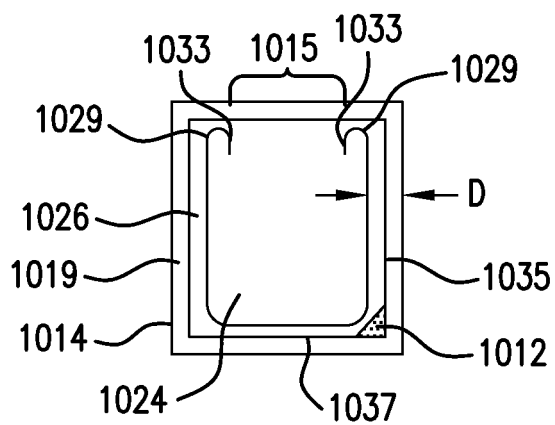


FIG. 13B

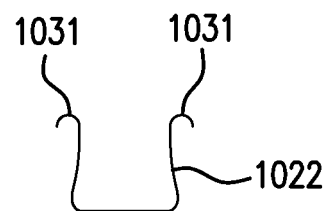


FIG. 13G

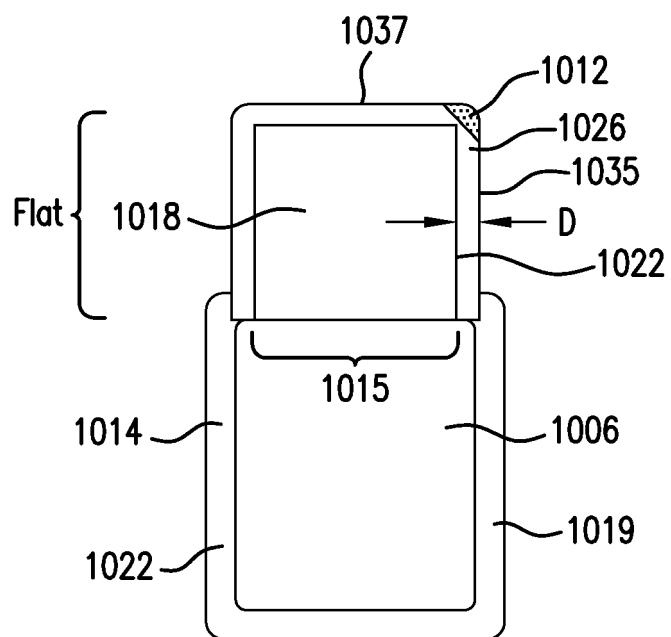


FIG. 13C

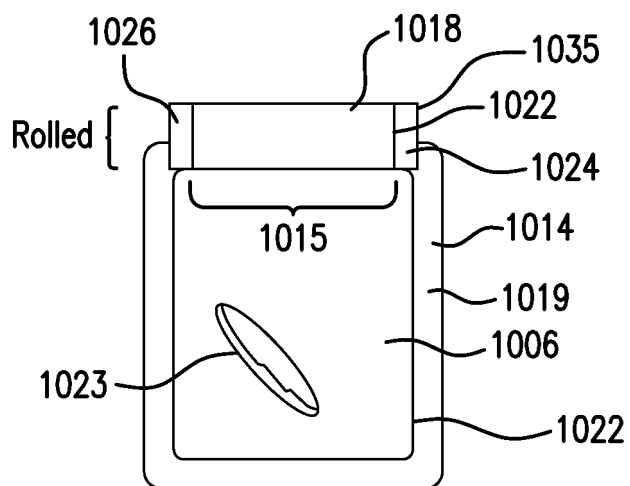


FIG. 13D

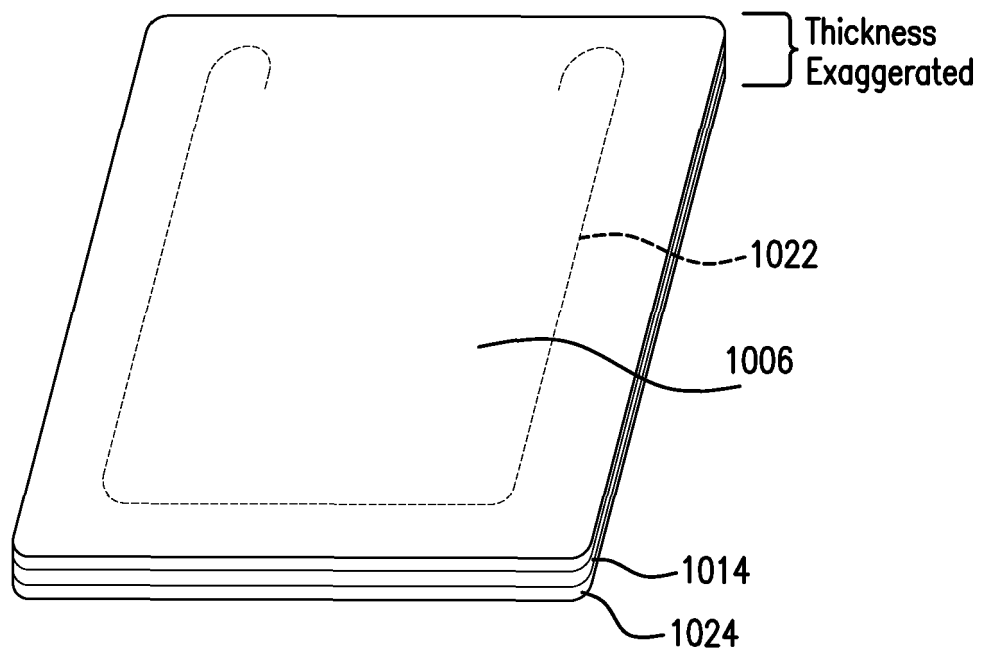


FIG.13E

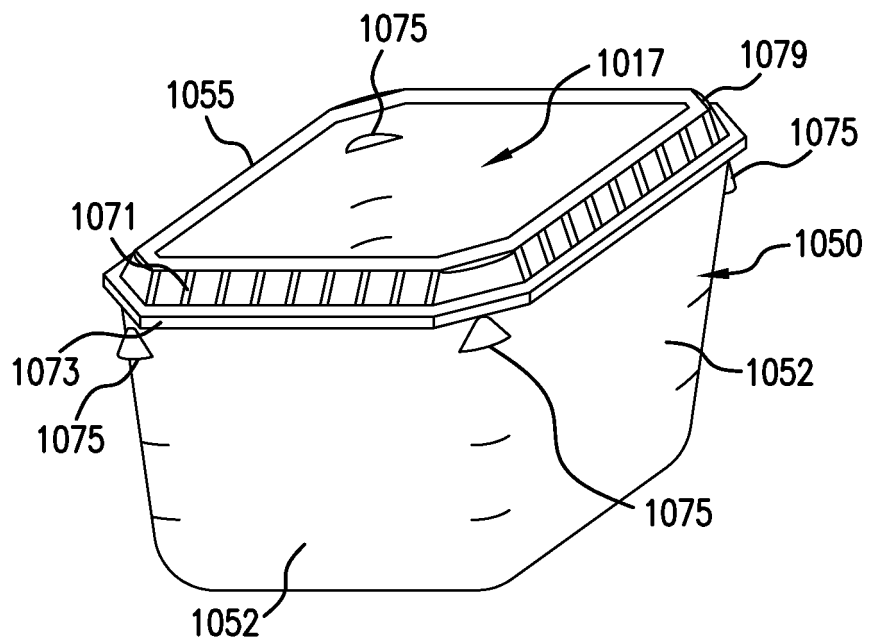


FIG. 14A

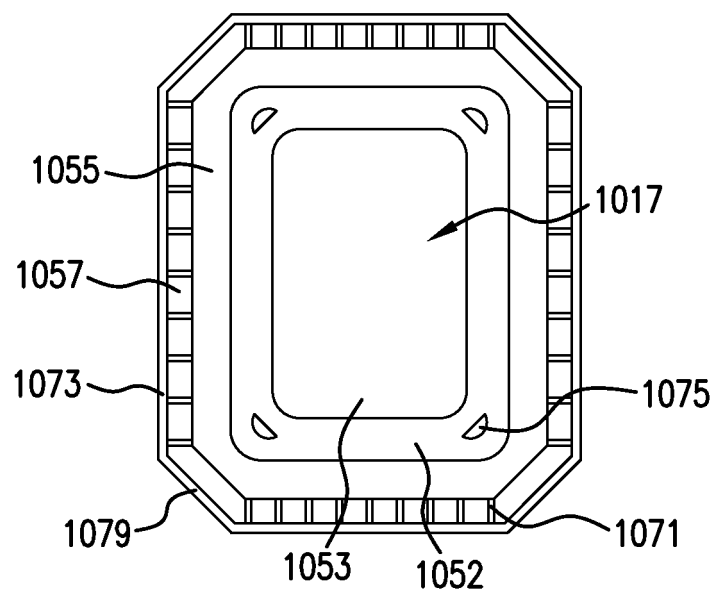


FIG. 14B

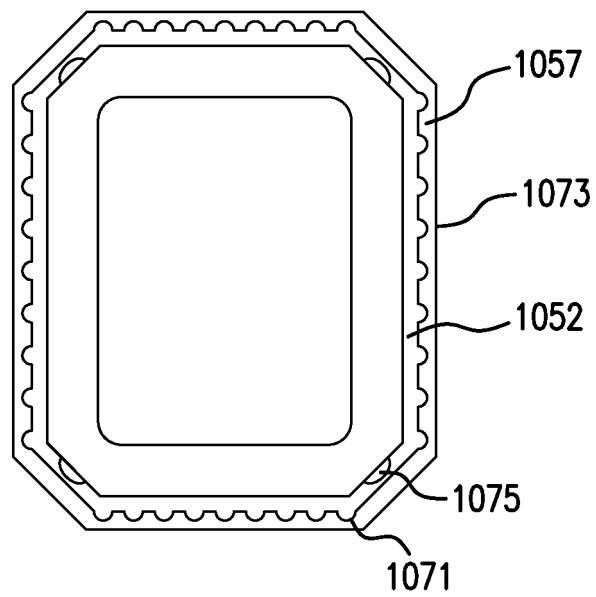


FIG. 14C

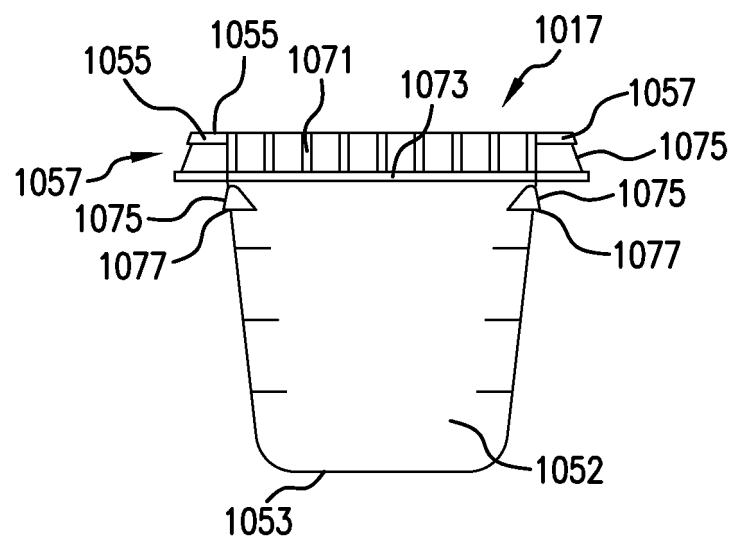


FIG. 14D

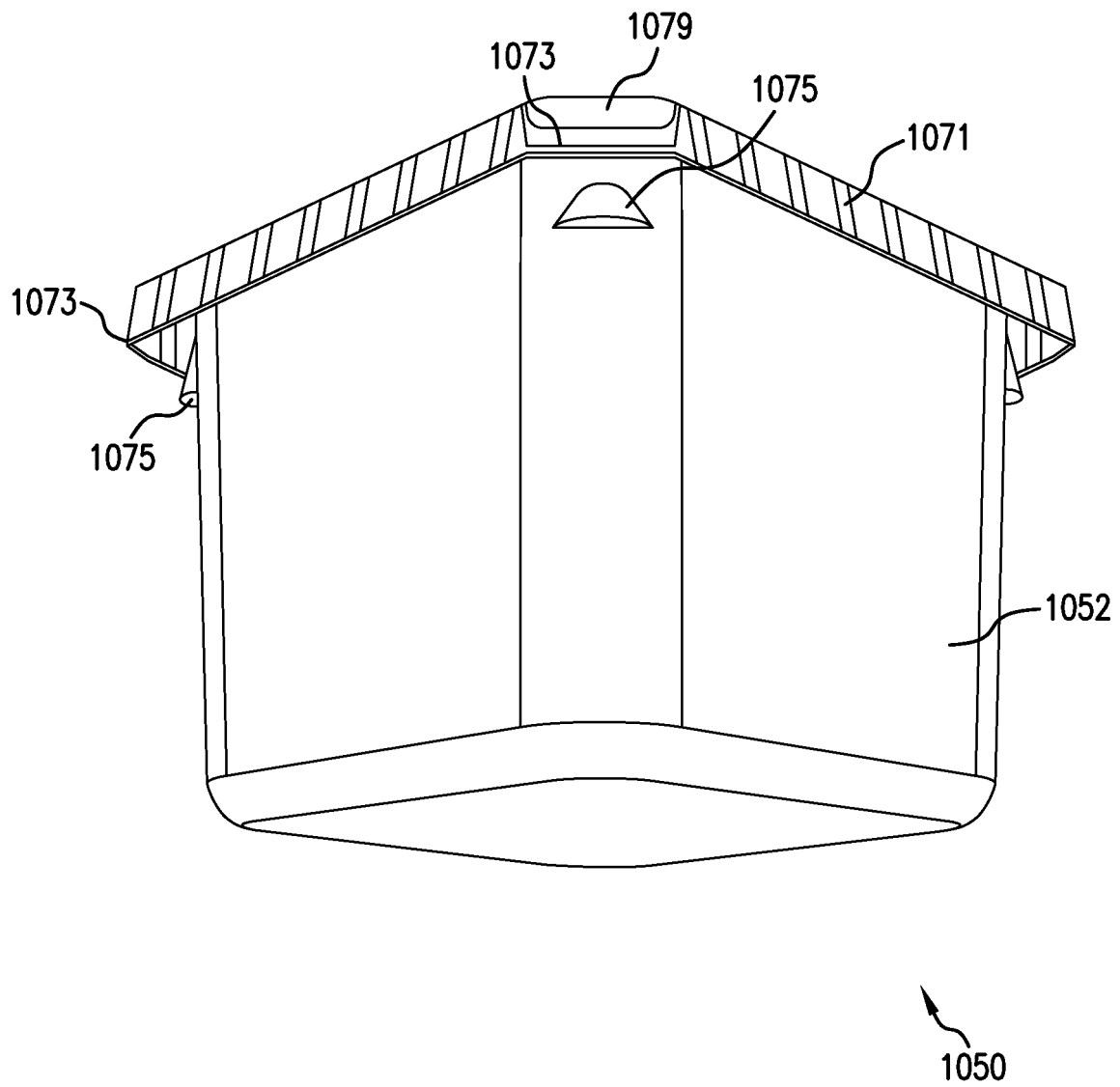


FIG. 14E

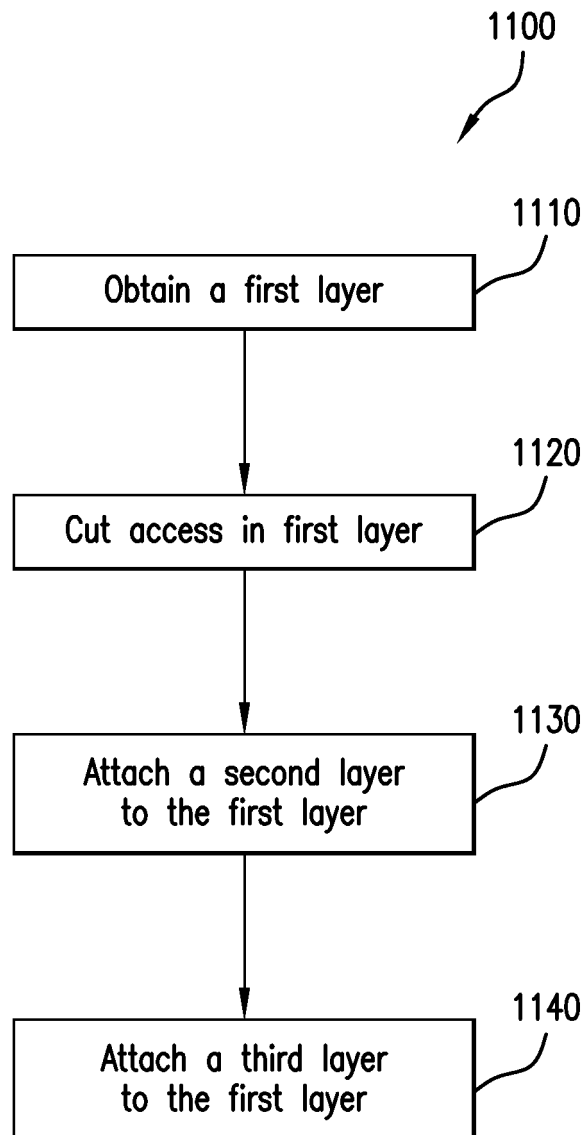


FIG.15

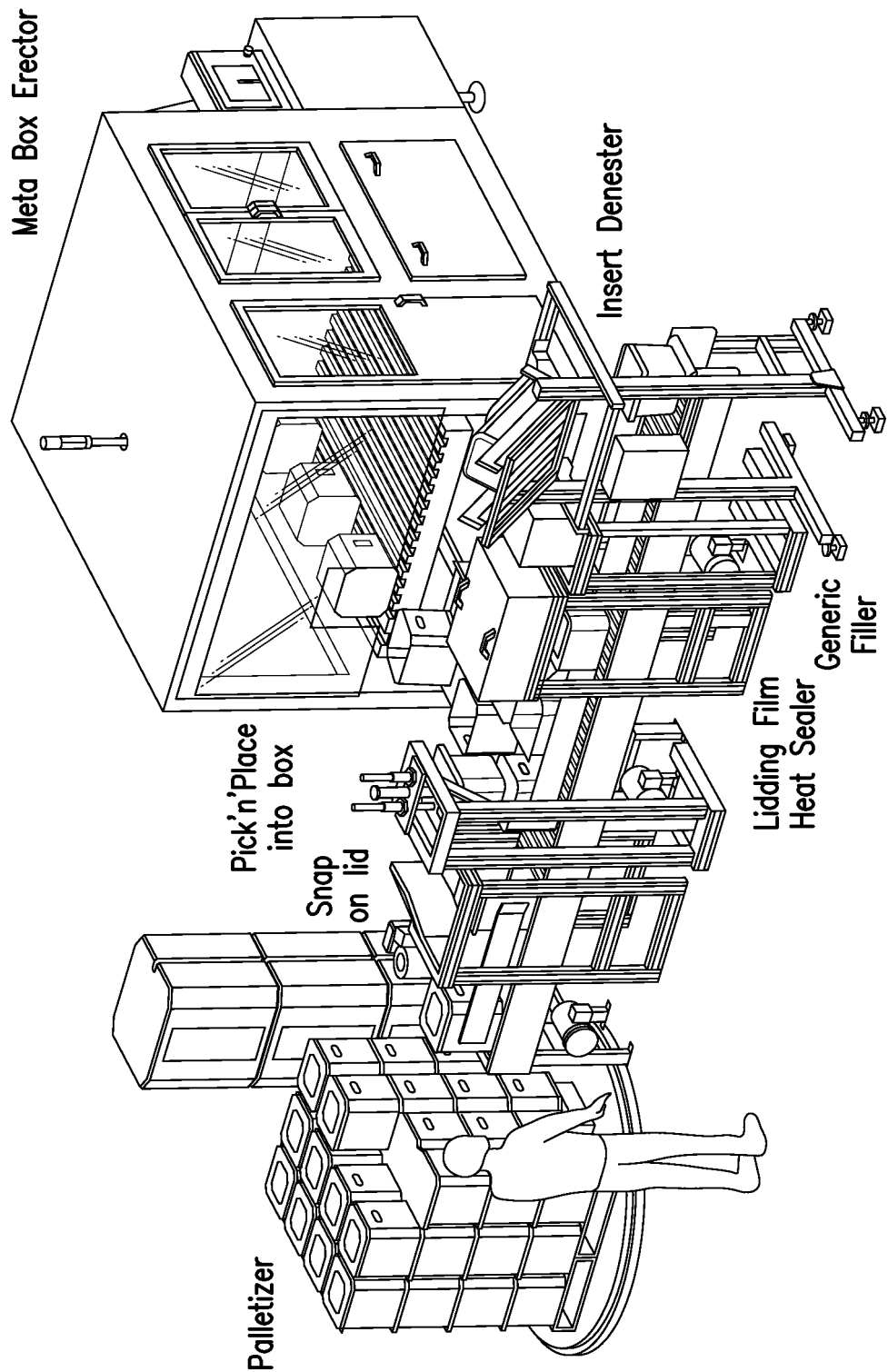


FIG.16

REFERENCES CITED IN THE DESCRIPTION

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