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(52) **U.S. Cl.** ..... **383/105**

(57) **ABSTRACT**

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A bag may include opposing first and second sidewalls of a pliable thermoplastic material that may be joined to each other along first and second side seals and a closed bottom. The sidewalls may remain un-joined along their top edges to form an opening into which trash and other items may be deposited. When the bag is placed in a trash receptacle, the un-joined top edges may be folded over the rim of the receptacle to secure the liner to the receptacle. To assist with securing the bag to the receptacle, the side seals may be directed to converge partially toward each other thereby forming a throat in the interior volume proximate the opening. When the top edges are folded over the receptacle rim, the throat may grip the receptacle. The bag may include a pattern between the converging portions. The bag may include a retention strip between the converging portions.

(73) Assignee: **The Glad Products Company**, Oakland, CA (US)

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(22) Filed: **Feb. 1, 2010**

**Related U.S. Application Data**

(60) Provisional application No. 61/150,158, filed on Feb. 5, 2009.

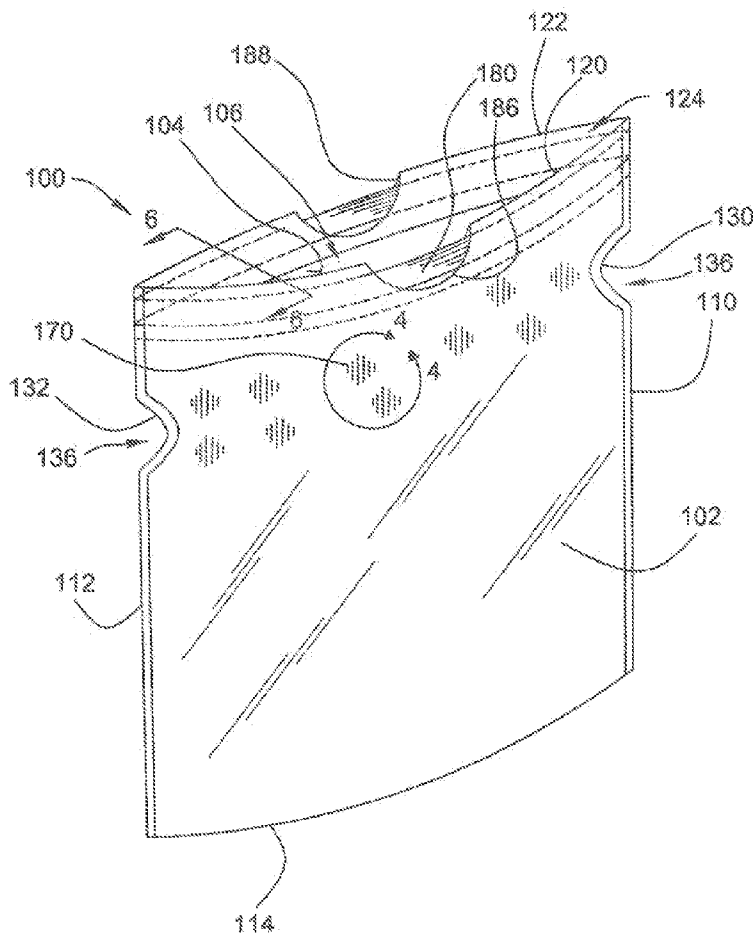




FIG. 2

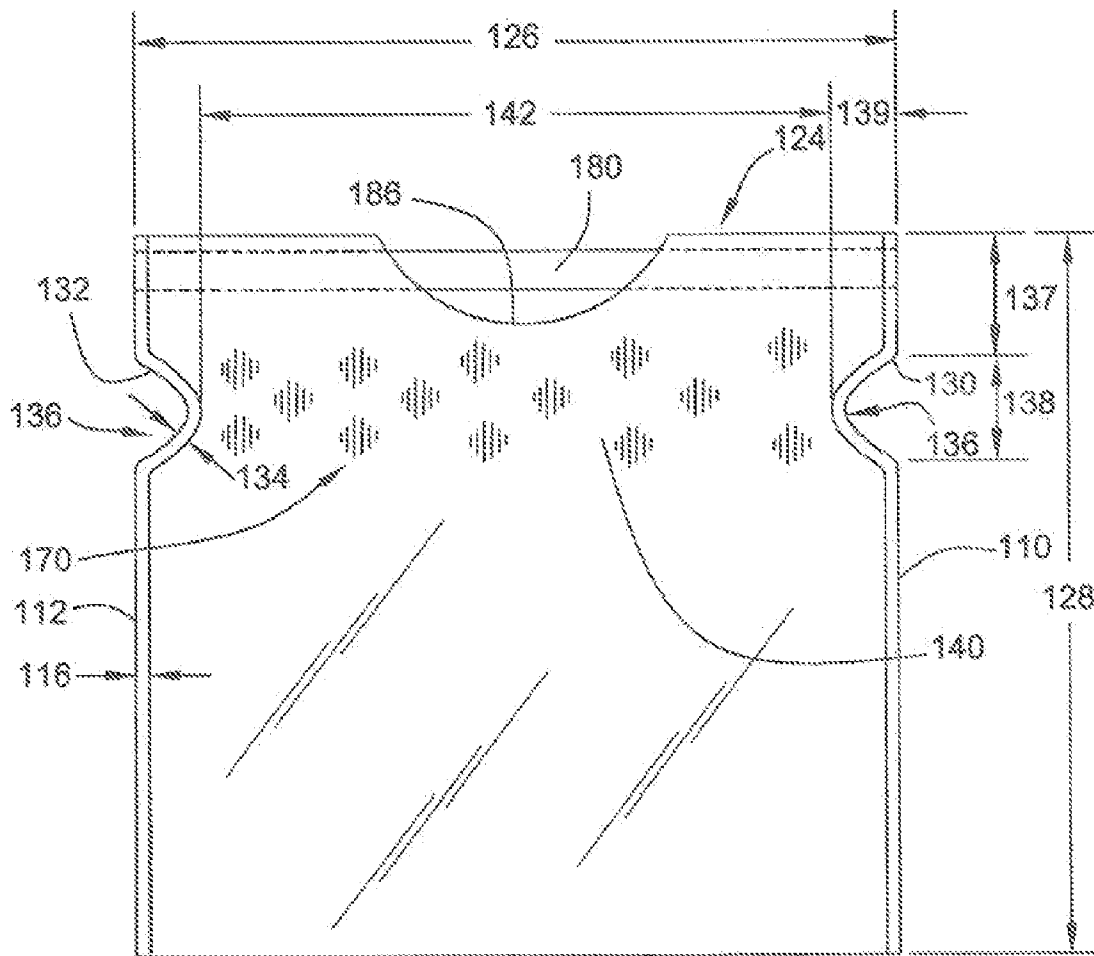


FIG. 3

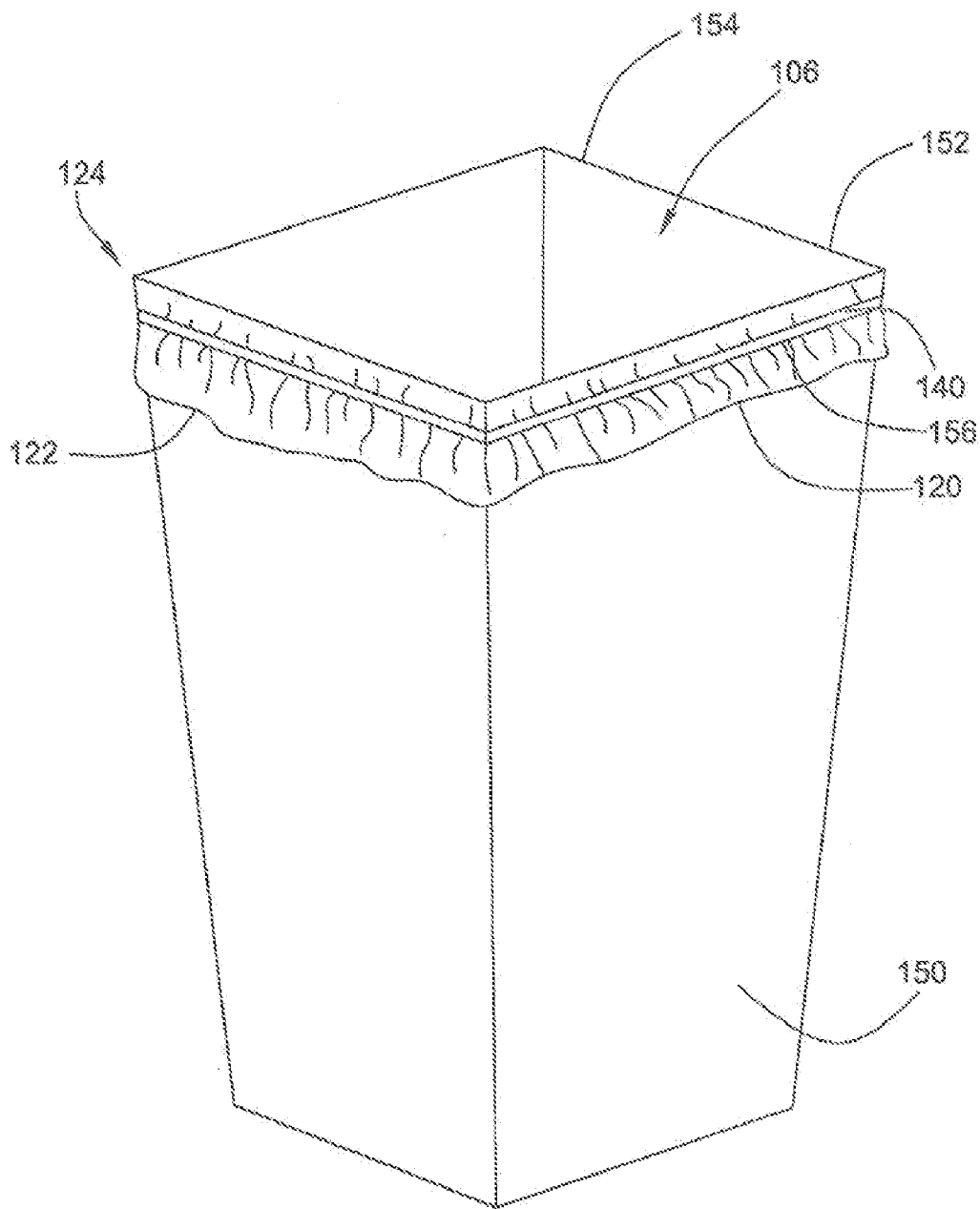


FIG. 4

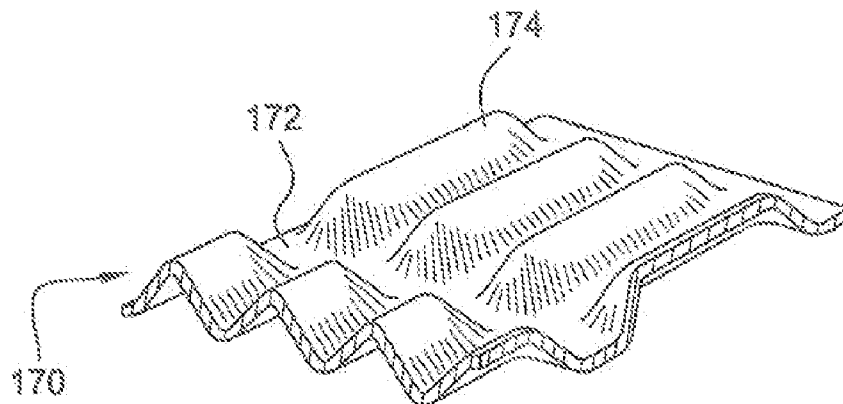
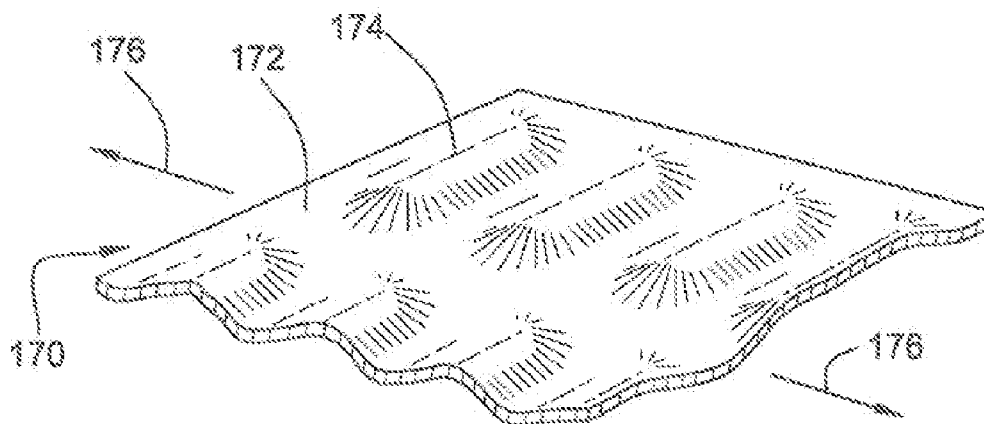


FIG. 5



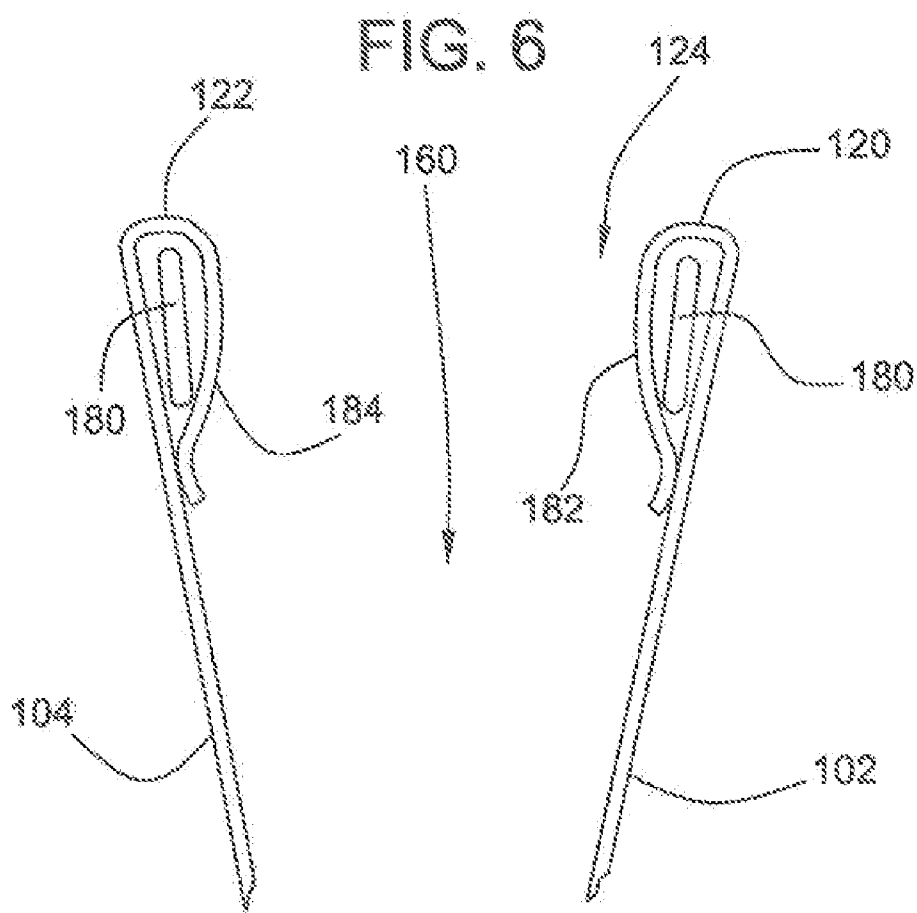


FIG. 7

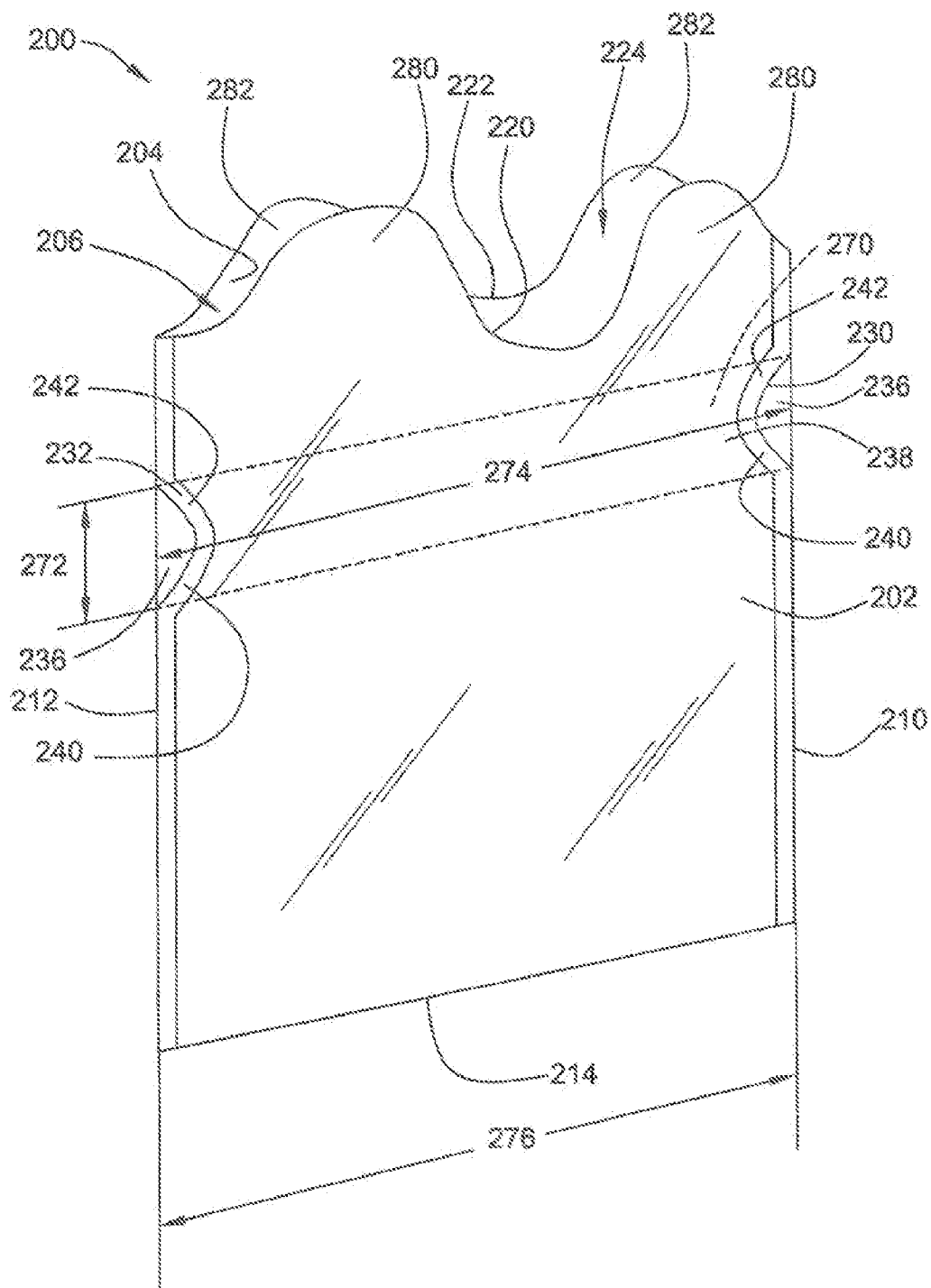
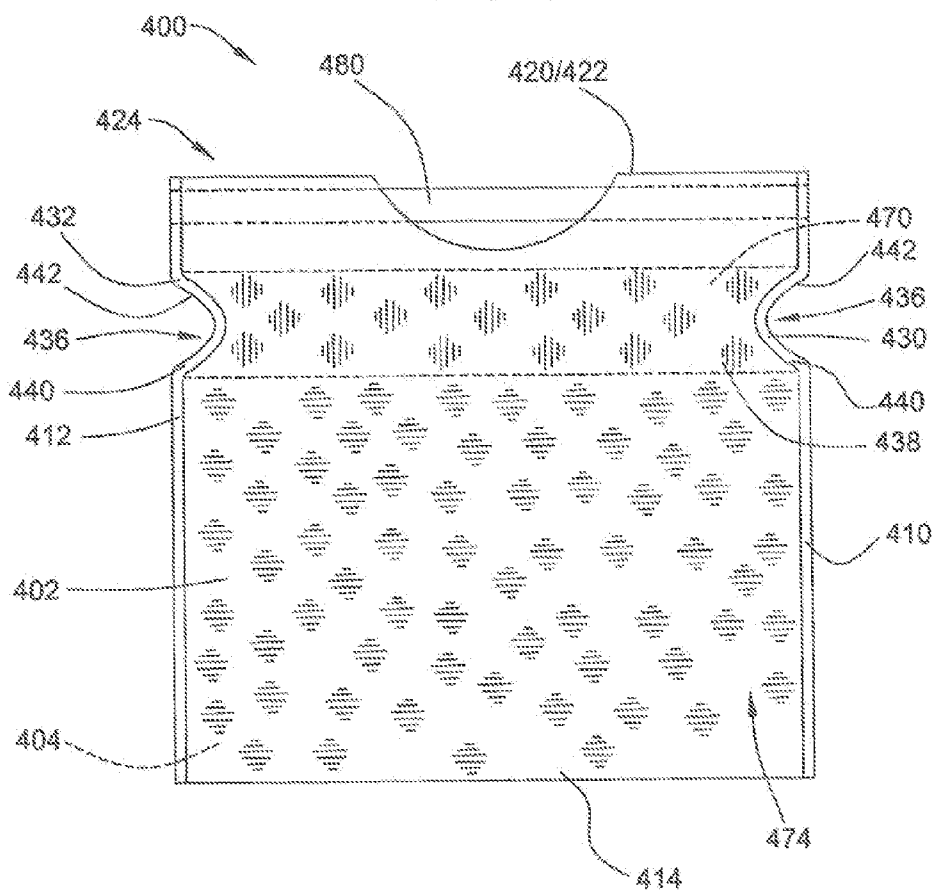
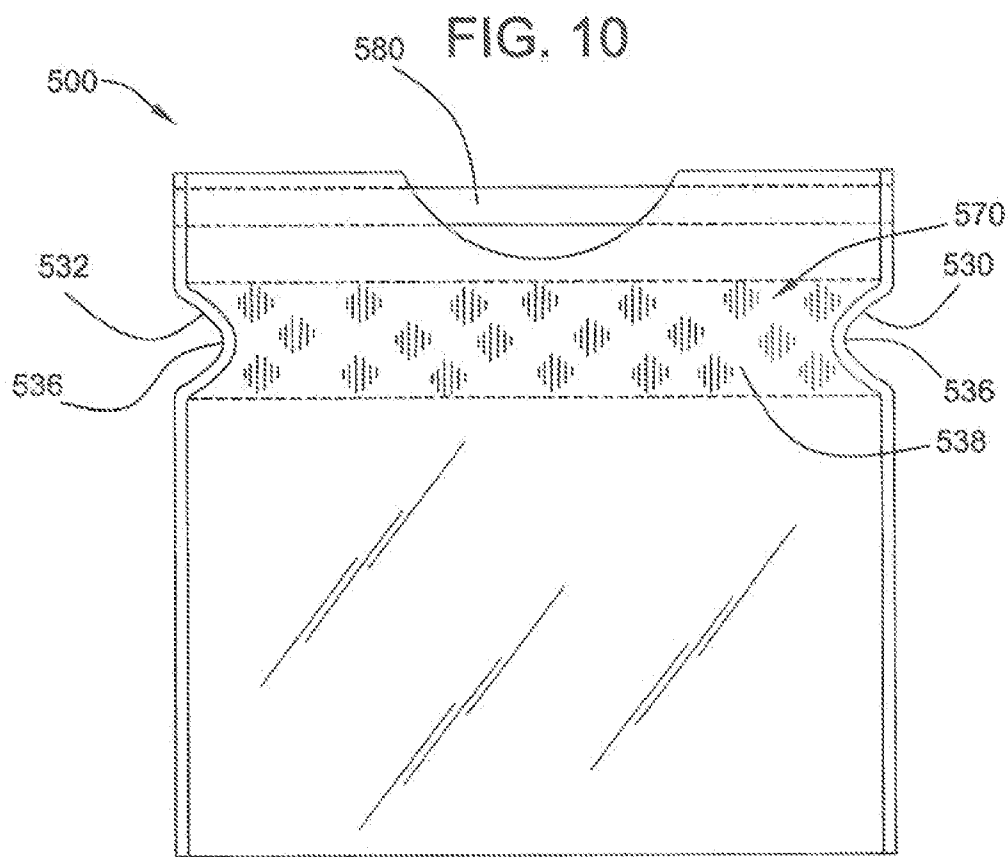


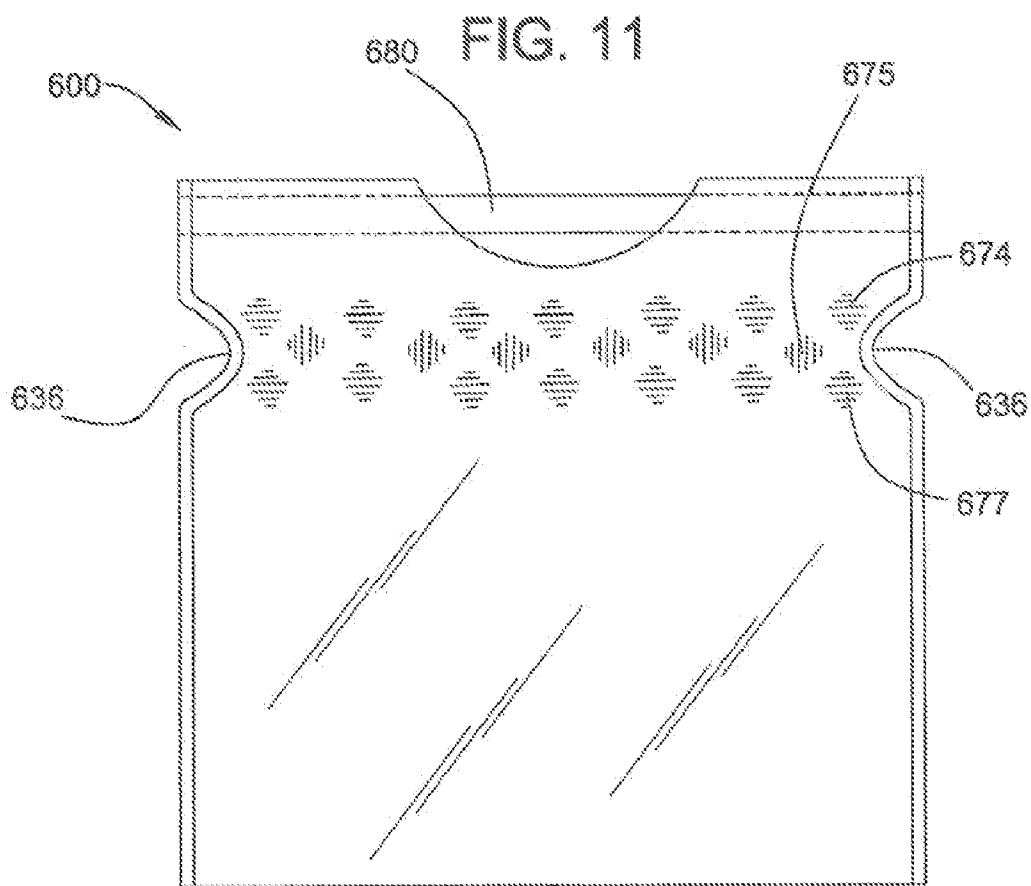


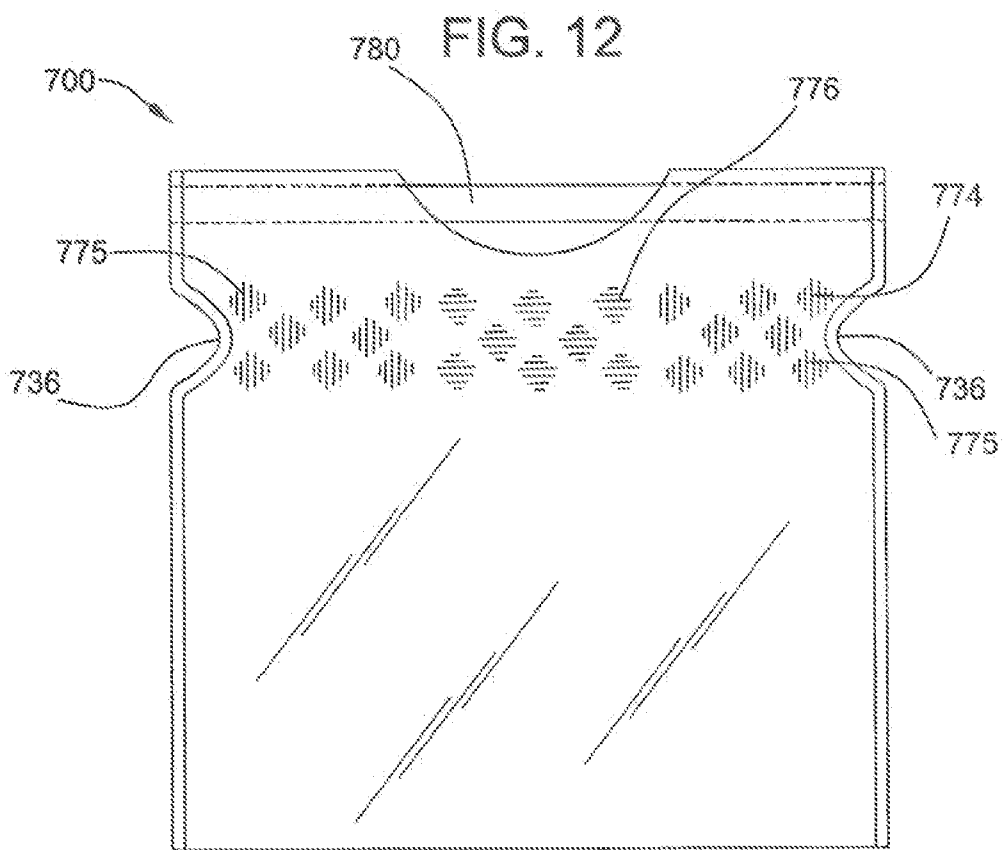


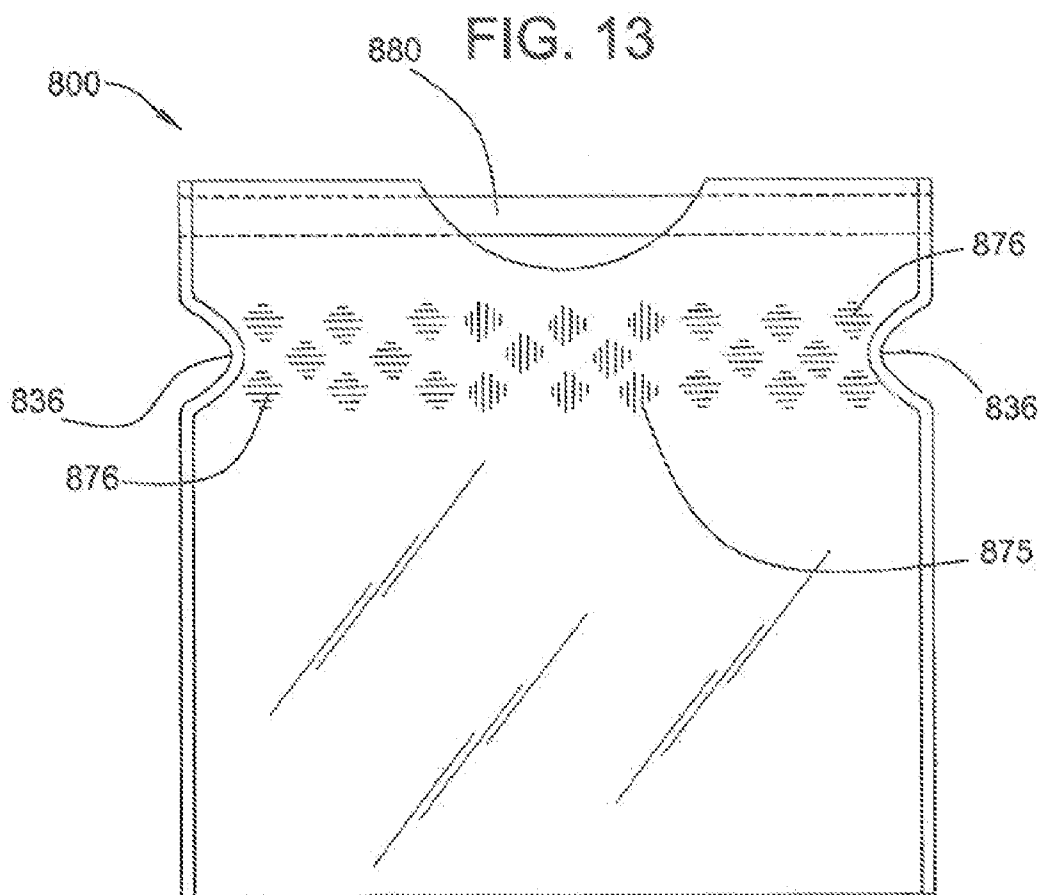
FIG. 9

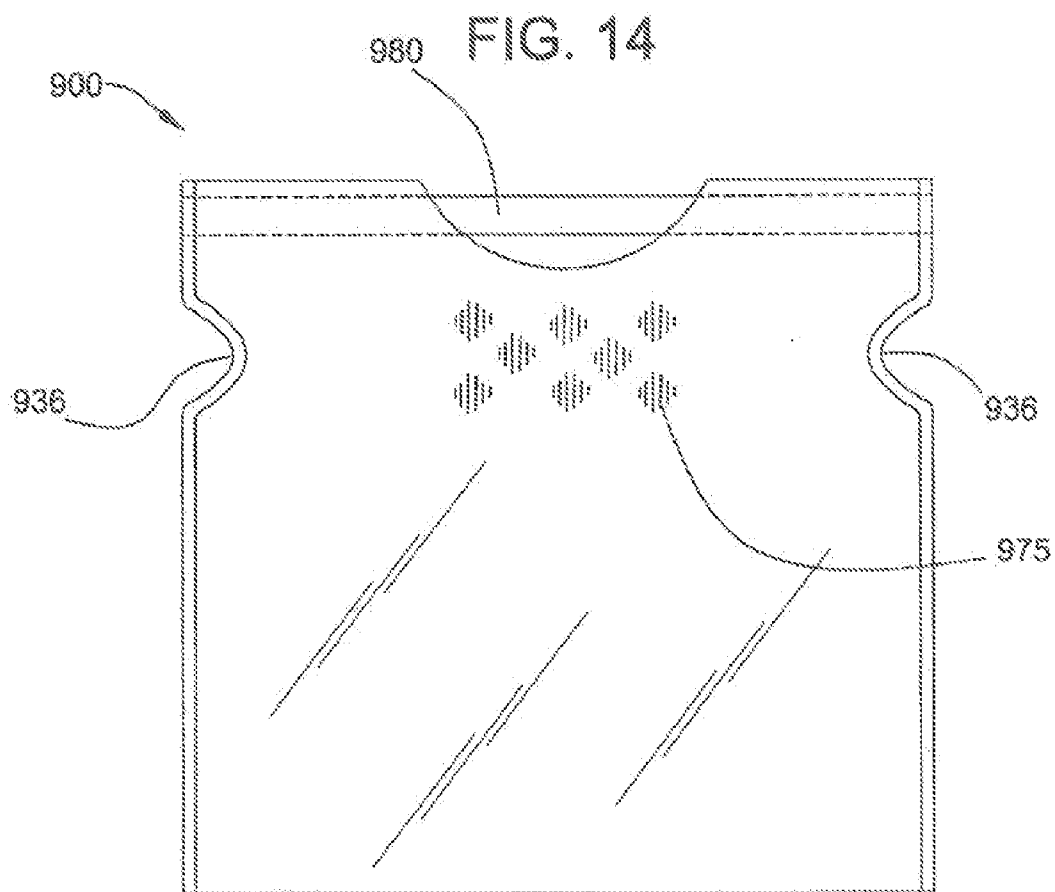


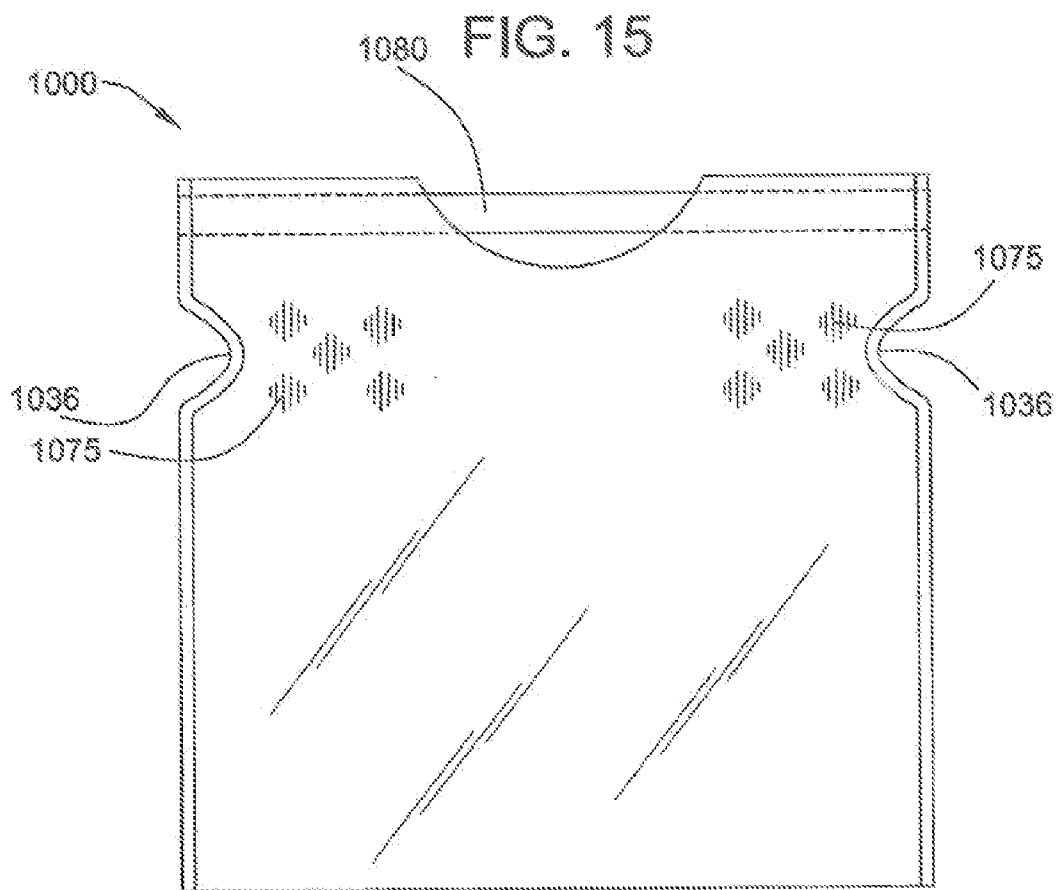


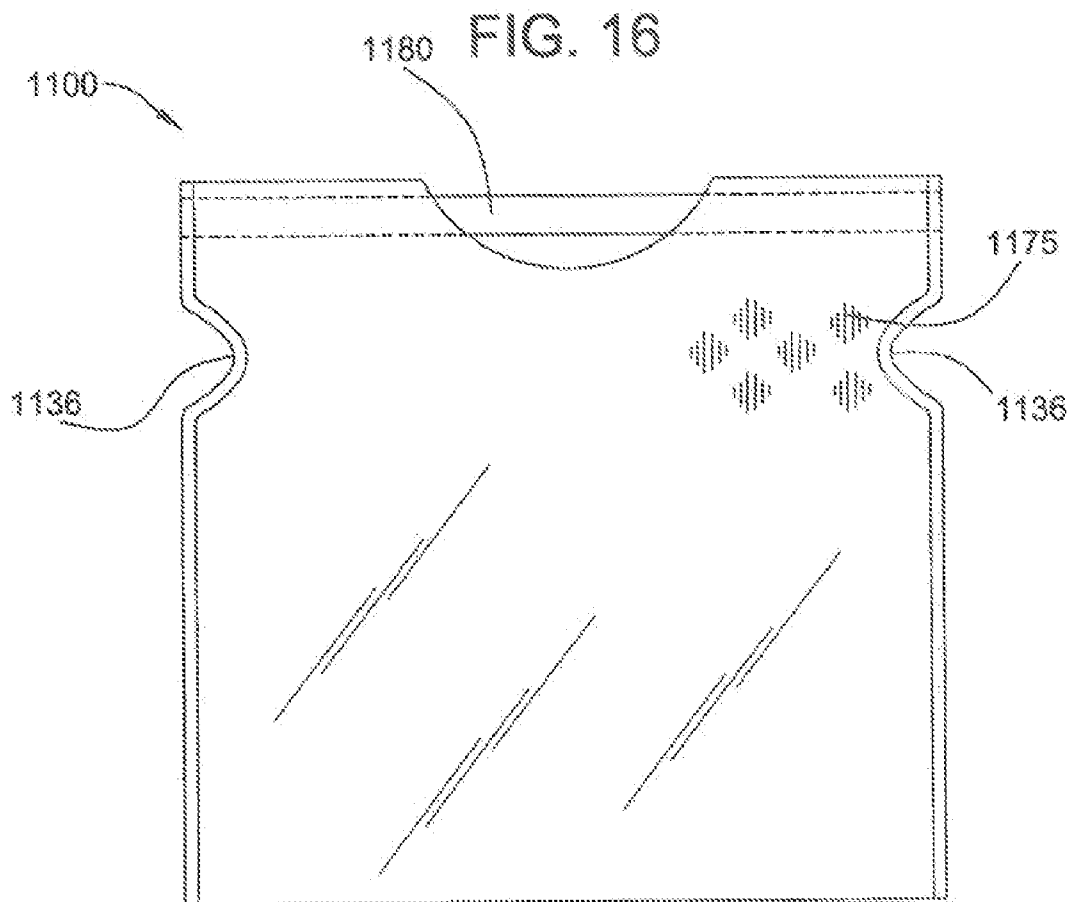














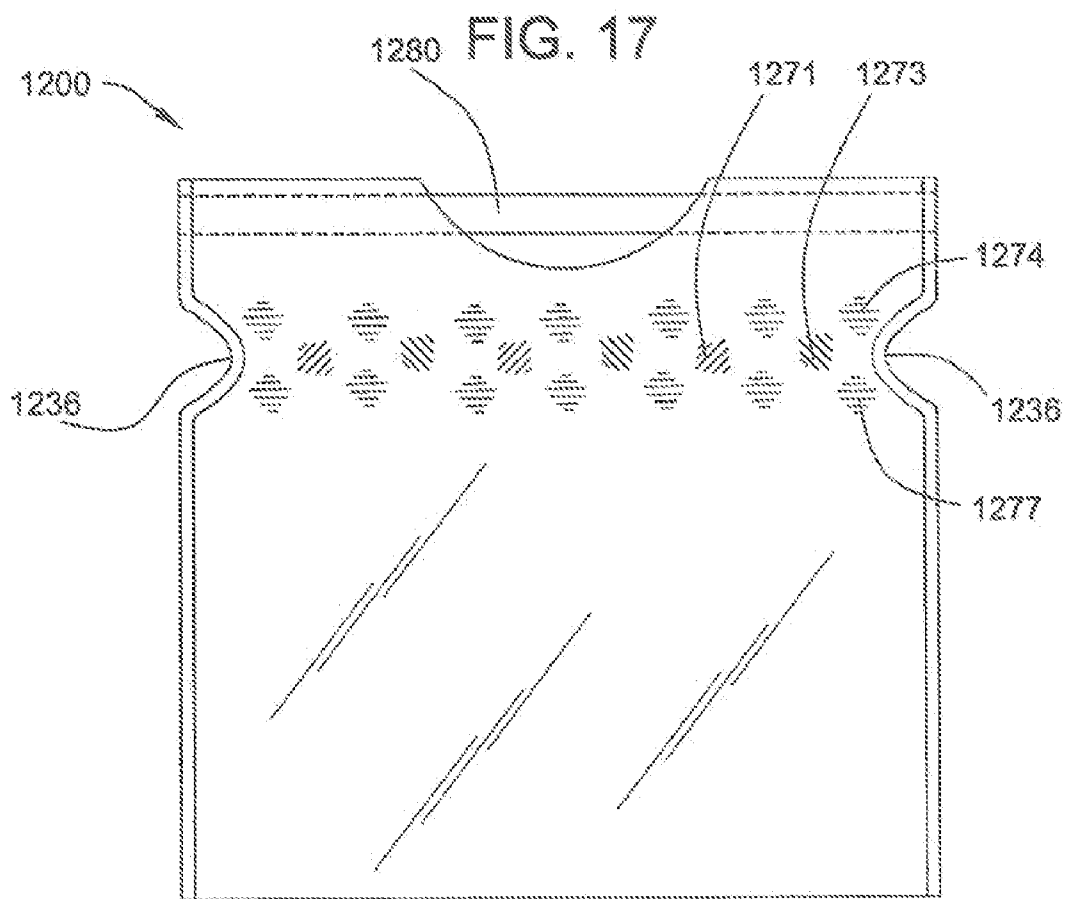


FIG. 18

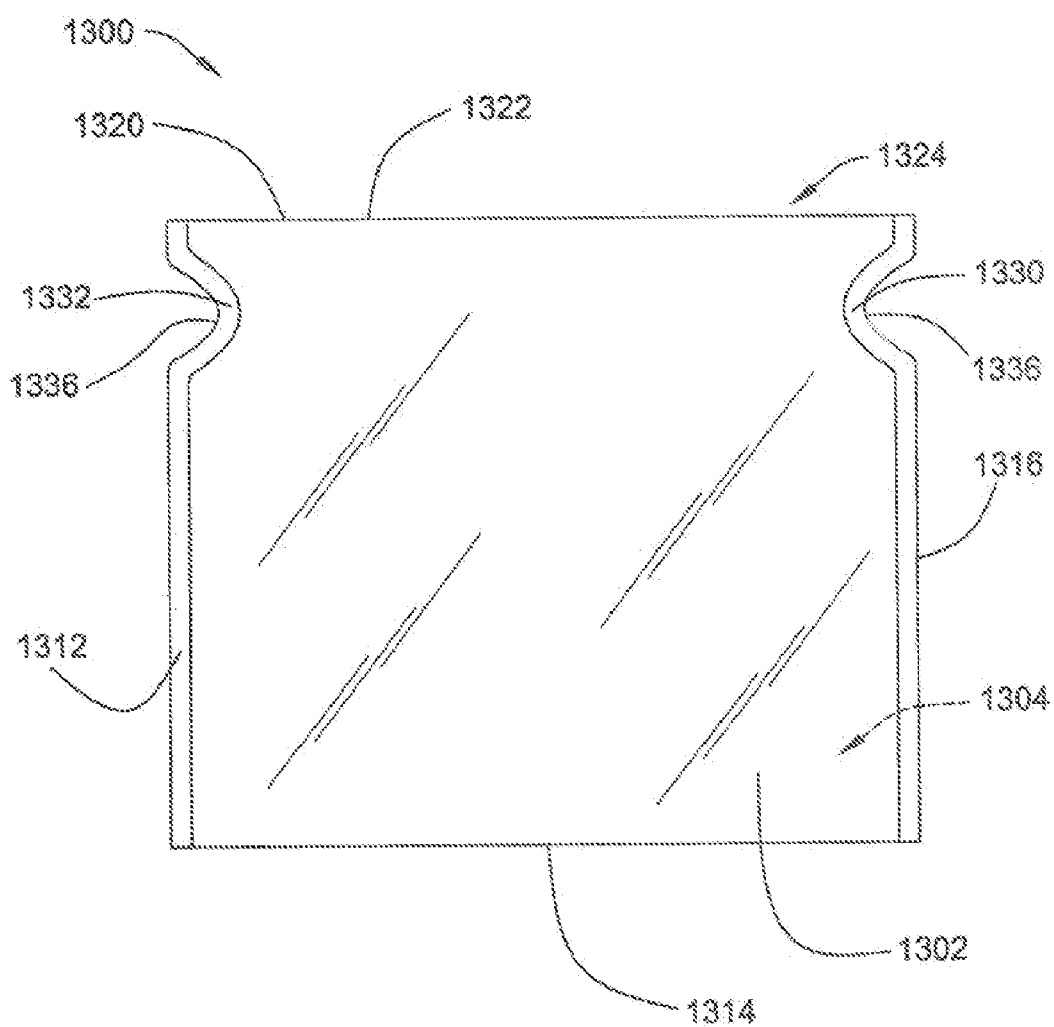


FIG. 19

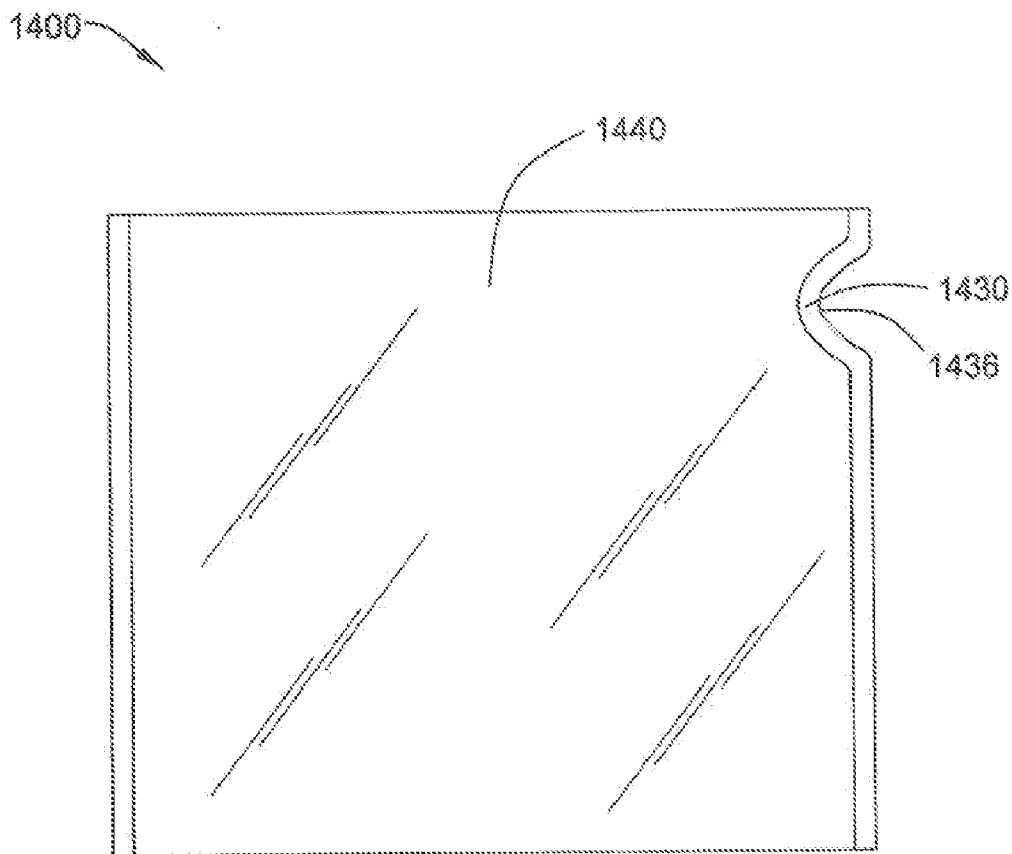


FIG. 20

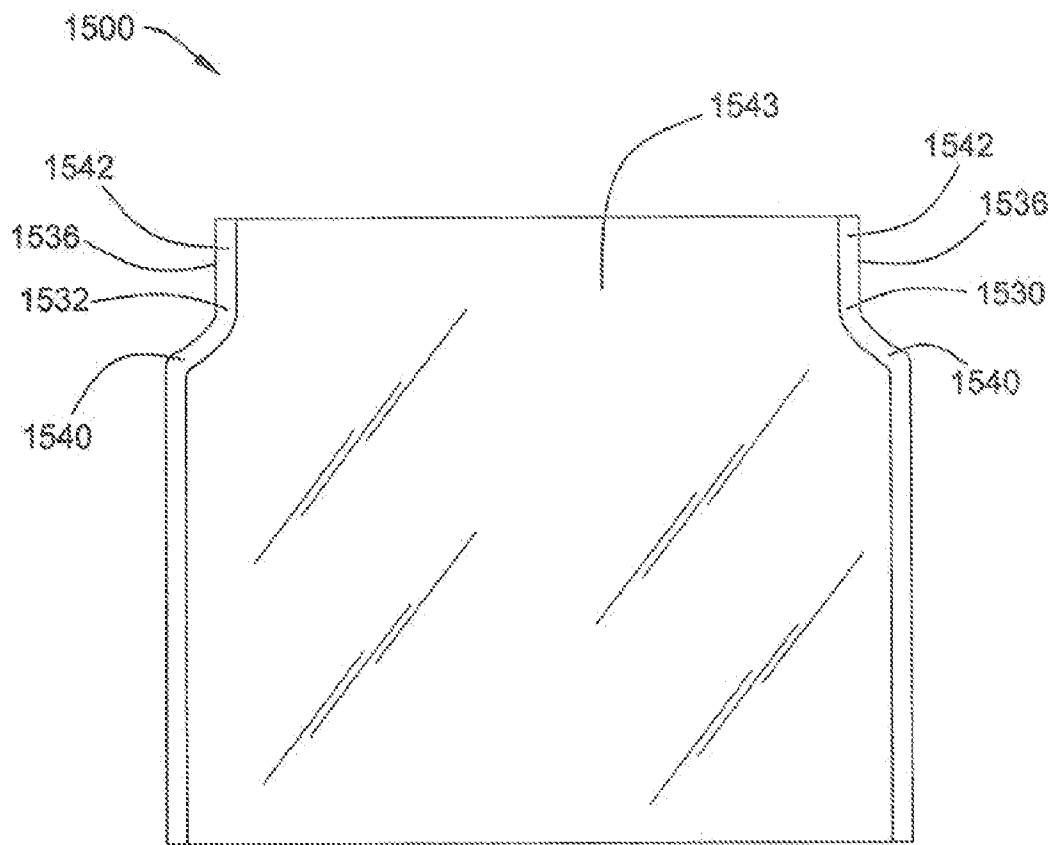


FIG. 21

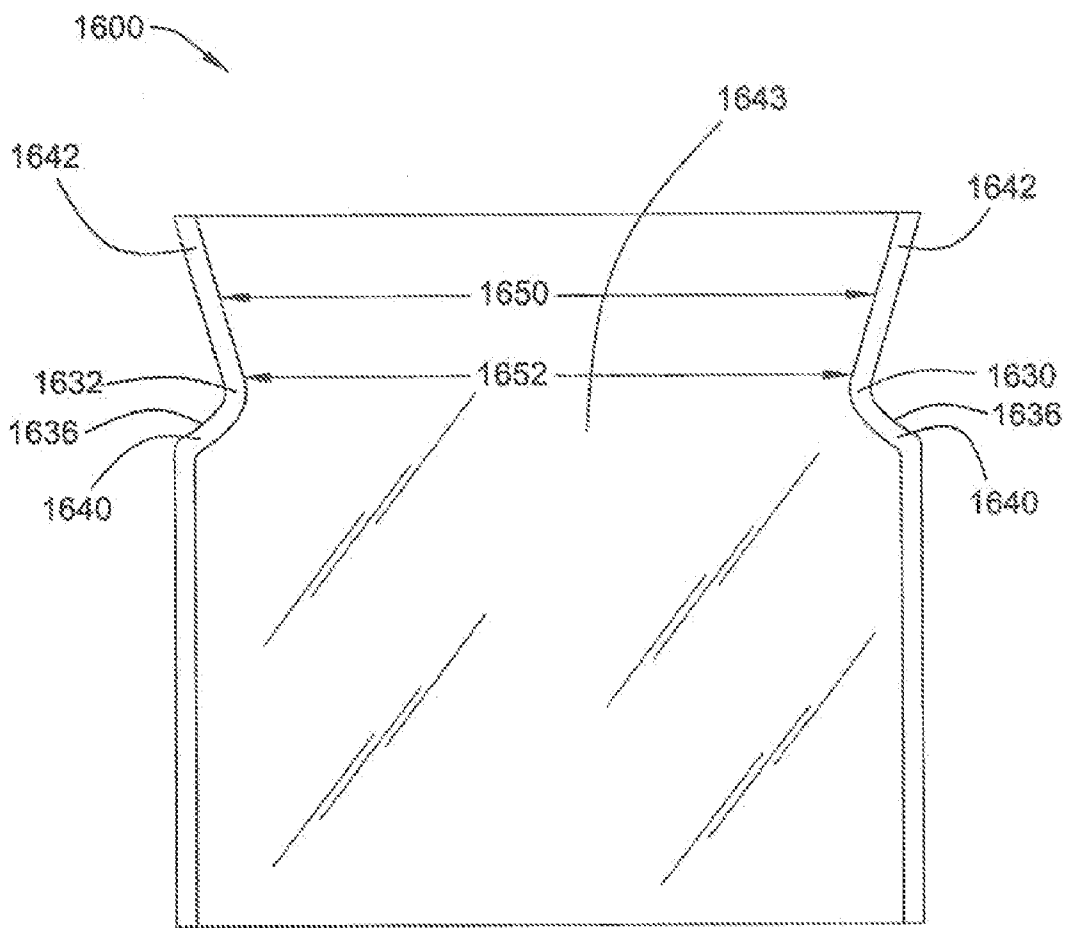


FIG. 22

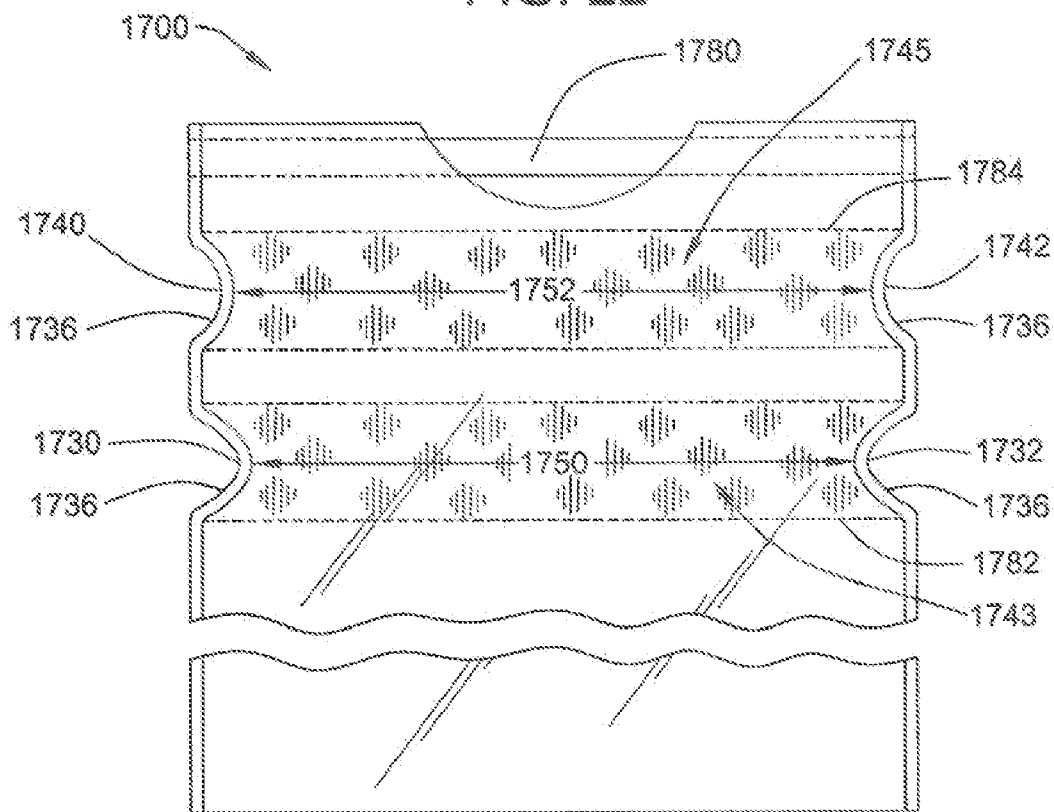


FIG. 23

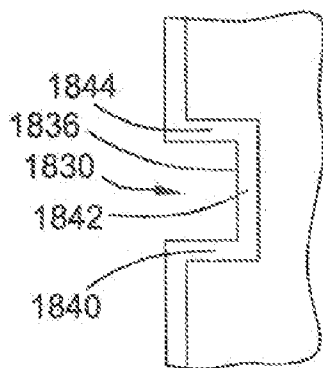


FIG. 24

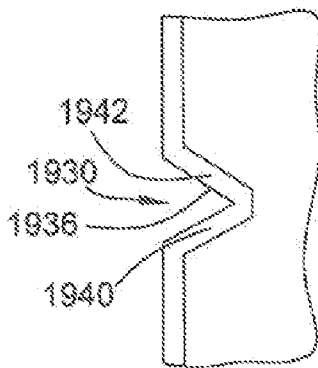


FIG. 25

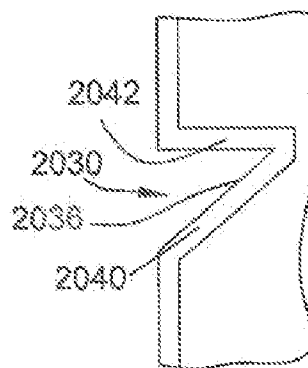


FIG. 26

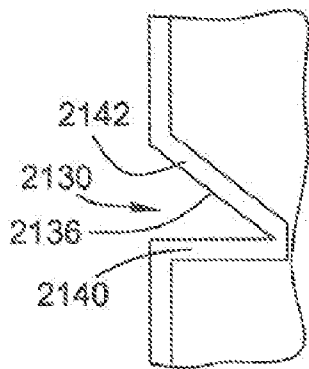


FIG. 27

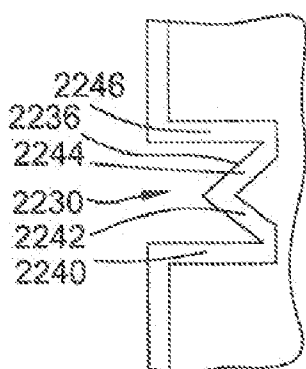


FIG. 28

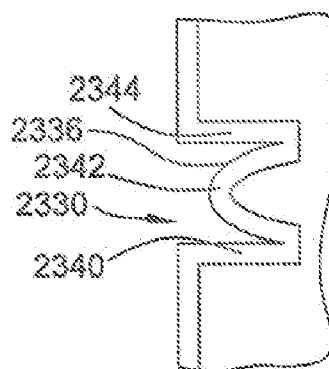


FIG. 29

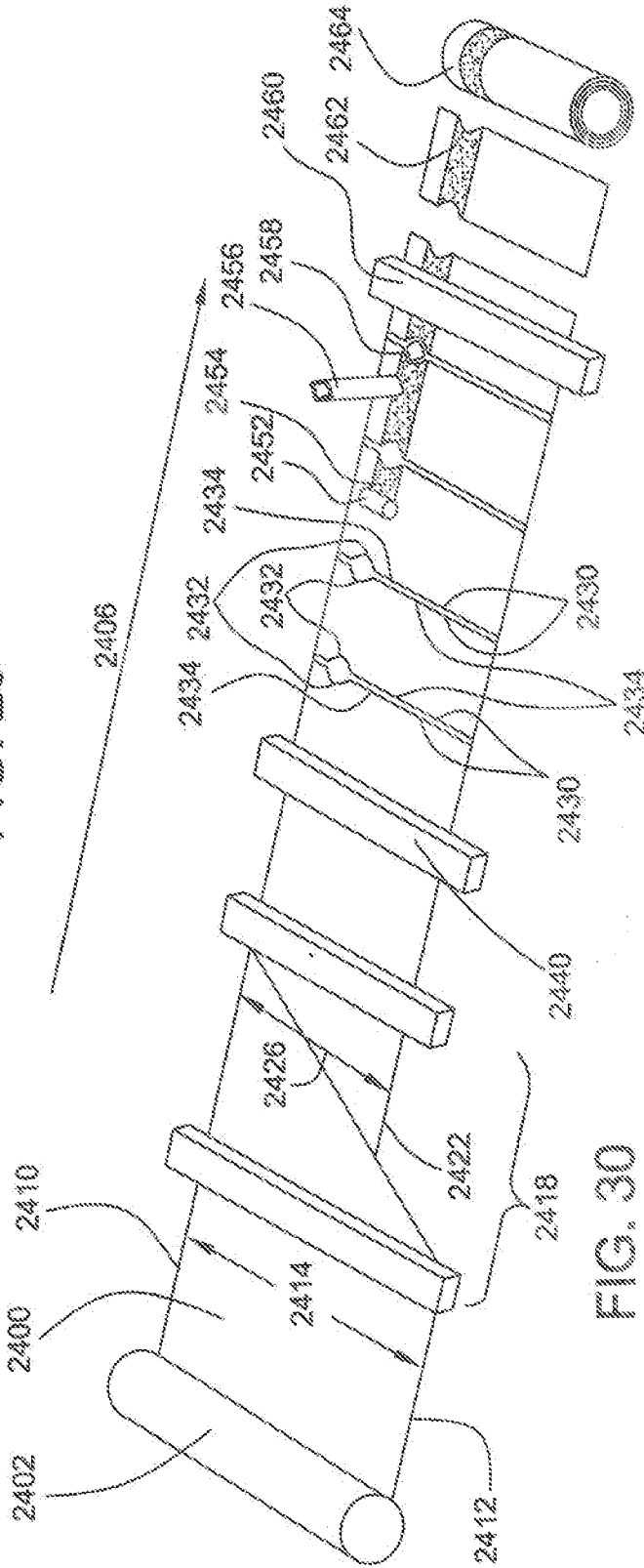


FIG. 30

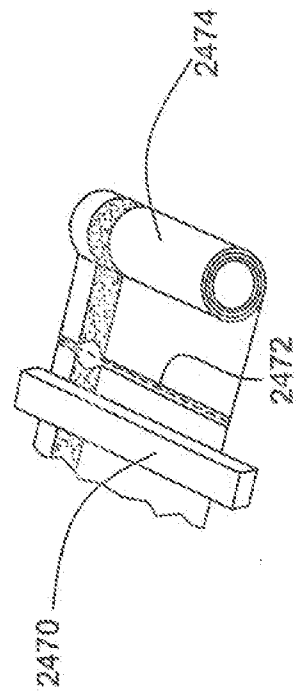




FIG. 31

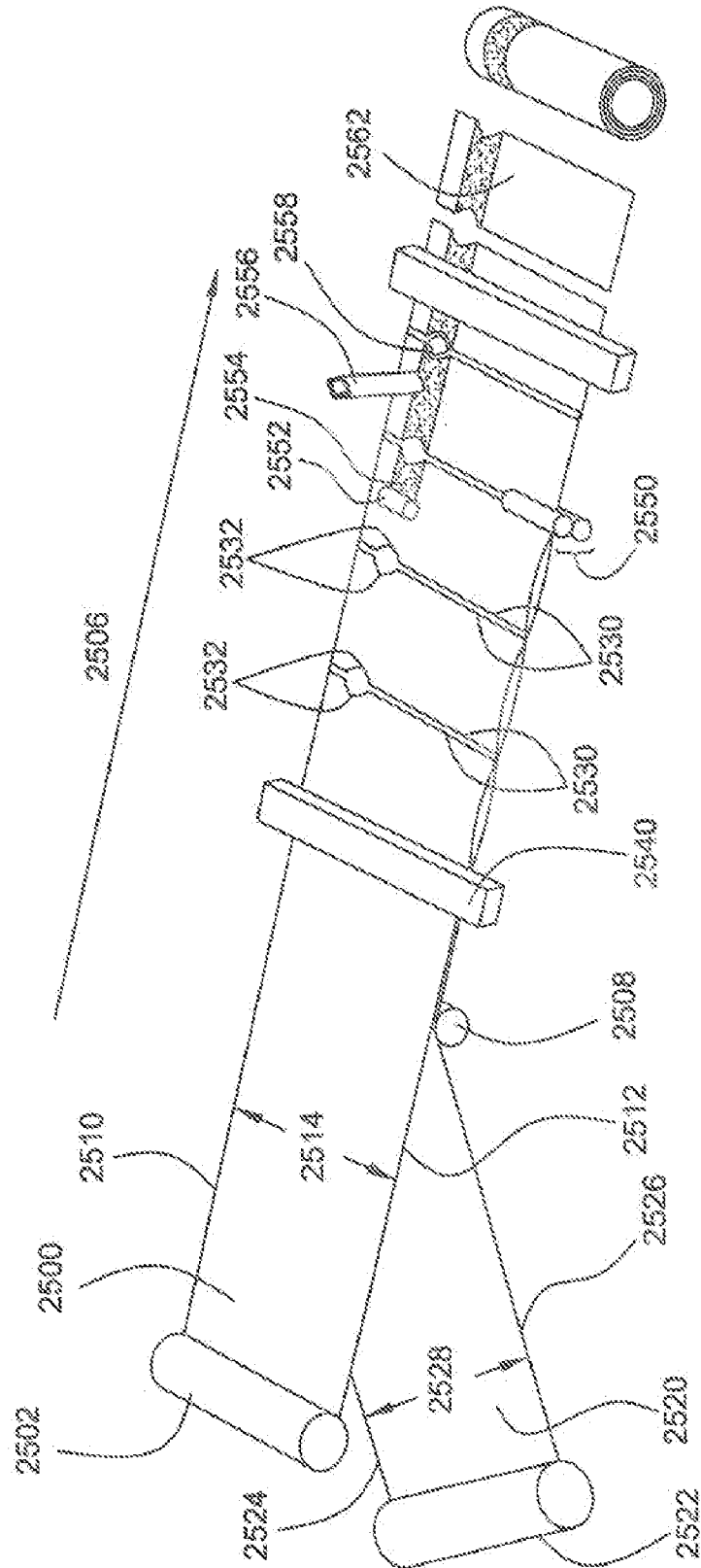




FIG. 33

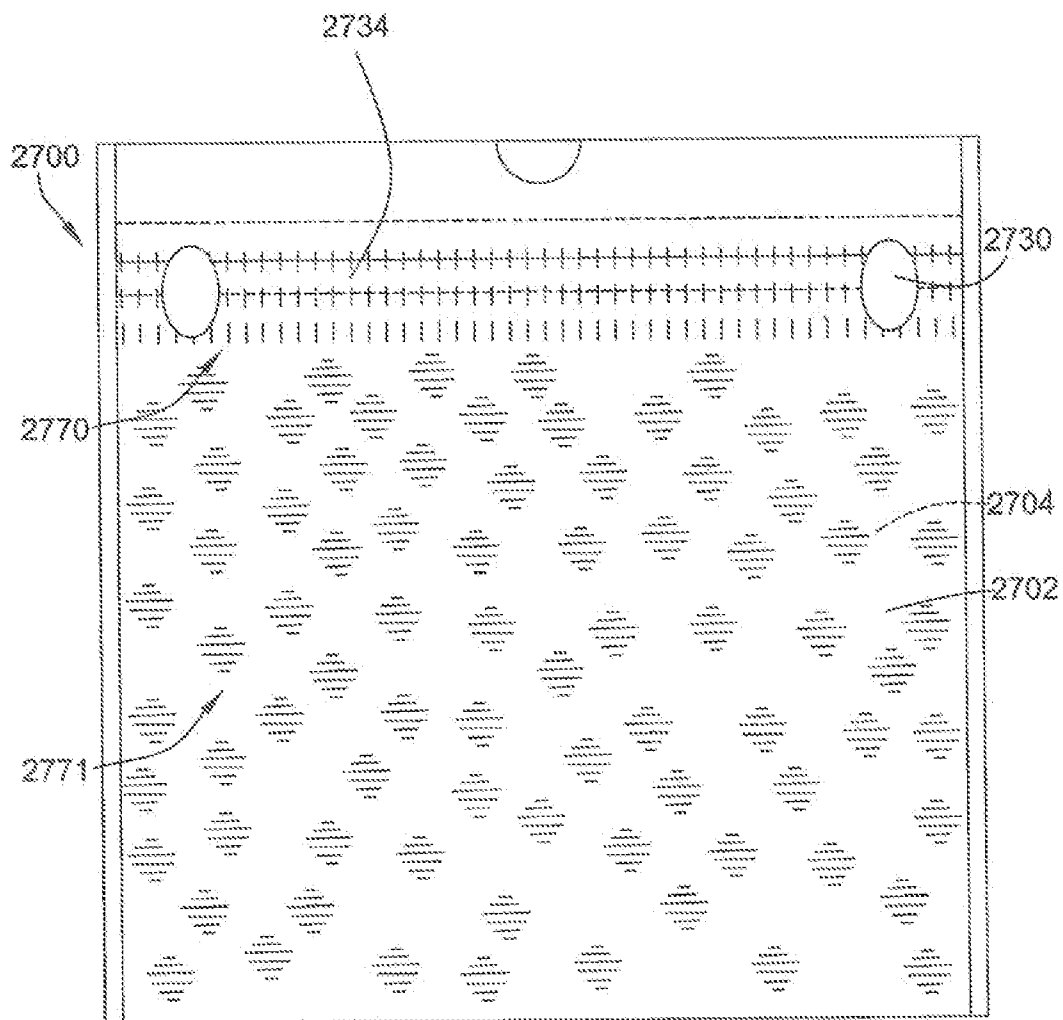


FIG. 34

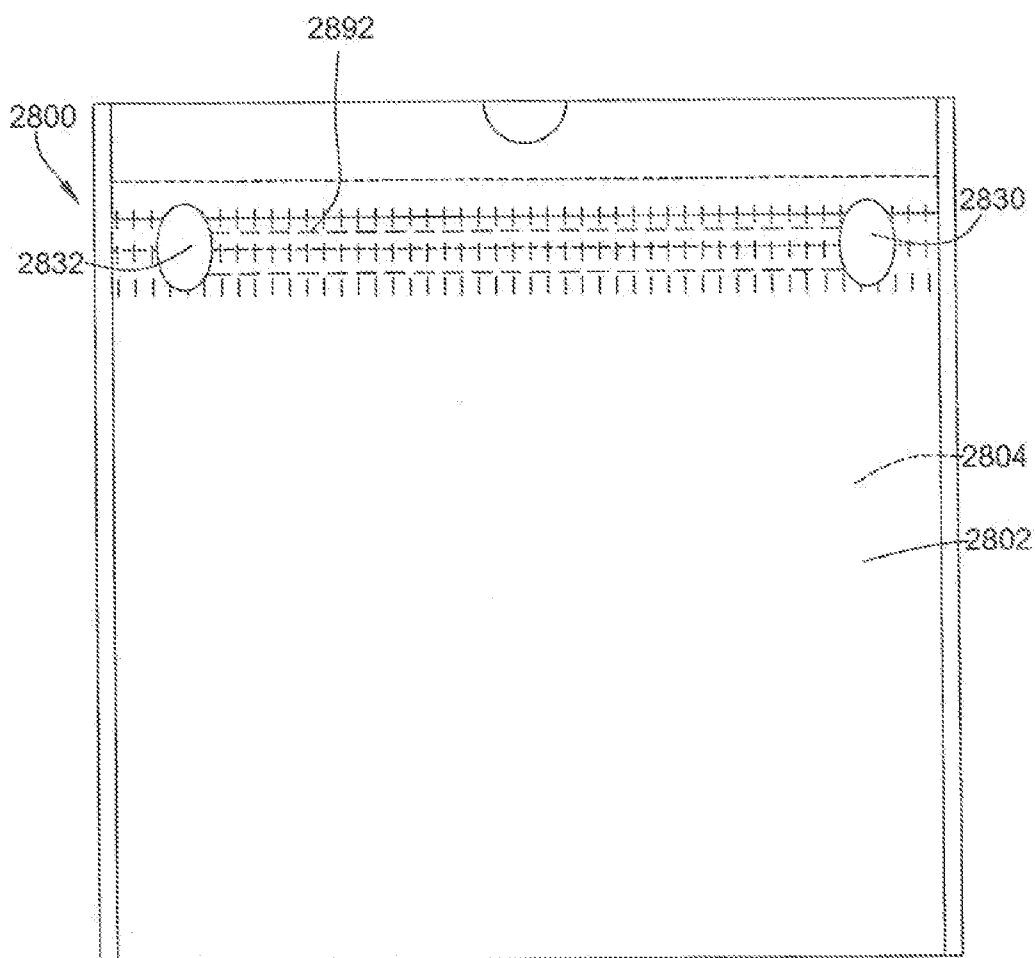


FIG. 35

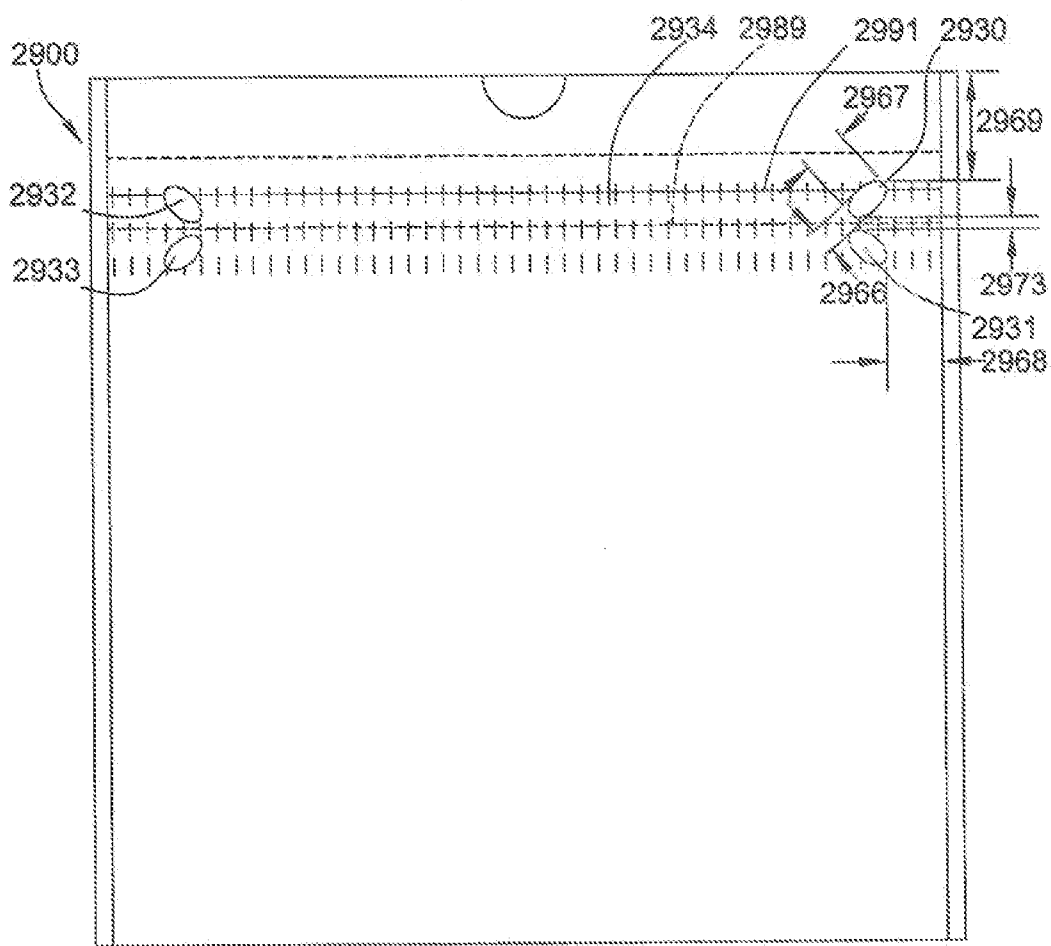


FIG. 36

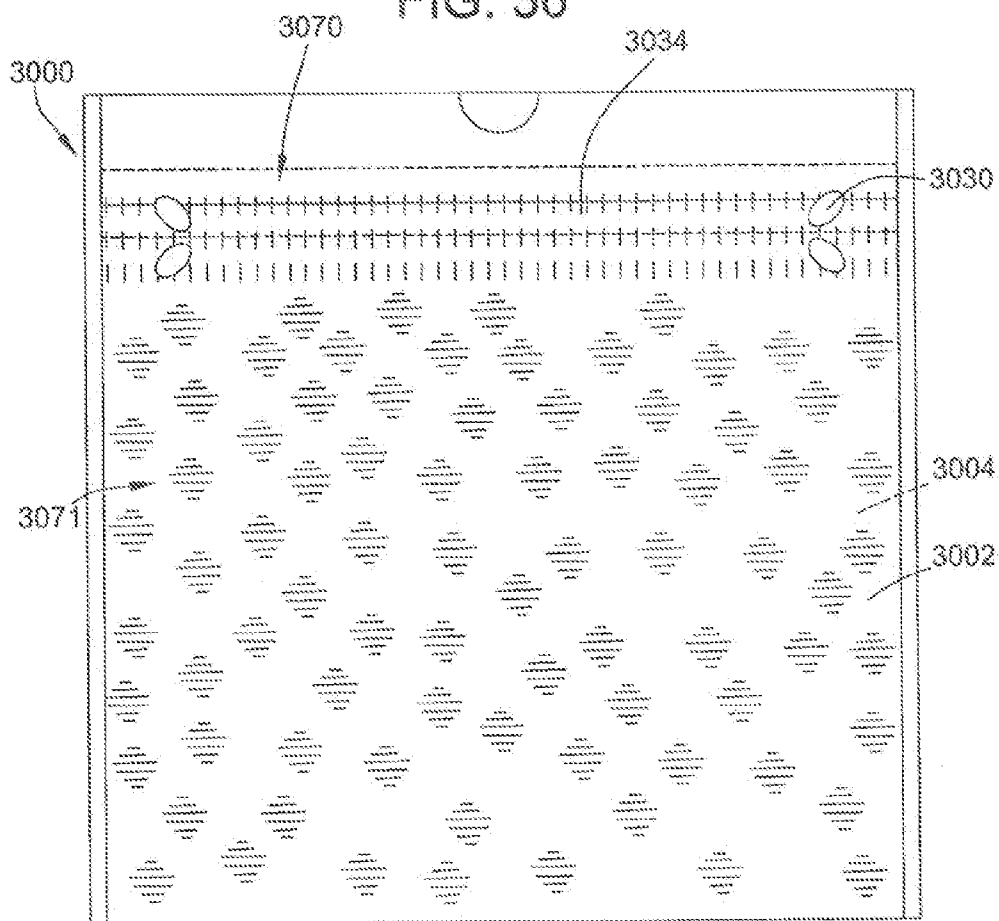


FIG. 37

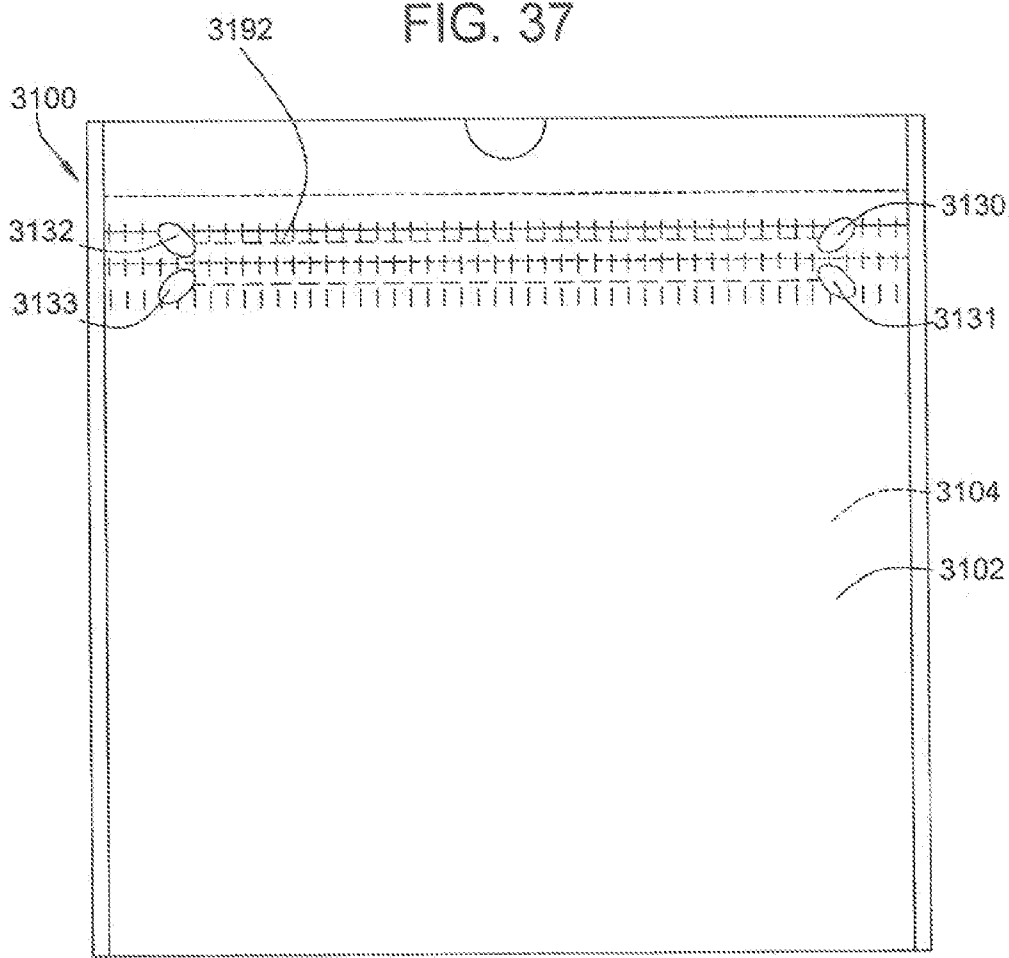


FIG. 38

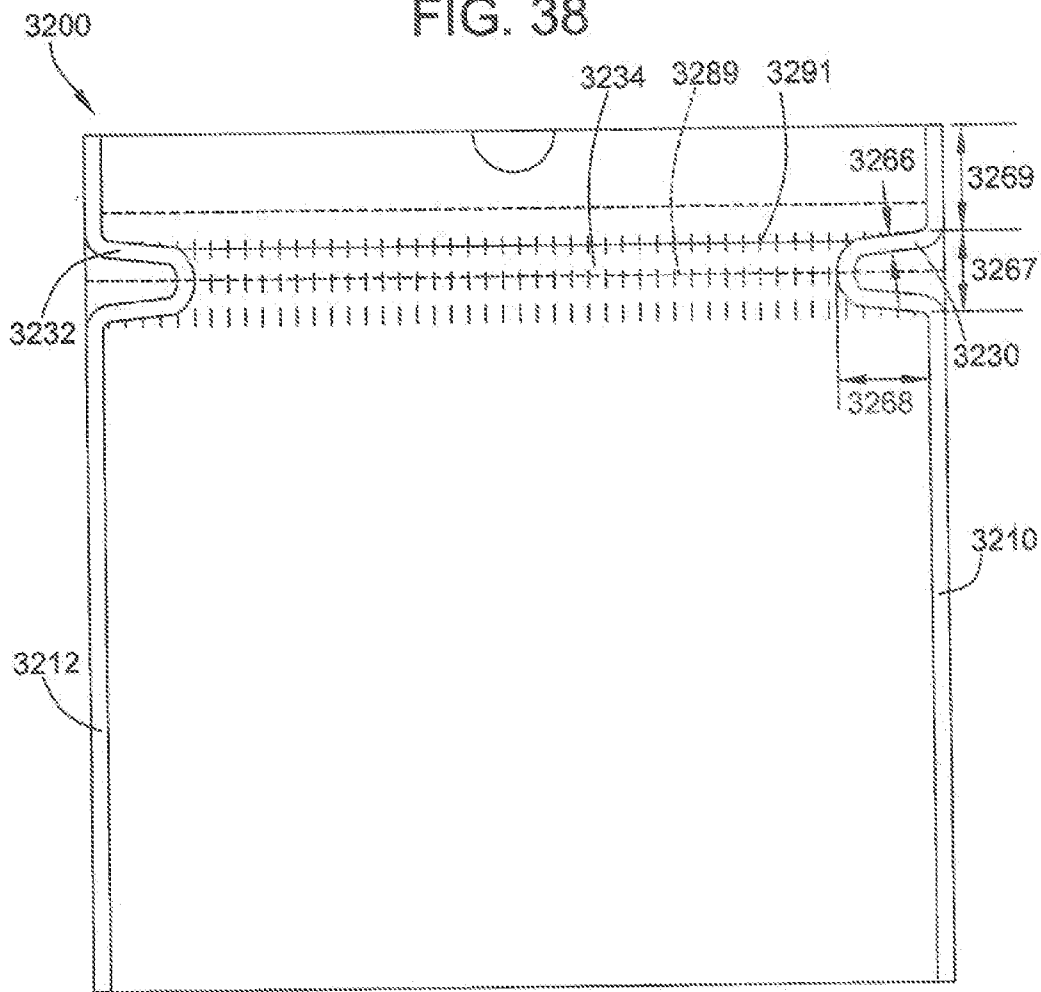
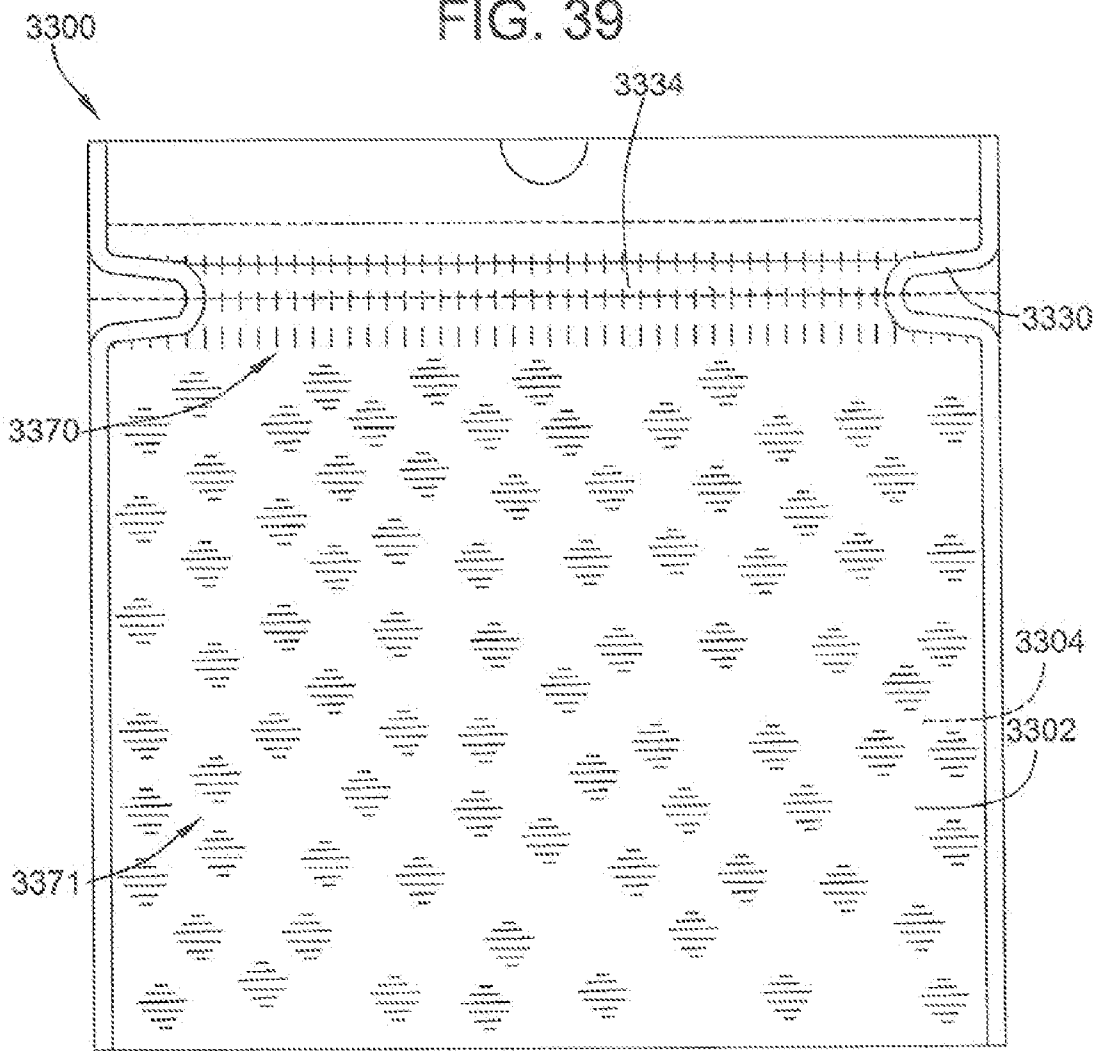




FIG. 39



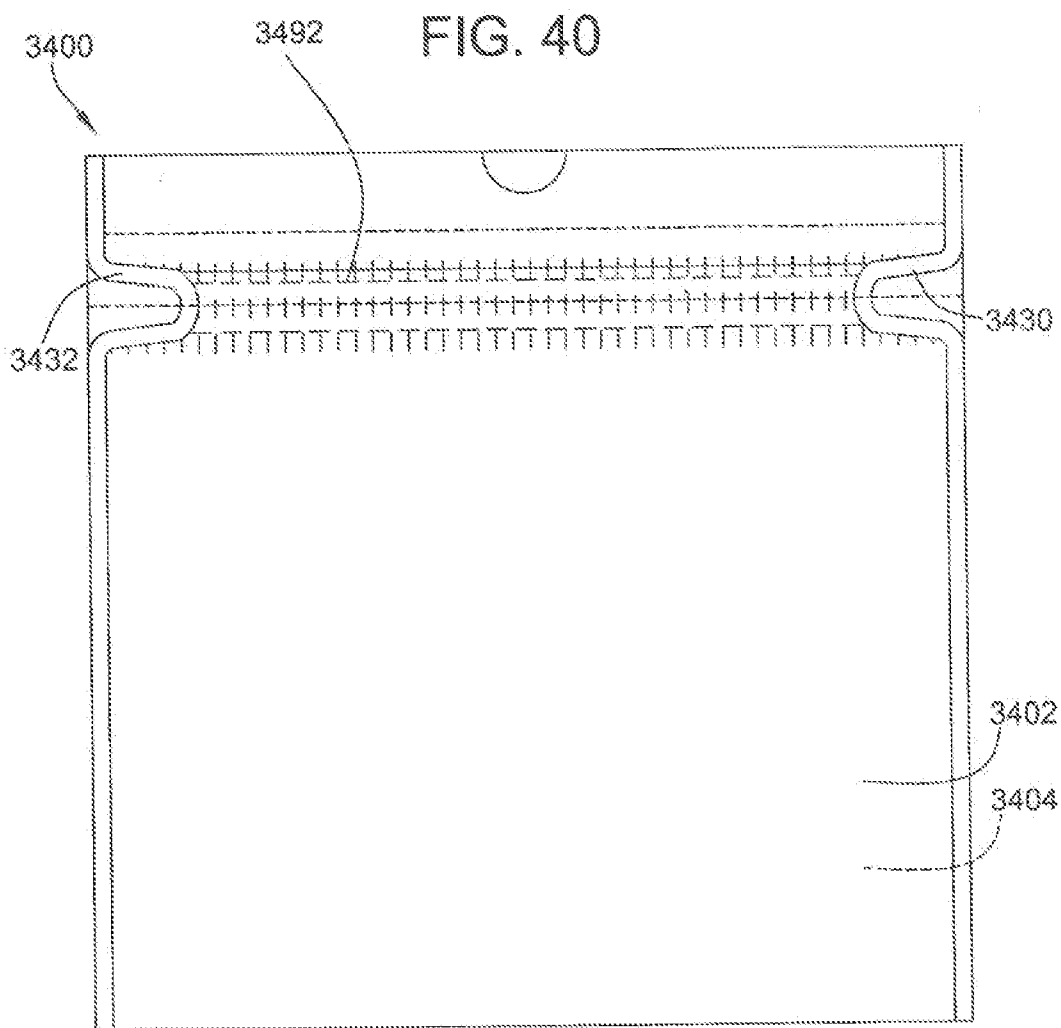


FIG. 41

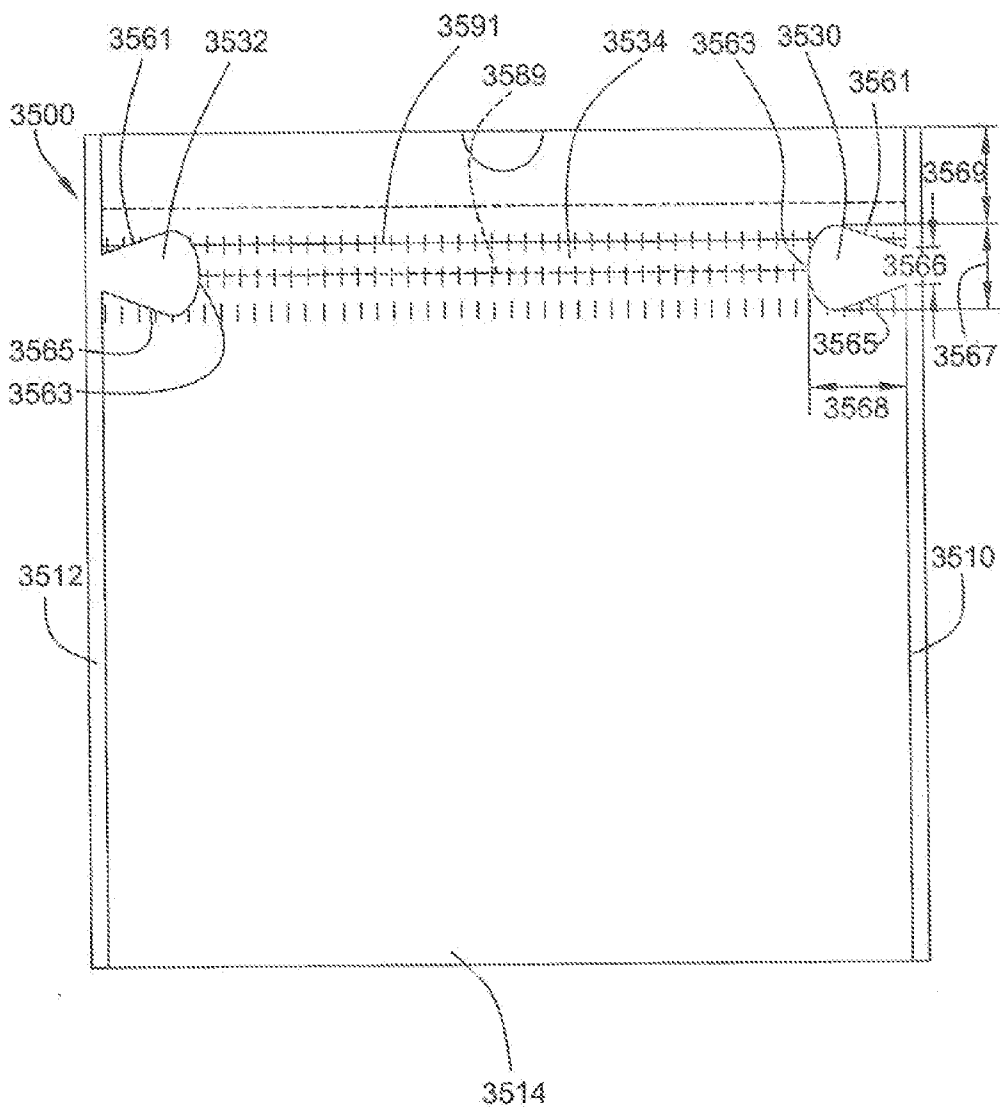


FIG. 42

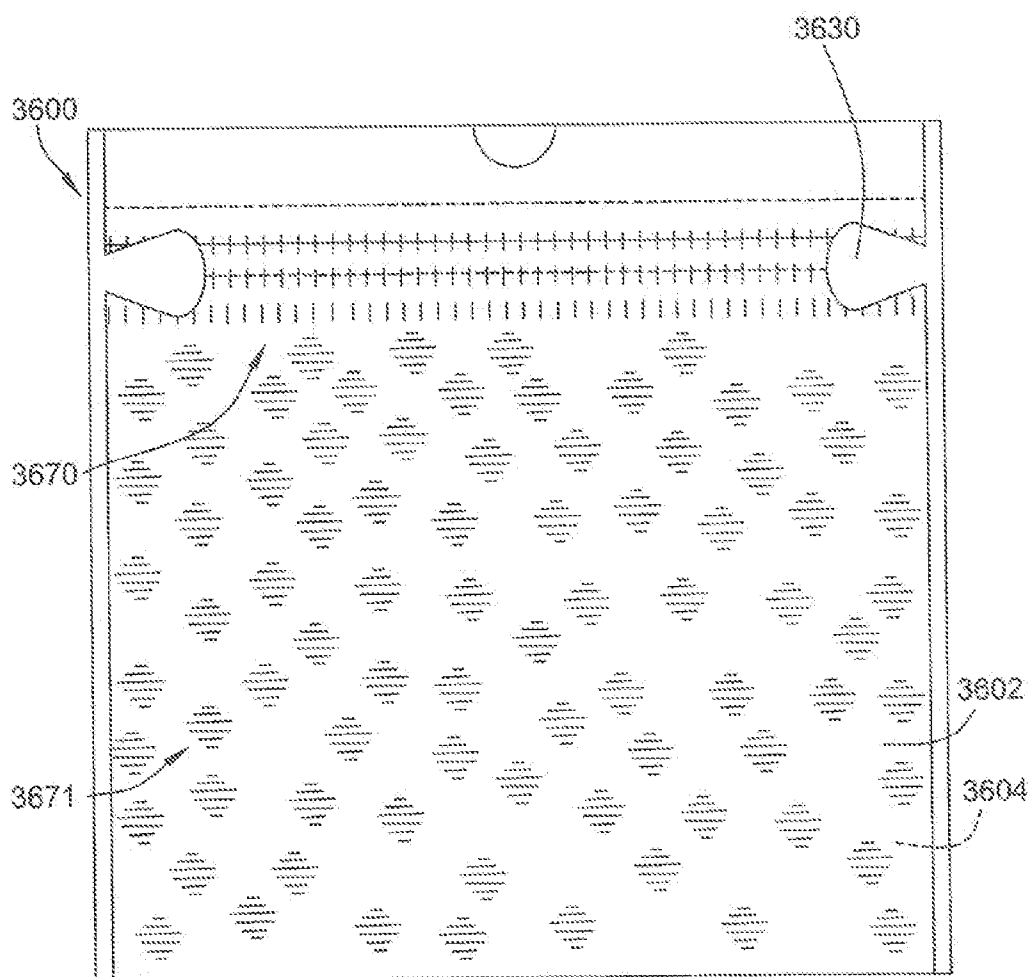


FIG. 43

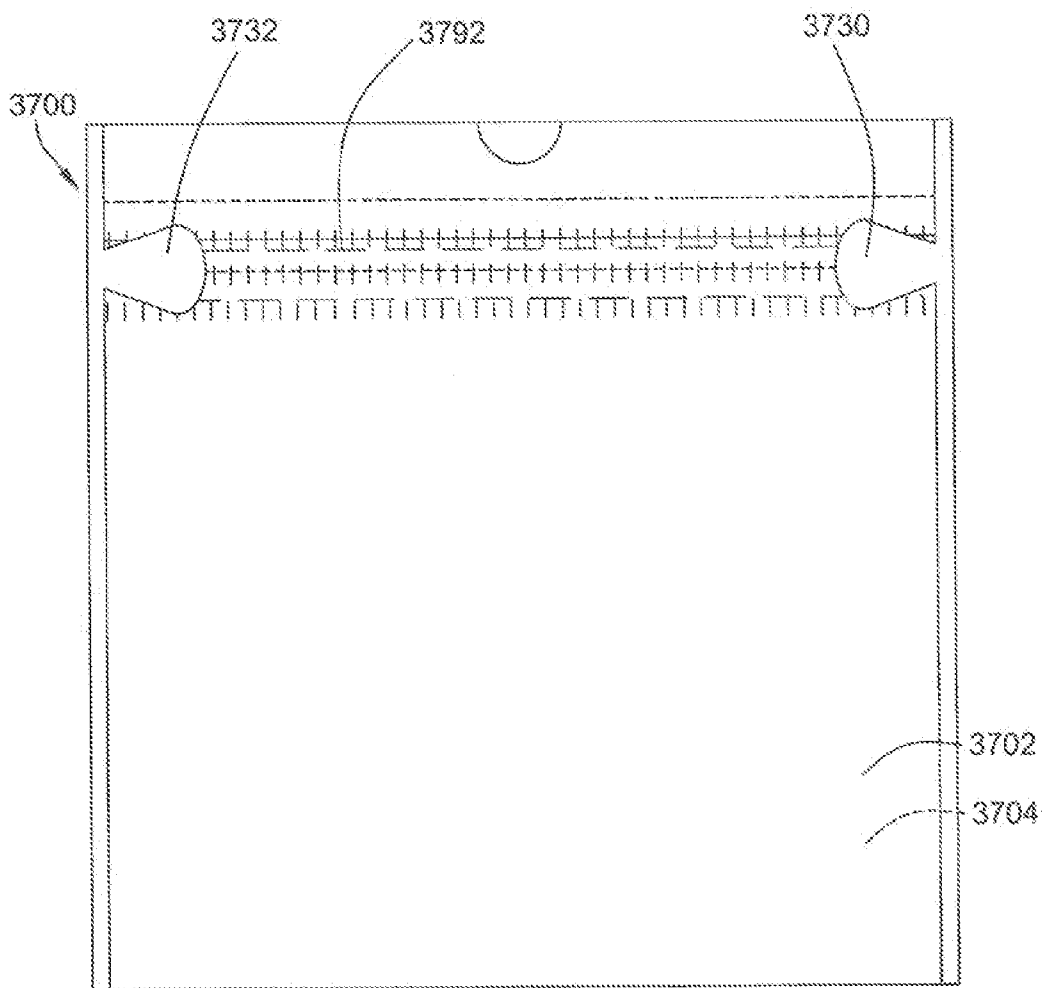


FIG. 44

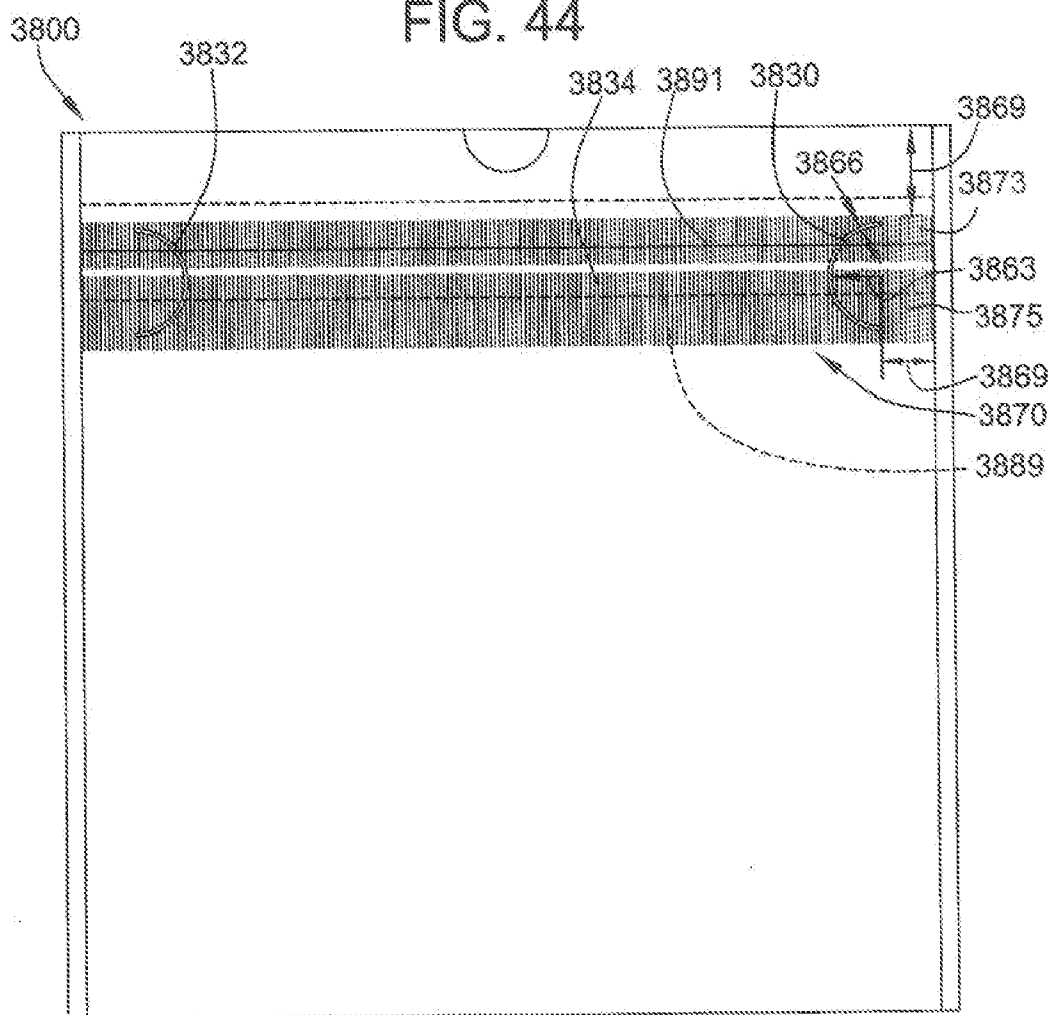


FIG. 45

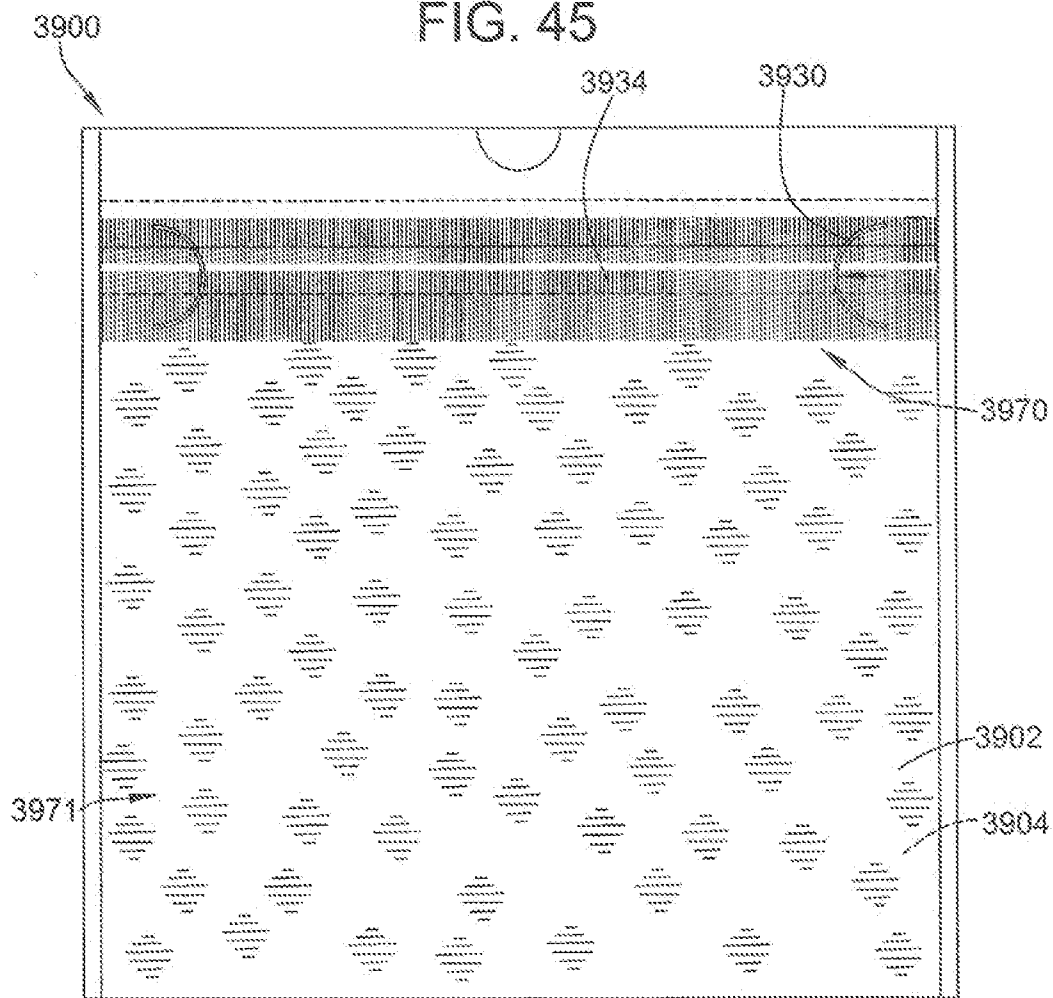
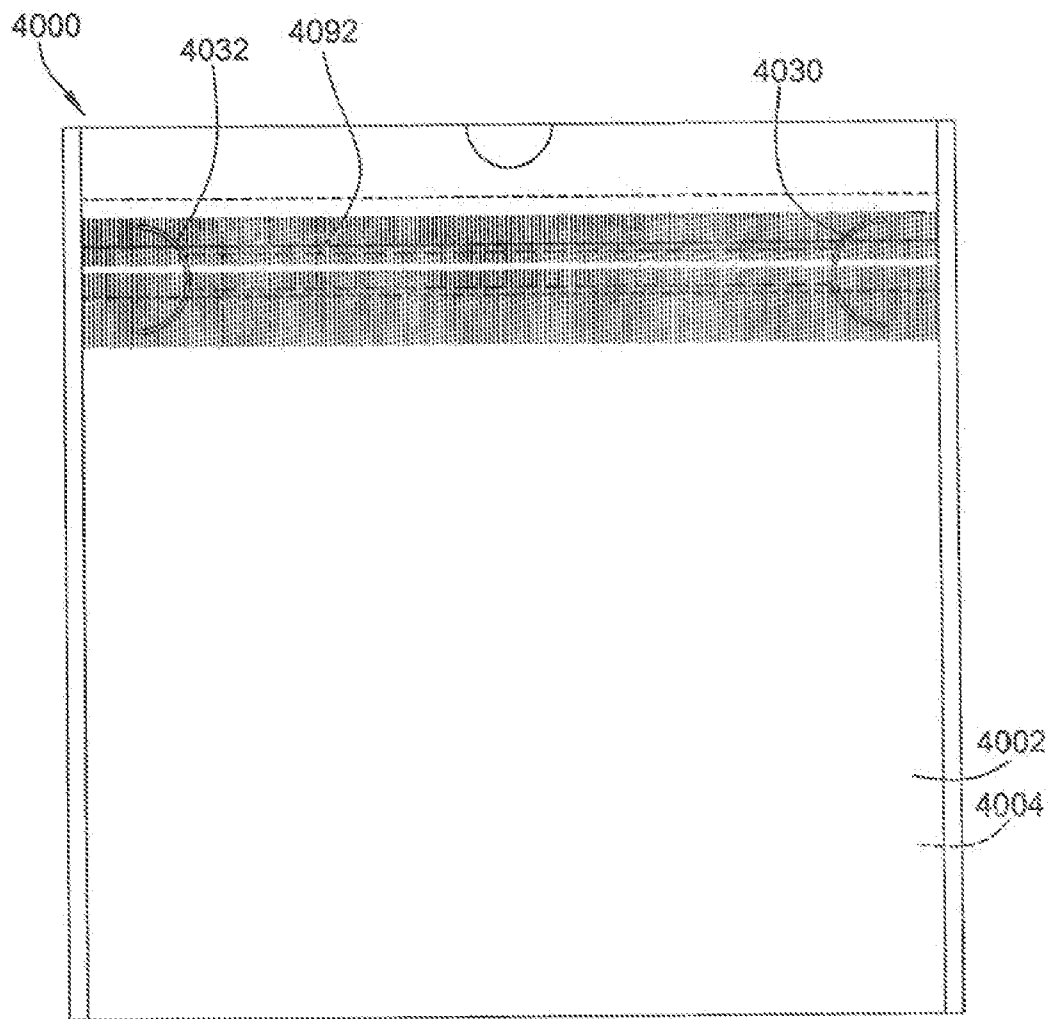
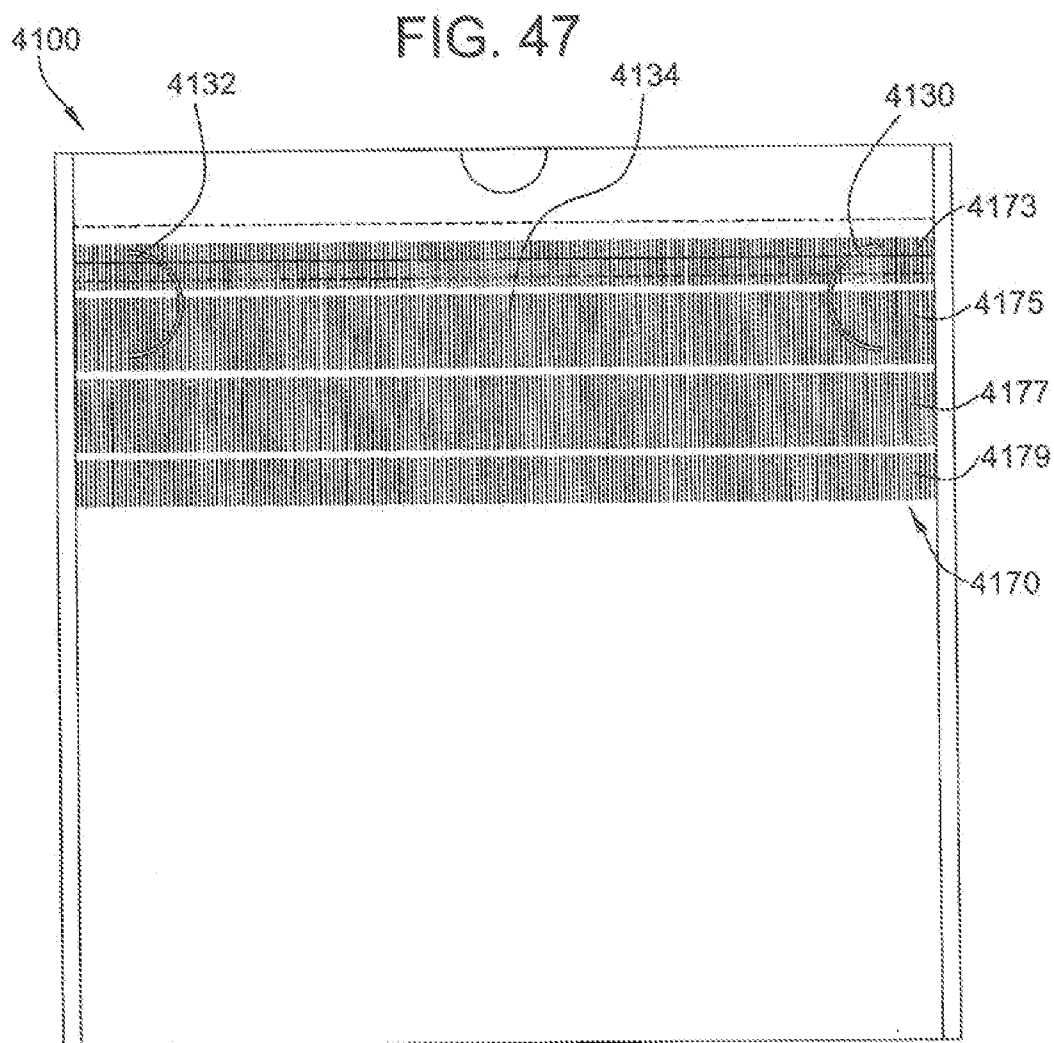
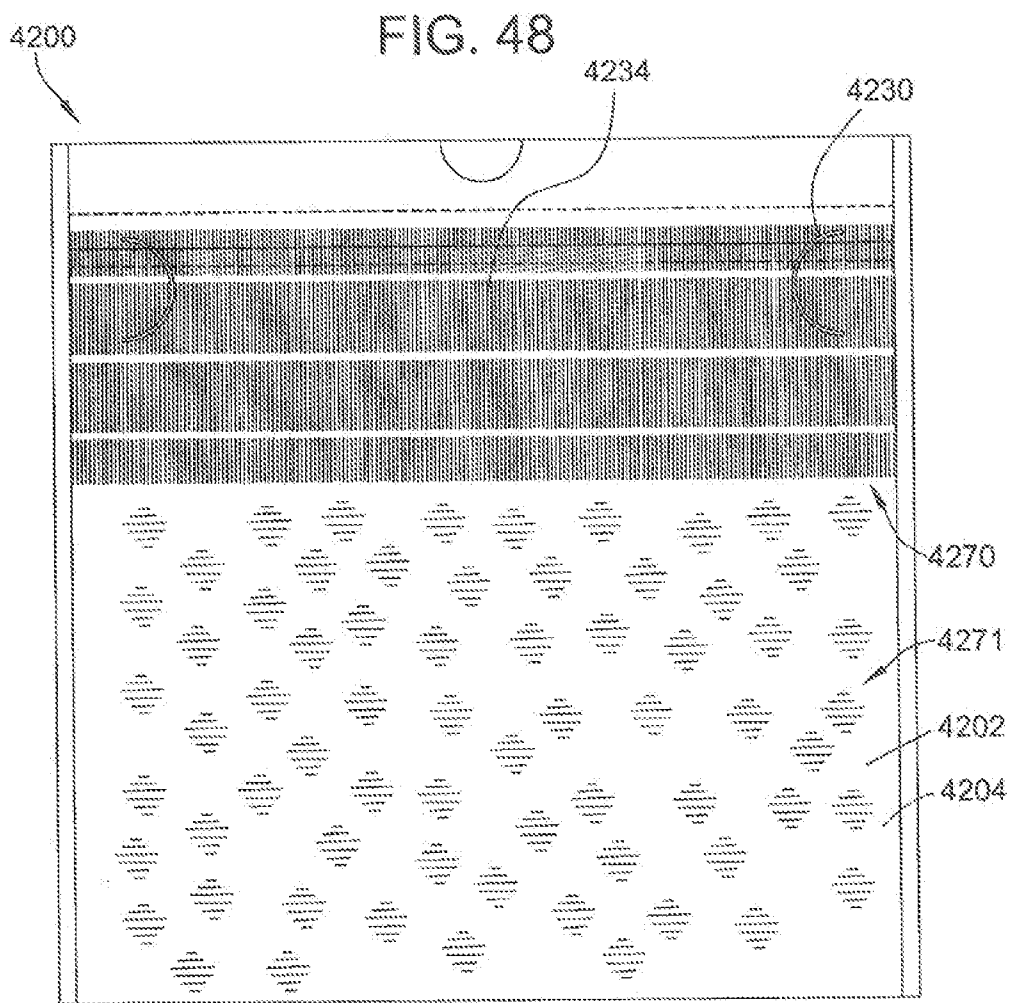


FIG. 46









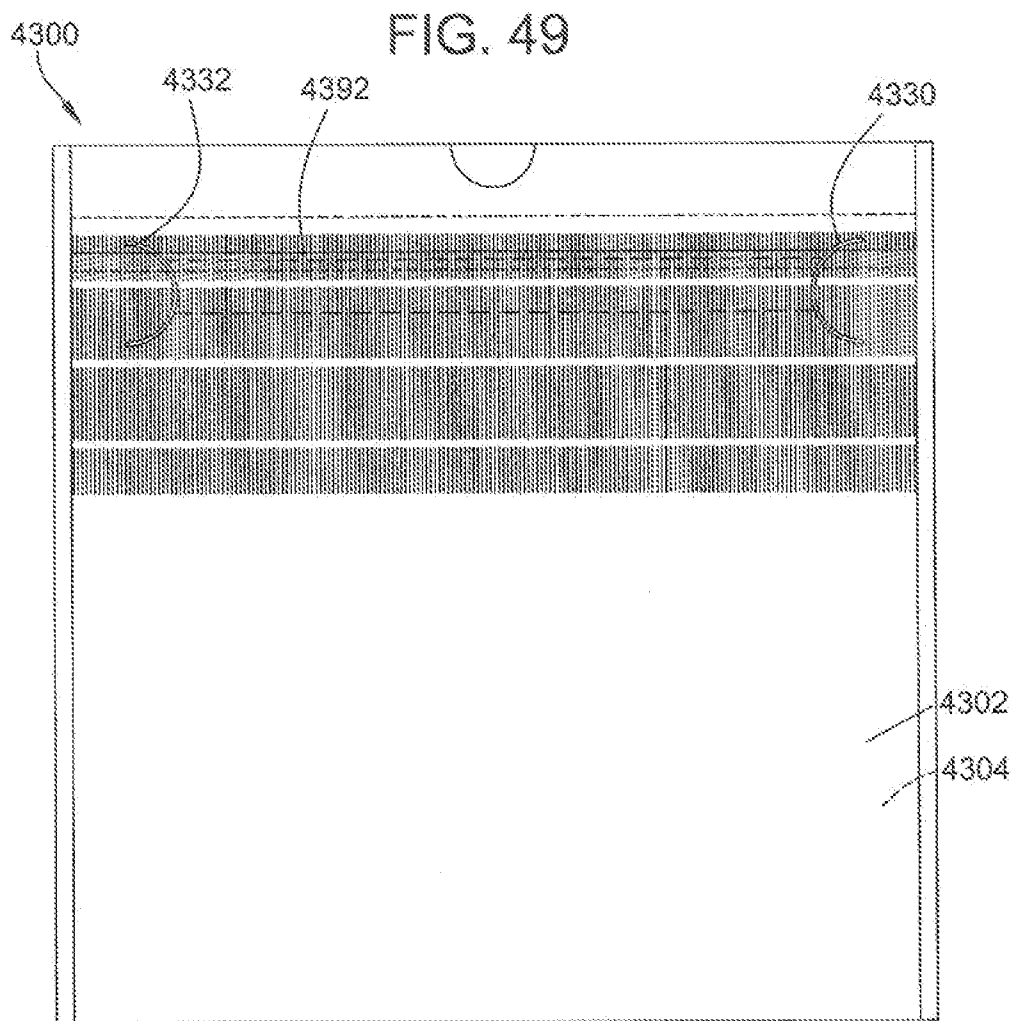


FIG. 50

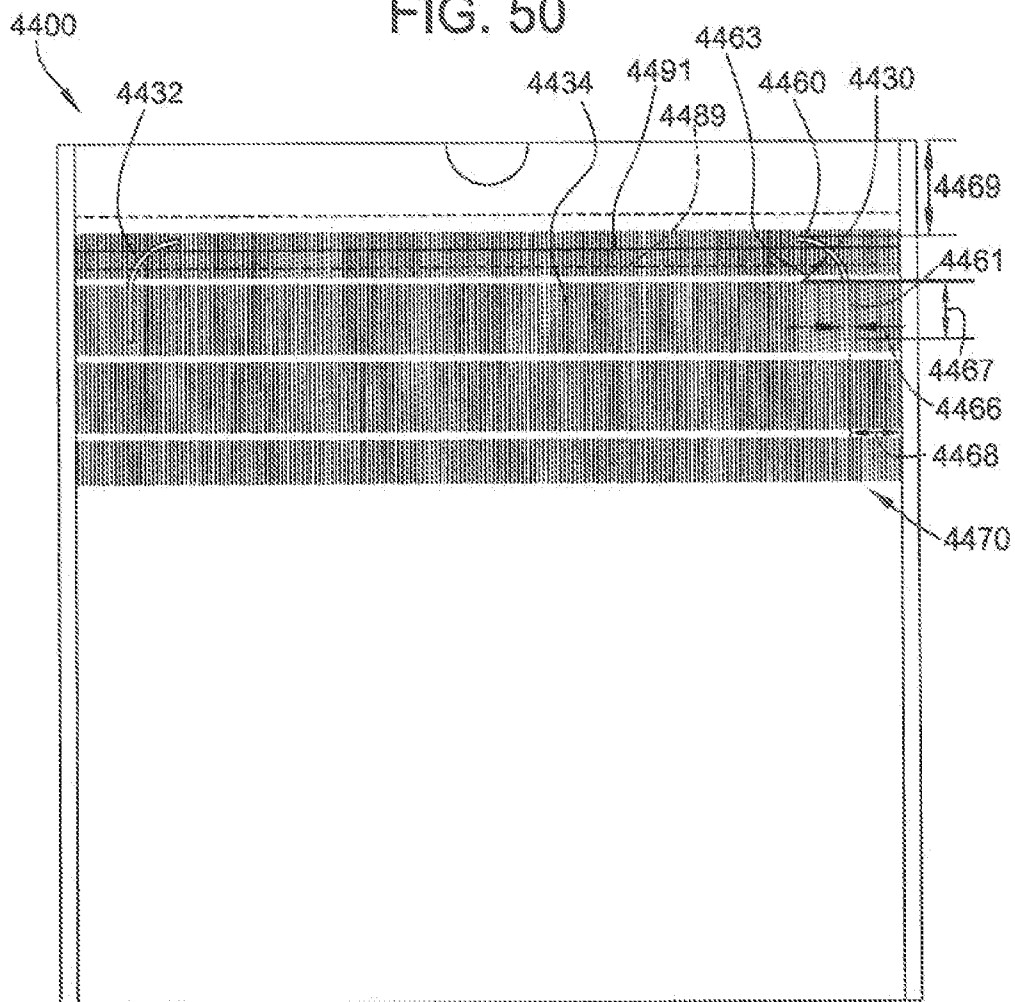


FIG. 51

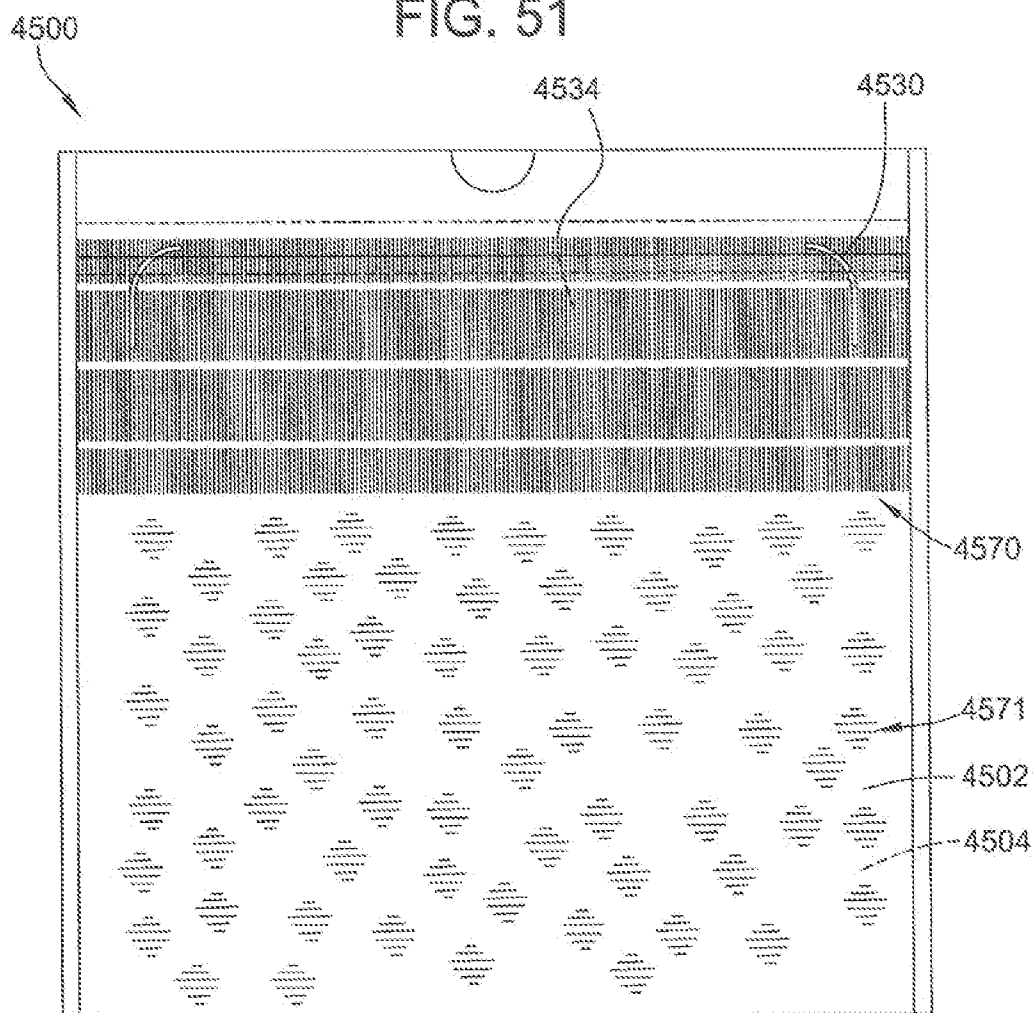


FIG. 52

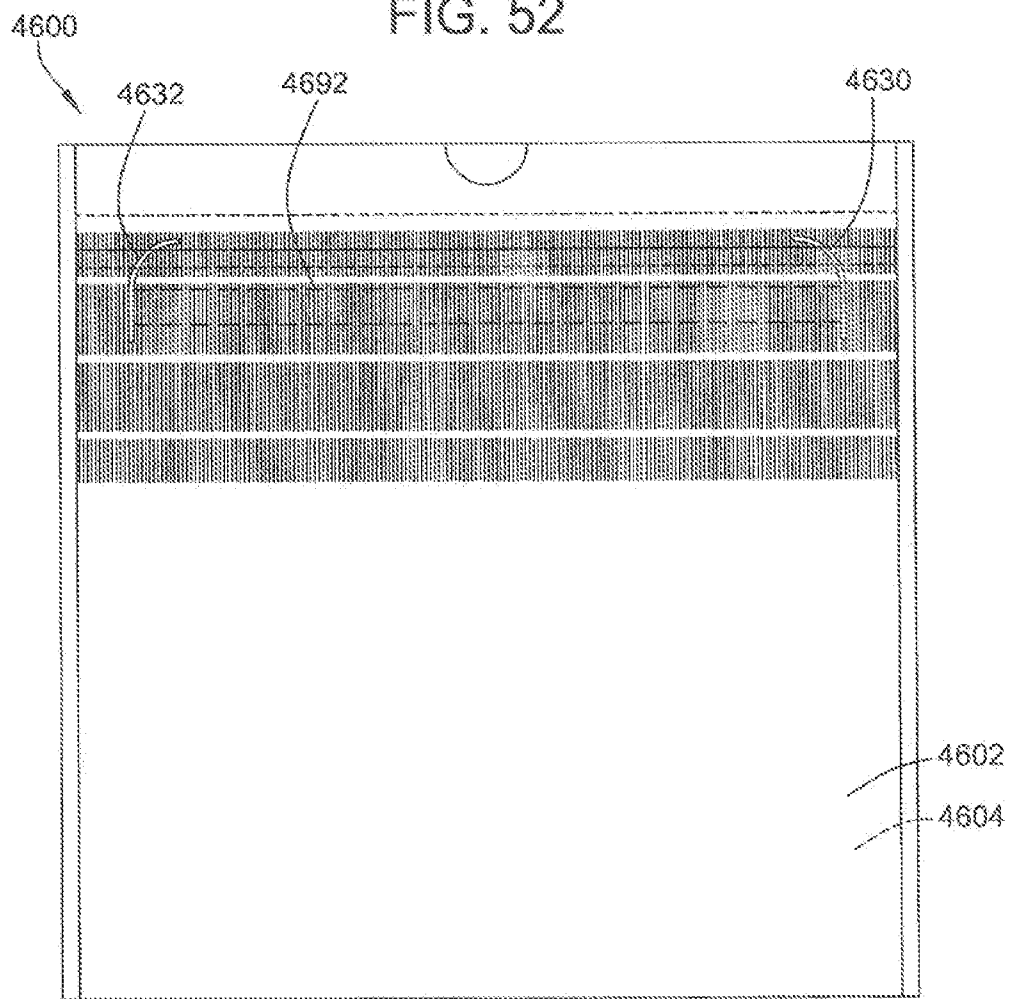


FIG. 53

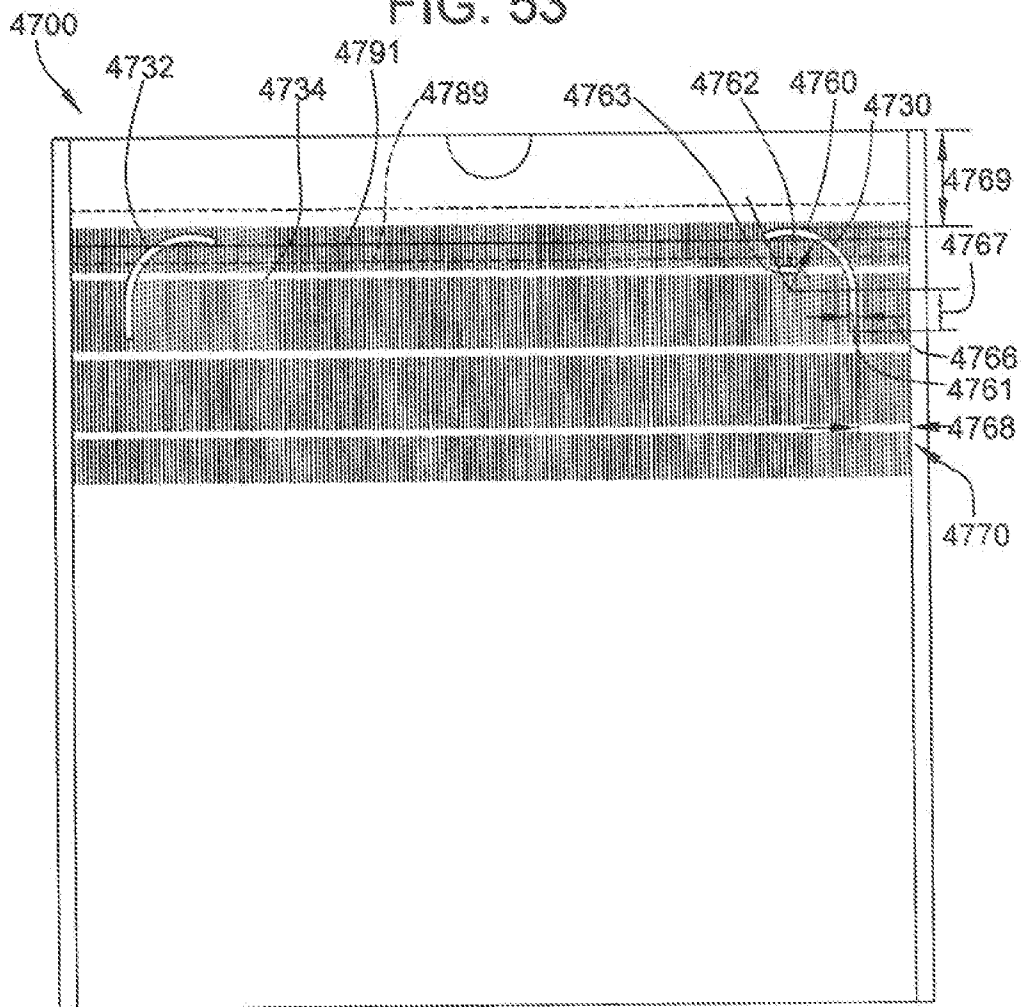


FIG. 54

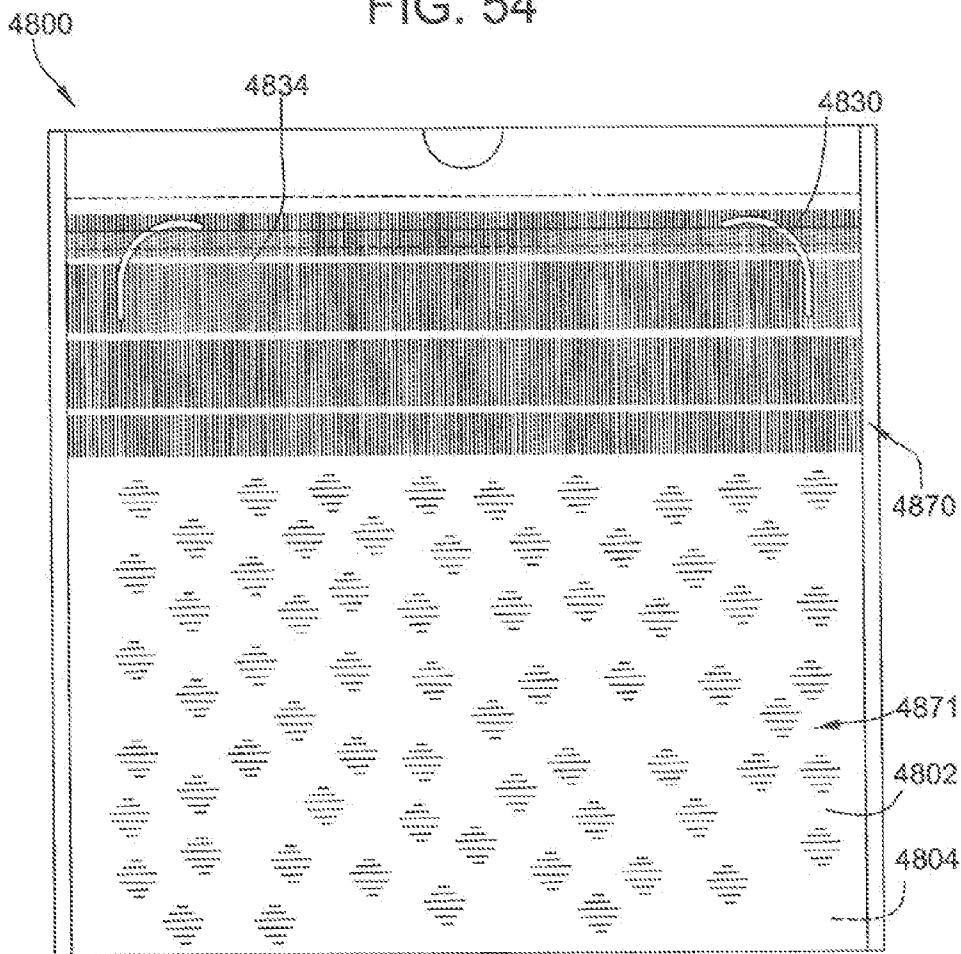
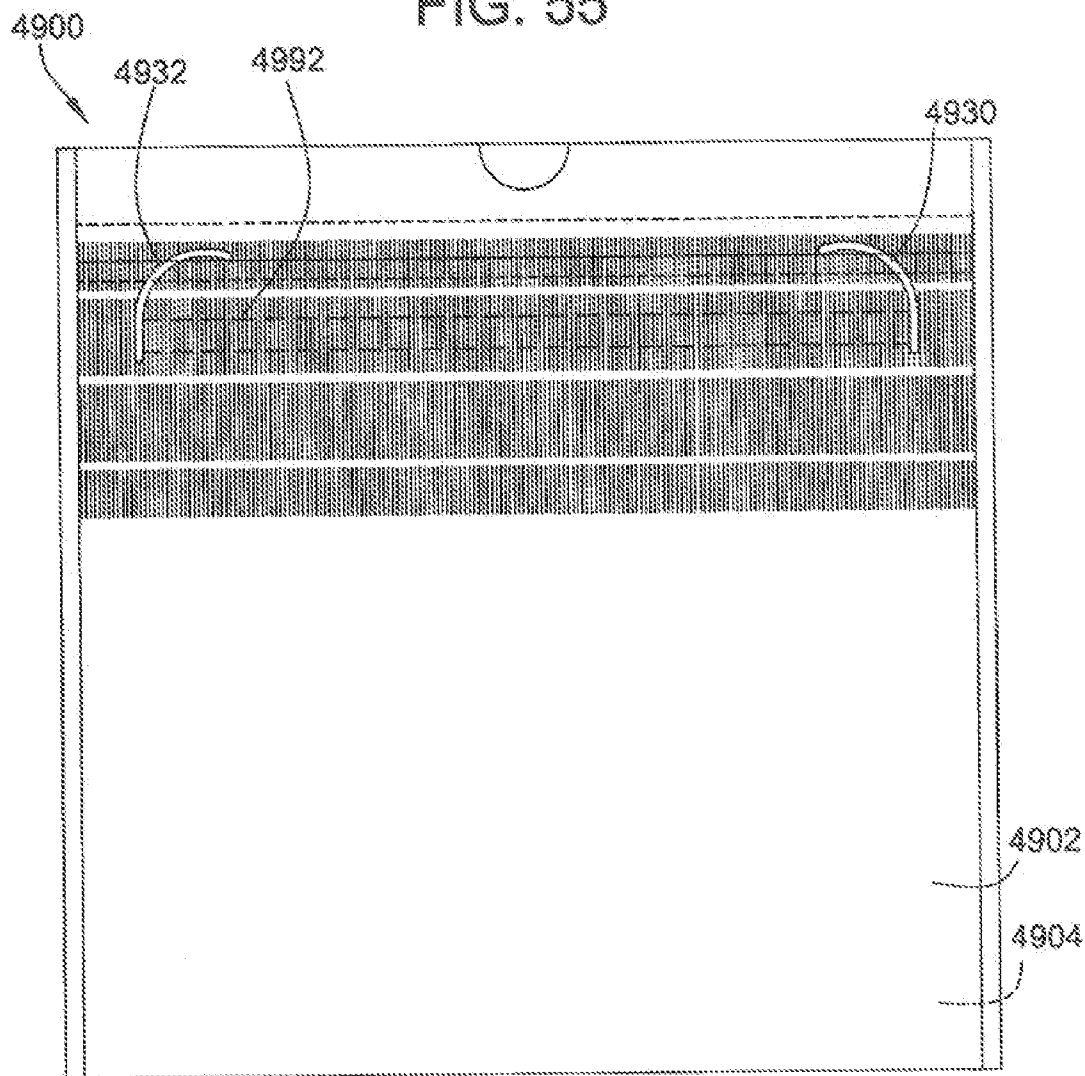




FIG. 55



**BAG**

**CROSS REFERENCE TO RELATED APPLICATIONS**

[0001] This application claims the benefit of U.S. Provisional Application No. 61/150,158, filed Feb. 5, 2009, which is hereby incorporated by reference in its entirety.

**BACKGROUND**

[0002] Among their many applications, it is known to use thermoplastic bags as disposable liners for trash receptacles. Trash receptacles that employ such liners can be small household kitchen garbage cans. The trash canisters are typically made from a rigid material like plastic or metal. The bags intended to be used as liners for such refuse containers are typically made from low-cost, pliable or flexible thermoplastic material. When the receptacle is full, the thermoplastic liner actually holding the trash may be removed for further disposal and replaced with a new liner.

[0003] When being utilized as a trash canister liner, it is important that the bag be secured in a manner that the bag can extend vertically within the canister so that items placed into the canister fall and collect at the bottom of the bag. Additionally, it is important that the bag does not unsecure or release itself with respect to the trash receptacle so as to fall into the trash receptacle. To avoid this problem, the open circumference of the bag is often folded over the lip or rim of the trash canister and may be tied thereto in order to retain the bag to the trash canister. However, tying knots into liner bags in order to secure them to the canister is an inconvenient and time consuming process. Therefore, it is desirable to develop a simpler and quicker method of securing trash bag liners to trash canisters. It is also desirable to implement the securing method in such a manner that it is inexpensive and may be facilitated in a high speed manufacturing environment.

**BRIEF SUMMARY**

[0004] The bag may be made from flexible, pliable, low-cost thermoplastic material. The bag may include rectangular first and second sidewalls that may be overlaid and joined to each other along a first side edge, a parallel second side edge and a closed bottom edge to delineate an interior volume. The first and second side edges and closed bottom edge may be formed by sealing the thermoplastic material together. To access the interior volume, the top edges of the sidewalls that are opposite the closed bottom edge may remain un-joined or unsealed to provide an opening.

[0005] To assist in securing the bag to a refuse canister when the bag is being used as a liner, the bag may include a retention feature proximate the opening. The retention feature may be formed as part of the side edge seals, particularly by arranging the generally straight and parallel side seals to converge partially towards each other near the opened top edge of the bag. By partially converging the side seals towards each other, the bag may be formed with a throat in which the width of the interior volume and opened top edge, as measured between the first and second side edges, is reduced. When the bag is inserted into a refuse canister, the opened top edge and the throat may be folded over the lip or rim of the canister. Because of the reduced width dimension corresponding to the throat, the converging portions of the side

edges that have been folded over the canister rim may grip around the perimeter of the canister thereby retaining the bag to the canister.

[0006] In a further embodiment, the bag may be provided with additional features to help retain it to the trash canister. These features may include forming the thermoplastic sidewall material between the opposing converging portions to have a stretchable or yieldable characteristic. Specifically, the sidewall may be formed so that the sheet-like thermoplastic material bunches together as a series of wrinkles or creases. When a pulling force is applied, the bunched together thermoplastic material may un-bunch thereby allowing the bag to stretch or expand. The thermoplastic material may have some shape memory tending to cause the material to re-bunch together, thereby providing an elastic or resilient characteristic to the bag and helping the throat to grip or constrict around the canister. In another embodiment, the bag may have strips of elastic material attached to one or both of the sidewalls and may extend between the converging portions of the first and second side edges. Like the patterns, the strip of elastic material may help grip and retain the bag to the refuse canister.

[0007] The bag may be produced by a high speed manufacturing process that processes continuous sheet-like webs of thermoplastic material into the finished bag via automated equipment. The process may include equipment, such as, seal bars, that the web or webs are directed between, that may form the side seals including the converging portions in a single, repeated step. Manufacturing the side seals in a single, repeated step may speed the manufacturing process and may reduce the cost of the finished bags.

[0008] An advantage of the thermoplastic bag having the retention feature is that it may better secure itself to the refuse container and may resist falling into the container. Another advantage is that the plastic bags with the retention features may be produced via a high-speed, low cost manufacturing process. These and other advantages and features of the invention will become apparent from the detail description and the accompanying drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0009] FIG. 1 is a perspective view of a thermoplastic bag adapted for use as a trash receptacle liner which includes a retention feature formed by directing the first and second side edges to converge toward each other.

[0010] FIG. 2 is a front elevational view of the plastic bag shown in FIG. 1.

[0011] FIG. 3 is a perspective view of the plastic bag of FIG. 1 inserted into and retained to a trash container.

[0012] FIG. 4 is a perspective view of the area indicated in FIG. 1 by circle 4-4 illustrating the thermoplastic material used for the bag, the material being formed to have a stretchable or yieldable characteristic, the material being in the un-stretched condition.

[0013] FIG. 5 is a perspective view similar to that of FIG. 4, illustrating the thermoplastic material as stretched out.

[0014] FIG. 6 is a cross-sectional view of the bag taken along lines 6-6 of FIG. 1, illustrating a draw tape being included for drawing closed the opening of the bag.

[0015] FIG. 7 is a perspective view of another embodiment of the thermoplastic bag adapted for use as a trash canister liner having a retention feature to help secure the bag to a refuse container.

[0016] FIG. 8 is a perspective view of another embodiment of a thermoplastic bag adapted for use as a trash canister liner

having a retention feature and a pattern adapted to provide a stretchable or yieldable characteristic.

[0017] FIG. 9 is a front elevational view of a thermoplastic bag adapted for use as a trash canister liner having a retention feature and a pattern to help secure the bag to a refuse canister.

[0018] FIG. 10 is a front elevational view of a thermoplastic bag adapted for use as a trash canister liner having a retention feature and a pattern to help secure the bag to a refuse canister.

[0019] FIG. 11 is a front elevational view of another embodiment.

[0020] FIG. 12 is a front elevational view of another embodiment.

[0021] FIG. 13 is a front elevational view of another embodiment.

[0022] FIG. 14 is a front elevational view of another embodiment.

[0023] FIG. 15 is a front elevational view of another embodiment.

[0024] FIG. 16 is a front elevational view of another embodiment.

[0025] FIG. 17 is a front elevational view of another embodiment.

[0026] FIG. 18 is front elevational view of a thermoplastic bag adapted for use as a trash canister liner having a retention feature to assist securing the bag to a refuse canister.

[0027] FIG. 19 is a front elevational view of another embodiment.

[0028] FIG. 20 is a front elevational view of another embodiment.

[0029] FIG. 21 is a front elevational view of another embodiment.

[0030] FIG. 22 is a front elevational view of another embodiment.

[0031] FIG. 23 is a partial front elevational view of another embodiment.

[0032] FIG. 24 is a partial front elevational view of another embodiment.

[0033] FIG. 25 is a partial front elevational view of another embodiment.

[0034] FIG. 26 is a partial front elevational view of another embodiment.

[0035] FIG. 27 is a partial front elevational view of another embodiment.

[0036] FIG. 28 is a partial front elevational view of another embodiment.

[0037] FIG. 29 is a schematic representation of a high speed manufacturing process for producing the trash bags which may process a single web of thermoplastic material.

[0038] FIG. 30 is a schematic representation of another embodiment of the manufacturing process.

[0039] FIG. 31 is another schematic representation of a high speed manufacturing process for producing the trash bags which may process multiple webs of thermoplastic material.

[0040] FIG. 32 is a front elevational view of another embodiment.

[0041] FIG. 33 is a front elevational view of another embodiment.

[0042] FIG. 34 is a front elevational view of another embodiment.

[0043] FIG. 35 is a front elevational view of another embodiment.

[0044] FIG. 36 is a front elevational view of another embodiment.

[0045] FIG. 37 is a front elevational view of another embodiment.

[0046] FIG. 38 is a front elevational view of another embodiment.

[0047] FIG. 39 is a front elevational view of another embodiment.

[0048] FIG. 40 is a front elevational view of another embodiment.

[0049] FIG. 41 is a front elevational view of another embodiment.

[0050] FIG. 42 is a front elevational view of another embodiment.

[0051] FIG. 43 is a front elevational view of another embodiment.

[0052] FIG. 44 is a front elevational view of another embodiment.

[0053] FIG. 45 is a front elevational view of another embodiment.

[0054] FIG. 46 is a front elevational view of another embodiment.

[0055] FIG. 47 is a front elevational view of another embodiment.

[0056] FIG. 48 is a front elevational view of another embodiment.

[0057] FIG. 49 is a front elevational view of another embodiment.

[0058] FIG. 50 is a front elevational view of another embodiment.

[0059] FIG. 51 is a front elevational view of another embodiment.

[0060] FIG. 52 is a front elevational view of another embodiment.

[0061] FIG. 53 is a front elevational view of another embodiment.

[0062] FIG. 54 is a front elevational view of another embodiment.

[0063] FIG. 55 is a front elevational view of another embodiment.

DESCRIPTION

[0064] Referring to FIG. 1, a pliable thermoplastic bag 100 which may be used as a liner for trash receptacles and refuse containers is illustrated. The bag 100 may be made from a first sidewall 102 and an opposing, second sidewall 104 that may be overlaid and may be joined to the first sidewall for defining an interior volume 106 for holding trash. The first and second sidewalls may be joined together along a first side seal 110 corresponding to a first edge of the sidewalls, a second side seal 112 that may be parallel to and spaced apart from the first side edge, and a closed bottom 114 that extends between the first and second side seals. The sidewalls 102, 104 may be joined along their edges by any suitable joining process such as, for example, heat sealing in which the thermoplastic material bonds or melts together. Other sealing or joining processes may include ultrasonic methods and adhesive.

[0065] The first and second sidewalls 102, 104 may be made of flexible or pliable thermoplastic material formed or drawn into a smooth, thin-walled web or sheet. Examples of suitable thermoplastic materials may include polyethylenes, such as, high density polyethylene, low density polyethylene, linear low density polyethylene, very low density polyethylene, polypropylene, ethylene vinyl acetate, nylon, polyester, ethylene vinyl alcohol, or ethylene-methyl acrylate, and may be formed in combinations and in single or multiple layers.

When used as a garbage can liner, the thermoplastic material may typically be opaque but may also be transparent, translucent, or tinted. Furthermore, the material used for the sidewalls may be a gas impermeable material and may include other features such as being treated with deodorants, scents, and/or disinfectants as is sometimes desirable in the production of trash can liners.

[0066] To access the interior volume **106**, the top edges **120**, **122** of the first and second sidewalls which are located opposite the bottom **114** remain un-joined to provide an opening **124**. Referring to FIG. 2, the width **126** of the opening **124** when the bag is laid flat on the first and second sidewalls **102**, **104** extends between the first side seal **110** and the second side seal **112**. The width **126** may have a range from about 10 inches (25.4 cm) to about 60 inches (152.4 cm). When the bag **100** is placed in a trash receptacle, the top edges **120**, **122** corresponding to the opening **124** are typically folded back over the rim to help retain the bag in a vertically extended position within the receptacle. The bag **100** may have a height **128**. The height may have a range from about 10 inches (25.4 cm) to about 60 inches (152 cm).

[0067] To assist in retaining the bag **100** to the container, the bag may be formed with certain retention features that grip around the circumference of the container. In the illustrated embodiment shown in FIGS. 1 and 2, the retention features may be formed as part of the first and second side seals **110**, **112**. The first and second side seals **110**, **112**, which may be otherwise generally straight, include respective first and second converging portions **130**, **132** that cause the sealed edges to partially converge or extend toward each other. The converging portions **130**, **132** may be continuations of the otherwise straight side seals **110**, **112** in which the material of the opposing sidewalls is physically joined together. In the illustrated embodiment, the side seals **110**, **112** including the opposing converging portions **130**, **132** may be generally symmetrical.

[0068] The converging portions may be formed where the side seals curve toward and then away from each other and may be located generally proximate to and just below the open top edges **120**, **122** of the bag **100**. By way of example, the converging portions **130**, **132** may be located a distance **137** below the open top edges **120**, **122** as in FIG. 2. The distance **137** may have a first range from about 0.5 inches (1.27 cm) to about 12 inches (30.48 cm), a second range from about 1 inch (2.54 cm) to about 6 inches (15.24 cm), and a third range from about 2.5 inches (6.35 cm) to about 5 inches (12.7 cm). In one embodiment, the distance **137** may be about 2.75 inches (7 cm). The converging portions **130**, **132** may extend towards each other away from the side seals **110**, **112** by a distance **139**. The distance **139** may have a first range from about 0.25 inches (0.64 cm) to about 6 inches (15.24 cm), a second range from about 0.5 inches (1.27 cm) to about 4 inches (10.16 cm), and a third range from about 1 inch (2.54 cm) to about 3 inches (7.62 cm). In one embodiment, the distance **139** may be about 2 inches (5.08 cm). The distance **139** may be a percentage of the width **126**. The percentage may have a first range from about 1% to about 25%, a second range from about 2% to about 16%, and a third range from about 4% to about 12%. In one embodiment, the percentage may be about 8%. The converging portions may have a distance **138** measured with respect to the side edges **110**, **112**. The distance **138** may have a first range from about 0.5 inches (1.27 cm) to about 10 inches (25.4 cm), a second range from about 1 inch (2.54 cm) to about 6 inches (15.24 cm), and a

third range from about 2 inches (5.08 cm) to about 4 inches (10.16 cm). In one embodiment, the distance **138** may be about 3 inches (7.62 cm). The distance **138** may be a percentage of the bag height **128**. The percentage may have a first range from about 1% to about 30%, a second range from about 2% to about 20%, and a third range from about 4% to about 15%. In one embodiment, the percentage may be about 7%. In the illustrated embodiment, the converging portions are generally arcuate or curved in shape, but in other embodiments the converging portion may have other shapes. Other examples of shapes for the converging portion include square, rectangular, triangular, chevron and combinations of the shapes. FIGS. 21-26 illustrate other shapes for the converging portion and are described herein.

[0069] The width of the actual seal between the first and second sidewalls **102**, **104** that makes up the converging portion may be the same as the width of the seal that makes up the side seals **110**, **112**. For example, the side seals **110**, **112** may have a width **116**. The width **116** may have a first range from about 0.031 inches (0.08 cm) to about 0.5 inches (1.27 cm), a second range from about 0.063 inches (0.16 cm) to about 0.375 inches (0.95 cm), and a third range from about 0.094 inches (0.238 cm) to about 0.25 inches (0.64 cm). In one embodiment, the width **116** may be about 0.16 inches (0.41 cm). The portion of the seal corresponding to the converging portions may have a width **134**. The width **134** may have a first range from about 0.031 inches (0.08 cm) to about 0.5 inches (1.27 cm), a second range from about 0.063 inches (0.16 cm) to about 0.375 inches (0.95 cm), and a third range from about 0.094 inches (0.238 cm) to about 0.25 inches (0.64 cm). In one embodiment, the width **134** may be about 0.16 inches (0.41 cm). In addition, the bag **100** in some embodiments may include first and second notches **136** disposed into the bag to correspond to the locations of the first and second converging portions **130**, **132**. The notches **136** protrude inwardly from the side seals **110**, **112** and may be delineated or outlined by the seals forming the converging portions **130**, **132** and may have an arcuate or curved shape similar or corresponding to the shape of the converging portions. Because the notches **136** may not interfere with seals forming the side seals **110**, **112** and the converging portions **130**, **132**, the first and second sidewalls **102**, **104** of the bag **100** remains sealed along the perimeter and the bag may remain leak-tight. The notches may provide a visual indication to a user as to the location of the bag opening and may help reduce the amount of thermoplastic material necessary to make the bag.

[0070] Referring to FIG. 2, the presence of the converging portions creates a throat **140** within the interior volume **106** of the bag **100**. The width **142** of the throat when measured as the bag **100** is laid flat is less than the width **126** of the opening **124**. When the first and second sidewalls **102**, **104** are separated to open the bag **100** and to expand the interior volume **106**, the diameter or maximum dimension across the interior volume is less in the area corresponding to the throat **140** than a location below the throat within the interior volume.

[0071] Referring to FIG. 3, when the bag **100** is inserted into a canister **150** and the top edges **120**, **122** are folded over the upper rim **152** of the canister, the portion of the bag corresponding to the throat **140** is turned inside out over the rim. In the illustrated embodiment, the canister **150** is formed as an upright rectangular structure with a square cross-section, but the bag is intended for use as a liner with trash canisters of any shape. The dimension of the throat **140** may be roughly equivalent to or slightly less than the exterior

perimeter **154** measured about the opening of the canister **150**. The throat may have an interior perimeter **156** which may be twice the width **142**. In a first example, the perimeter **154** of the canister may be about 44 inches (112 cm) and the perimeter **156** of the throat may be about 41 inches (104 cm). In a second example, the perimeter **154** of the canister may be about 58 inches (147 cm) and the perimeter **156** of the throat may be about 55 inches (140 cm). In a third example, the perimeter **154** of the canister may be about 85 inches (216 cm) and the perimeter **156** of the throat may be about 82 inches (208 cm). Thus, the throat **140** formed by the converging portions may fit tightly around and grip to the outer periphery of the canister **150**. This helps prevent the bag from falling into the canister, especially as trash and other refuse items are put into and collect within the lined canister.

[0072] The bag may include additional features to assist in securing it to a refuse container. For example, referring to FIGS. **1** and **2**, the bag **100** may be formed with a pattern **170** formed or imparted into the first and second sidewalls **102**, **104** that generally extends between the first and second converging portions **130**, **132**. The pattern **170** may extend partially or completely between the converging portions. The pattern **170** may provide the bag with a stretchable or yieldable characteristic within the region of the throat. Examples of such patterns and similar features are disclosed in U.S. Pat. No. 6,139,185; U.S. Publication No. 2004/0134923; U.S. Pat. No. 6,394,651; U.S. Pat. No. 6,394,652; U.S. Pat. No. 6,150,647; U.S. Pat. No. 6,513,975; and U.S. Pat. No. 6,695,476, each of which is herein incorporated by reference in their entirety.

[0073] Referring to FIGS. **4** and **5**, the pattern **170** may be formed as a plurality of stretchable or strainable networks in which the normally planar, sheet-like thermoplastic material of the first and second sidewalls may be bunched together in a series of parallel wrinkles or creases. These include a plurality of first regions **172** that may correspond to the planar sheet of the side wall and a plurality of second regions **174** formed as rib-like elements that may protrude from the plane of the first regions and that may appear bunched or contracted together when in an un-tensioned state illustrated in FIG. **4**. When a pulling force is applied, as indicated by arrows **176** in FIG. **5**, the rib-like second regions may be able to unbend or geometrically deform so that the first and second regions may become substantially co-planar with each other. This unbunching action may stretch or elongate the pattern thereby adding to the overall area of the sidewalls.

[0074] The thermoplastic material into which the pattern **170** is imparted may demonstrate shape memory causing the first and second regions to return to the geometry of the un-tensioned state illustrated in FIG. **4** when any applied forces are removed. Thus the bag **100** may demonstrate a degree of resiliency or elasticity within the region of the throat **140**. Referring back to FIG. **3**, when in use, the pattern **170** may stretch or expand the throat **140** to allow the bag to be folded over the lip or rim of the garbage canister **150**. The resiliency associated with the pattern may cause the throat **140** to constrict or contract about the outer perimeter of the canister **150** thereby securing and retaining the bag **100** within the canister. While in the illustrated embodiment, the pattern **170** is shown as only being applied as a band between the converging portions **130**, **132**, in other embodiments the pattern may be located in other areas of the bag sidewalls **102**, **104**.

[0075] The bag may include other features that facilitate its use as a liner for trash receptacles. For example, referring back to FIGS. **1** and **2**, to close the opening **124** of the bag **100** when, for example, disposing of the trash receptacle liner, the bag may be fitted with a draw tape **180**. To accommodate the draw tape **180**, referring to FIG. **6**, the first top edge **120** of the first sidewall **102** may be folded back into the interior volume **106** and may be attached to the interior surface of the sidewall to form a first hem **182**. Similarly, the second top edge **122** of the second sidewall **104** may be folded back into the interior volume and may be attached to the second sidewall to form a second hem **184**. In another embodiment, the hem may be formed such that the sidewalls may be folded to the exterior of the sidewall and may be attached to the exterior surface of the sidewall. The draw tape **180**, which may be attached at the first and second side seals **110**, **112**, may extend along the first and second top edges **120**, **122** loosely through the first and second hems **182**, **184**. To access the draw tape **180** as illustrated in FIGS. **1** and **2**, first and second notches **186**, **188** may be disposed through the respective first and second top edges **120**, **122**. Pulling the draw tape **180** through the notches **186**, **188** will constrict the top edge **120**, **122** thereby drawing closed the opening **124**.

[0076] Referring to FIG. **7**, there is illustrated another embodiment of a plastic bag **200** intended for use as a trash receptacle liner and including converging portions **230**, **232**. The bag **200** may include a first sidewall **202** and an opposed second sidewall **204** overlaid and joined to the first sidewall to define an interior volume **206**. The first and second sidewalls may be sealed together by a first side seal **210**, a second side seal **212**, and closed bottom **214** extending between the first and second side seals. An opening **224** is provided for accessing the interior volume **206** by leaving the first and second top edges **220**, **222** of the respective first and second sidewalls **202**, **204** unsealed and un-joined.

[0077] The first and second converging portions **230**, **232** may be formed along the side seals **210**, **212** generally proximate and just below the opening **224** formed by the unsealed first and second top edges **220**, **224**. The first and second converging portions **230**, **232** may be formed by directing the seals that otherwise extend along the first and second side seals **210**, **212** laterally toward and then back away from each other. Accordingly, the converging portions **230**, **232** may each have respective intersecting first and second legs **240**, **242** that provide the converging portions with a general arch-shaped appearance. Because the converging portions and side edges may be formed as a continuous seal, the periphery of the bag may remain leak tight. The presence of the converging portions **230**, **232** produces a throat **238** wherein the interior volume **206** of the bag **200** has a reduced width compared with the remainder of the bag. As discussed herein, when the un-joined top edges **220**, **222** are folded over the lip or rim of a trash container, the converging portions **230**, **232** and throat **238** may help secure and retain the bag to the canister.

[0078] In the illustrated embodiment, the bag **200** does not have the notches discussed above that correspond to first and second converging portions **230**, **232**. Accordingly, there are portions **236** of the first and second sidewalls **202**, **204** that extend along the first and second seals **210**, **212** and that are delineated by the converging portions **230**, **232**. The portions **236** are made of sidewall material that may not be joined or sealed together. The lack of notches and the use of the portions **236** may be used with any of the embodiments described herein, as appropriate.

[0079] In the embodiment illustrated in FIG. 7, the bag 200 may include other features. For example, first and second retention strips 270 may be attached to the interior or exterior surfaces of the first and second sidewalls 202, 204 and may be positioned so as to generally extend between the first and second converging portions 230, 232. The retention strip 270 may have a width 272. The width 272 may have a first range from about 0.01 inches (0.0254 cm) to about 3 inches (7.62 cm), a second range from about 0.02 inches (0.0508 cm) to about 1 inch (2.54 cm), and a third range from about 0.04 inches (0.1016 cm) to about 0.375 inches (0.95 cm). In one embodiment, the width 272 may be about 0.06 inches (0.16 cm). The retention strip 270 may have a length 274. The length 274 may have a first range from about 5% to about 100% of the bag width 276, a second range from about 10% to about 50% of the bag width 276, and a third range from about 10% to about 30% of the bag width 276. In one embodiment, the length 274 may be about 20% of the bag width 276. The retention strips 270 may be made from a suitable elastic material and may be attached in an un-tensioned or tensioned state. The retention strips 270 may be made of materials, such as, thermoplastic elastomers (such as, styrenic block copolymers, polyolefin blends, elastomeric alloys, thermoplastic polyurethanes, thermoplastic copolyester, thermoplastic polyamides), ethylene propylene rubber, ethylene propylene diene M-class rubber, ultra-low density polyethylene, polybutene-1, ethylene vinyl acetate, ethylene methyl acrylate, ethylene ethyl acrylate, natural rubber, or combinations thereof. The retention strips 270 may provide a degree of elasticity or resiliency to the throat 238. Accordingly, when the top edges 220, 222 of the bag are folded over a canister, the retention strips 270 may cooperate with the converging portions to grip and secure the opening 224 of the bag around the canister. In another embodiment, a retention strip may be on one sidewall and the other sidewall may not have a retention strip. In the embodiment illustrated in FIG. 7, the bag may lack the pattern discussed above. However, in other embodiments, the bag may include one or more retention strips, the patterns, such as, the embodiments shown in FIG. 1 or FIG. 8, or both a pattern and a retention strip, such as, FIG. 9 or FIG. 10.

[0080] To close the opening 224 of the bag 200 during disposal, the embodiment of the bag 200 illustrated in FIG. 7 may also include tie flaps 280, 282. The tie flaps 280, 282 may be extensions of the top edges 220, 222 of the respective sidewalls 202, 204 that may be tied together when the bag 200 is removed from the receptacle and disposed of. In another embodiment, the top edges 220, 222 may be straight and may not include a drawstring, such as, the embodiment shown in FIG. 10. The tie flap closure, the drawstring closure, and the straight top edge may be used with any of the embodiments described herein, as appropriate. In addition to tie flaps and draw tapes, other suitable closing mechanisms may include twist ties and mechanical clips.

[0081] Referring to FIG. 8, there is illustrated another embodiment of a thermoplastic bag 300 adapted for use as a trash canister liner. The bag 300 may include a first sidewall 302 and a second sidewall 304 that may be rectangular in shape and that may be overlaid and joined to each other along a first side edge 310, a second side edge 312, and a closed bottom 314 that extends between the first and second side edges. The joined together first and second sidewalls 302, 304 may provide an interior volume 306 for accommodating trash. To access the interior volume 306 to insert trash and

refuse, the top edges 320, 322 of the respective sidewalls 302, 304 that are spaced apart from the closed bottom edge 314 remain un-joined to provide an opening 324.

[0082] To help secure the bag 300 to a canister, as discussed herein, the bag may be provided with a retention feature of first and second converging portions 330, 332 formed along the respective first and second side edges 310, 312. The converging portions 330, 332 may be located proximate to and just below the opening 324 and may be provided by directing the side seals that otherwise extend along the side edges 310, 312 laterally toward and then back away from each other. The converging portions 330, 332 thereby form a throat 334 that has a reduced dimension or perimeter compared to a lower portion of the bag. As discussed herein, when the first and second top edges 320, 322 are folded over the rim of a canister, the throat 334 may grip about the rim and secure the bag 300 to the canister. In another embodiment, the bag may not include notches 336.

[0083] The bag 300 may include other features that may facilitate its use as a trash canister liner. For example, one or both of the sidewalls 302, 304 may include patterns 370, 371 in the form of strainable or yieldable networks as discussed herein. The pattern 370 may extend between the converging portions 330, 332 as discussed herein. The pattern 371 may extend between the first and second side edge 310, 312 and from near or at the throat 334 toward the closed bottom edge 314. A substantial portion of the sidewalls 302, 304, including the portion between the converging portions 330, 332, include the patterns 370, 371.

[0084] The pattern 371 may provide resiliency or elasticity to other portions of the bag 300. An advantage of providing the pattern 371 across the first and second sidewalls 302, 304 may be an improved toughness or durability of the bag 300. For example, when the bag 300 is used as a canister liner and heavy objects are dropped or inserted into the canister, the pattern 371 may stretch or yield as the objects come into contact with the sidewalls 302, 304. This stretching and yielding of the sidewalls may help absorb and dissipate the force otherwise created by the inserted object. The pattern 371 may include horizontal ribs which may allow that portion of the bag to stretch in the vertical direction. The pattern 370 may include vertical ribs which may allow that portion of the bag to stretch in the horizontal direction. The embodiment of the bag 300 illustrated in FIG. 8 may lack the elastic retention strips discussed above with respect to FIG. 7, though in other embodiments the bag may include both the pattern and one or more elastic retention strips.

[0085] In addition to the patterns 370, 371 and converging portions 330, 332, the bag 300 illustrated in FIG. 8 may include a draw tape 380 proximate the opening 324. As described herein, the draw tape 380 may be accessible via and may be pulled through notches 386, 388 to close the opening 324 when disposing of the bag 300. In another embodiment, the bag may not include a draw tape. In other embodiments, the bag may include other closing mechanisms and features.

[0086] Referring to FIG. 9, there is illustrated another embodiment of a bag 400 for use as a liner for a trash receptacle. The bag 400 may include opposing first and second pliable thermoplastic sidewalls 402, 404 that may be rectangular in shape and may be joined along a first edge 410, a spaced apart second edge 412, and a closed bottom 414 extending between the first and second edges. To access the interior volume 406 defined between the sidewalls 402, 404, the top edges 420, 422 of the respective sidewalls may remain

un-joined to provide an opening 424. To close the opening when disposing of the bag 400, the first and second top edges 420, 422 of the sidewalls may be closed using the draw tape 480.

[0087] To assist in securing the bag 400 to a canister when used as a liner, the first and second side edges 410, 412 may include converging portions 430, 432 proximate to and just below the opening 424. As described herein, the converging portions 430, 432 may be formed by directing the seals along the first and second edges 410, 412 partially toward and then back away from each other. The converging portions 430, 432, may thereby form a throat 438 that enables the bag to restrict about and grip the rim of a canister. The converging portions 430, 432, may be arch-shaped or triangular in shape and may include inclined first and second legs 440, 442 that may be continuations of the respective first and second edges 410, 412 formed as seals joining the sidewalls together. The bag 400 may also include notches 436 formed adjacent to the converging portions 430, 432. In another embodiment, the bag may not include the notches 436. The bag may also include additional features to assist in securing it to a canister, such as the pattern 474 and the elastic retention strips 470 extending between the converging portions 430, 432.

[0088] Referring to FIG. 10, there is illustrated another embodiment of a bag 500 for use as a liner for a trash receptacle. The bag 500 may be similar to bag 100, as shown in FIG. 2, except the bag 500 may include one or more retention strips 538 as described herein. The retention strip 538 may extend partially or completely between the converging portions 530, 532 as described herein. The bag 500 may use any of the patterns and arrangements described herein, as appropriate. In another embodiment, the bag may not include notches 536. In another embodiment, the bag may not include the draw tape 580.

[0089] Referring to FIG. 11, there is illustrated another embodiment of a bag. The bag 600 may be similar to bag 100 in FIG. 2, except the bag 600 may alternate the orientation of the second regions 674. For example, regions 675 may have vertical ribs and regions 677 may have horizontal ribs. The regions 675 may allow the throat to stretch or expand as described herein. The regions 677 may allow the bag to stretch or expand in the vertical direction. In other embodiments, the length and arrangement of the regions may be different, such as, the various embodiments described herein, as appropriate. These arrangements of the regions may be used with any of the embodiments described herein, as appropriate. In another embodiment, the bag may not include notches 636. In another embodiment, the bag 600 may include a retention strip. In another embodiment, the bag may not include the draw tape 680.

[0090] Referring to FIG. 12, there is illustrated another embodiment of a bag. The bag 700 may be similar to bag 600 in FIG. 11, except the bag 700 has a different arrangement of the second regions 774. The left and right portions of the bag may have regions 775 with vertical ribs. The center portion of the bag may have regions 776 with horizontal ribs. In one embodiment, the regions 775 may be located on the left one third of the bag width and the right one third of the bag width, and the regions 776 may be located in the center one third of the bag width. In another embodiment, the widths of the regions may be different, such as, one fourth of the bag width on the left and on the right, and one half of the bag width in the center. These arrangements of the regions may be used with any of the embodiments described herein, as appropriate. In

another embodiment, the bag may not include the notches 736. In another embodiment, the bag 700 may include a retention strip. In another embodiment, the bag may not include the draw tape 780.

[0091] Referring to FIG. 13, there is illustrated another embodiment of a bag. The bag 800 may be similar to bag 700 in FIG. 12, except that the locations of the vertical rib regions 875 and the horizontal rib regions 876 are reversed as compared to the locations of the vertical rib regions 775 and the horizontal rib regions 776 in FIG. 12. In one embodiment, the regions 876 may be located on the left one third of the bag width and the right one third of the bag width, and the regions 875 may be located in the center one third of the bag width. In another embodiment, the widths of the regions may be different, such as, one fourth of the bag width on the left and on the right, and one half of the bag width in the center. These arrangements of the regions may be used with any of the embodiments described herein, as appropriate. In another embodiment, the bag may not include the notches 836. In another embodiment, the bag 800 may include a retention strip. In another embodiment, the bag may not include the draw tape 880.

[0092] Referring to FIG. 14, there is illustrated another embodiment of a bag. The bag 900 may be similar to bag 800 in FIG. 13, except that the horizontal rib regions have been removed. In one embodiment, the vertical rib regions 975 may be located in the center one third of the bag width. In another embodiment, the widths of the regions may be different, such as, one half of the bag width in the center. In another embodiment, horizontal rib regions may be substituted for one or more of the vertical rib regions 975. These arrangements of the regions may be used with any of the embodiments described herein, as appropriate. In another embodiment, the bag may not include the notches 936. In another embodiment, the bag 900 may include a retention strip. In another embodiment, the bag may not include the draw tape 980.

[0093] Referring to FIG. 15, there is illustrated another embodiment of a bag. The bag 1000 may be similar to bag 600 in FIG. 12, except that the horizontal rib regions have been removed. In one embodiment, the vertical rib regions 1075 may be located on the left one fourth of the bag width and the right one fourth of the bag width. In another embodiment, the widths of the regions may be different, such as, one third of the bag width on the left and on the right. In another embodiment, horizontal rib regions may be substituted for one or more of the vertical rib regions 1075. These arrangements of the regions may be used with any of the embodiments described herein, as appropriate. In another embodiment, the bag may not include the notches 1036. In another embodiment, the bag 1000 may include a retention strip. In another embodiment, the bag may not include the draw tape 1080.

[0094] Referring to FIG. 16, there is illustrated another embodiment of a bag. The bag 1100 may be similar to bag 1000 in FIG. 15, except that the left side of the vertical rib regions have been removed. In one embodiment, the vertical rib regions 1175 may be located on the right one third of the bag width. In another embodiment, the regions 1175 may be located on the left side. In another embodiment, the widths of the regions may be different, such as, one fourth of the bag width on the right. In another embodiment, horizontal rib regions may be substituted for one or more of the vertical rib regions 1175. These arrangements of the regions may be used with any of the embodiments described herein, as appropriate.

ate. In another embodiment, the bag may not include the notches 1136. In another embodiment, the bag 1100 may include a retention strip. In another embodiment, the bag may not include the draw tape 1180.

[0095] Referring to FIG. 17, there is illustrated another embodiment of a bag. The bag 1200 may be similar to bag 600 in FIG. 11 except that some of the rib regions are at an angle. In one embodiment, the regions 1271 may have ribs which are angled to the right and regions 1273 may have ribs which are angled to the left. The ribs may have an angle from 0 degrees to 180 degrees with respect to the horizontal. The regions 1271 may alternate with respect to regions 1273 as shown in FIG. 17. In another embodiment, the angular rib regions may be substituted for one or more of the horizontal rib regions 1274, 1277, as appropriate. The angular rib regions may be used with any of the embodiments described herein, as appropriate. These arrangements of the regions may be used with any of the embodiments described herein, as appropriate. In another embodiment, the bag may not include the notches 1236. In another embodiment, the bag 1200 may include a retention strip. In another embodiment, the bag may not include the draw tape 1280.

[0096] Referring to FIG. 18, there is illustrated another embodiment of a bag 1300 for use as a liner for a trash receptacle. The bag 1300 may include first and second sidewalls 1302, 1304 that may be joined along the first and second side edges 1310, 1312 and a closed bottom 1314 to define an interior volume accessible via an opening 1324. To assist in securing the bag 1300 to a canister, the first and second, side edges 1310, 1312 may include converging portions 1330, 1332 that converge partially toward each other proximate the opening 1324. In the illustrated embodiment, the bag 1300 lacks additional features such as patterns and elastic retentions strips discussed herein, but in other embodiments could include such features. Additionally, the un-joined top edges 1320, 1322 of the respective sidewalls 1302, 1304 that delineate the opening 1324 may be straight and lack the draw tapes or tie flaps described above. In another embodiment, the bag may not include the notches 1336.

[0097] Referring to FIG. 19, there is illustrated another embodiment of a bag. The bag 1400 may be similar to the bag 1300 in FIG. 18 except that only one side has a converging portion 1430. The converging portion 1430 creates a throat 1440. The bag 1400, the converging portion 1430 and/or the throat 1440 may have similar dimensions as the bags, converging portions and/or throats described herein. In another embodiment, the converging portion may be located on the left side of the bag. The single converging portion may be used with any of the embodiments described herein, as appropriate. For example, the bag may include a draw tape. As another example, the bag may include any of the patterns and arrangements described herein, as appropriate, such as, a pattern in the throat and/or in other portions of the bag. As a further example, the bag may include one or more retention strips. In another embodiment, the bag may not include the notch 1436.

[0098] Referring to FIG. 20, there is illustrated another embodiment of a bag. The bag 1500 may have a converging portion 1530 and converging portion 1532. The converging portions 1530, 1532 may have a first leg 1540 and a second leg 1542. The first leg 1540 may extend inward toward the center of the bag. The second leg 1542 may extend upward toward the top of the bag. The converging portions 1530, 1532 create a throat 1543. The bag 1500, the converging portions 1530,

1532 and/or the throat 1543 may have similar dimensions as the bags, converging portions and/or throats described herein. In another embodiment, the bag may include a single converging portion. In another embodiment, the bag may not have the notches 1536. The converging portions 1530, 1532 may be used with any of the embodiments described herein, as appropriate. For example, the bag may include a draw tape. As another example, the bag may include any of the patterns and arrangements described herein, as appropriate, such as, a pattern in the throat and/or in other portions of the bag. As a further example, the bag may include one or more retention strips.

[0099] Referring to FIG. 21, there is illustrated another embodiment of a bag. The bag 1600 may have a converging portion 1630 and a converging portion 1632. The converging portions 1630, 1632 may have a first leg 1640 and a second leg 1642. The first leg 1640 may extend inward toward the center of the bag. The second leg 1642 may extend upward toward the top of the bag and outward away from the center of the bag. The converging portions 1630, 1632 create a throat 1643. The bag 1600, the converging portions 1630, 1632 and/or the throat 1643 may have similar dimensions as the bags, converging portions and/or throats described herein, as appropriate. Due to the outward angle of the second legs 1642, the bag 1600 has a throat 1643 which is able to engage cans with different rim perimeters. For example, if a can had a rim perimeter which corresponds to twice the dimension 1650, then the bag 1600 may engage the can at approximately that location on the bag. As another example, if the can had a rim perimeter which corresponds to twice the dimension 1652, then the bag 1600 may engage the can at approximately that location on the bag. In another embodiment, the bag may include a single converging portion. In another embodiment, the bag may not have the notches 1636. The converging portions 1630, 1632 may be used with any of the embodiments described herein, as appropriate. For example, the bag may include a draw tape. As another example, the bag may include any of the patterns and arrangements described herein, as appropriate, such as, a pattern in the throat and/or in other portions of the bag. As a further example, the bag may include one or more retention strips.

[0100] Referring to FIG. 22, there is illustrated another embodiment of a bag. The bag 1700 may have a converging portion 1730, a converging portion 1732, a converging portion 1740, and a converging portion 1742. The converging portions 1730, 1732 may be larger than the converging portions 1740, 1742. The converging portions 1730, 1732 create a throat 1743. The converging portions 1740, 1742 create a throat 1745. The throat 1745 may be larger than the throat 1743. The bag 1700, the converging portions 1730, 1732, 1740, 1742 and/or the throats 1743, 1745 may have similar dimensions as the bags, converging portions and/or throats described herein, as appropriate. The bag 1700 has throats 1743, 1745 which are able to engage cans with different rim perimeters. For example, if a can had a rim perimeter which corresponds to twice the dimension 1750, then the bag 1700 may engage the can at approximately that location on the bag. As another example, if the can had a rim perimeter which corresponds to twice the dimension 1752, then the bag 1700 may engage the can at approximately that location on the bag. In another embodiment, the bag may include converging portions on only one side, such as, converging portions 1730, 1740. In another embodiment, the bag may not have the notches 1736. The converging portions 1730, 1732, 1740,



**1742** may be used with any of the embodiments described herein, as appropriate. For example, the bag may not include the draw tape **1780**. As another example, the bag may include any of the patterns and arrangements described herein, as appropriate, such as, a pattern in the throat and/or in other portions of the bag. As a further example, the bag may not include one or more retention strips **1782**, **1784**. In another embodiment, the bag may include three, four, five or more throats. In another embodiment, the throats **1743**, **1745** may be the same size. In another embodiment, the converging portions **1730**, **1740** may be on one side and the other side may include any of the converging portions described herein, as appropriate.

[0101] Referring to FIG. 23, there is illustrated another embodiment of a converging portion for a bag. The converging portion **1830** may include a first leg **1840**, a second leg **1842**, and a third leg **1844**. The first leg **1840** may extend inward toward the center of the bag. The second leg **1842** may extend upward toward the top of the bag. The third leg **1844** may extend outward toward the side edge of the bag. The converging portion **1830** may have a rectangular shape. The converging portion **1830** may have similar dimensions as the converging portions described herein, as appropriate. In another embodiment, the bag may not have the notch **1836**. The converging portion **1830** may be used with any of the embodiments described herein, as appropriate.

[0102] Referring to FIG. 24, there is illustrated another embodiment of a converging portion for a bag. The converging portion **1930** may include a first leg **1940** and a second leg **1942**. The first leg **1940** may extend inward toward the center of the bag. The second leg **1942** may extend upward toward the top of the bag and outward toward the side edge of the bag. The converging portion **1930** may have a triangle shape. The triangle may have equal sides. The converging portion **1930** may have similar dimensions as the converging portions described herein, as appropriate. In another embodiment, the bag may not have the notch **1936**. The converging portion **1930** may be used with any of the embodiments described herein, as appropriate.

[0103] Referring to FIG. 25, there is illustrated another embodiment of a converging portion for a bag. The converging portion **2030** may include a first leg **2040** and a second leg **2042**. The first leg **2040** may extend inward toward the center of the bag and upward toward the top of the bag. The second leg **2042** may extend outward toward the side edge of the bag. The converging portion **2030** may have a triangle shape. The triangle may be a right triangle. The converging portion **2030** may have similar dimensions as the converging portions described herein, as appropriate. In another embodiment, the bag may not have the notch **2036**. The converging portion **2030** may be used with any of the embodiments described herein, as appropriate.

[0104] Referring to FIG. 26, there is illustrated another embodiment of a converging portion for a bag. The converging portion **2130** may include a first leg **2140** and a second leg **2142**. The first leg **2140** may extend inward toward the center of the bag. The second leg **2142** may extend upward toward the top of the bag and outward toward the side edge of the bag. The converging portion **2130** may have a triangle shape. The triangle may be a right triangle. The converging portion **2130** may have similar dimensions as the converging portions described herein, as appropriate. In another embodiment, the

bag may not have the notch **2136**. The converging portion **2130** may be used with any of the embodiments described herein, as appropriate.

[0105] Referring to FIG. 27, there is illustrated another embodiment of a converging portion for a bag. The converging portion **2230** may include a first leg **2240**, a second leg **2242**, a third leg **2244** and a fourth leg **2246**. The first leg **2240** may extend inward toward the center of the bag. The second leg **2242** may extend upward toward the top of the bag and outward toward the side of the bag. The third leg **2244** may extend inward toward the center of the bag and upward toward the top of the bag. The fourth leg **2246** may extend outward toward the side edge of the bag. The converging portion **2230** may have a chevron shape. The converging portion **2230** may have similar dimensions as the converging portions described herein, as appropriate. In another embodiment, the bag may not have the notch **2236**. The converging portion **2230** may be used with any of the embodiments described herein, as appropriate.

[0106] Referring to FIG. 28, there is illustrated another embodiment of a converging portion for a bag. The converging portion **2330** may include a first leg **2340**, a second leg **2342**, and a third leg **2344**. The first leg **2340** may extend inward toward the center of the bag. The second leg **2342** may be a curve with the ends extending inward toward the center of the bag. The third leg **2344** may extend outward toward the side edge of the bag. The converging portion **2330** may have similar dimensions as the converging portions described herein, as appropriate. In another embodiment, the bag may not have the notch **2336**. The converging portion **2330** may be used with any of the embodiments described herein, as appropriate.

[0107] Bags of the aforementioned type may be produced in a high speed, automated manufacturing process such as that illustrated in FIG. 29. The illustrated manufacturing process may include automated equipment and arranged stations that may convert continuous sheet-like webs of planar, thermoplastic material into the finished bags. The web may initially be provided in roll of thermoplastic sheet material. For example, a first web **2400** of flexible thermoplastic material may be unwound from a first roll **2402** and movingly directed along a machine direction **2406** by the processing equipment. When unwound, the first web **2400** may have a first side edge **2410** and a second side edge **2412** that define a width **2414** that may be perpendicular to the machine direction **2406**.

[0108] To provide the enclosed interior volume of the finished bag, the web **2400** may be folded in half orthogonally about the machine direction **2406** by a folding operation **2418**. When folded in half, the first and second side edges **2410**, **2412** may be moved adjacent to each other. The width **2426** of the folded web **2400** may be half of the width **2414** of the unfolded web. Moreover, once folded, the center of the web **2400** provides a crease or outer side edge **2422** that may correspond to the closed bottom of the finished bag. In another embodiment, the roll **2402** may include a folded web and the folding operation is not necessary.

[0109] To provide the side edges of the finished bag, side seals **2430** may be formed into the web **2400** at intermittent spaces along the web and may be perpendicular to the machine direction **2406**. The spaced apart seals may be symmetrical and identical to each other. The seals **2430** may be formed as generally straight, continuous lines that extend between the aligned edges **2410**, **2412** and the creased second edge **2422**. Each of the seals **2430** may include the converging

portion 2432 and the straight portion 2434. Each pair of adjacent, intermittently spaced seals 2430 may correspond to the sealed side edges of the finished bag.

[0110] To form the seals 2430, the folded web 2400 may be directed through a sealing operation 2440. The sealing operation 2440 may include one or more sealing bars which creates the seals 2430. Heat may be applied to the web 2400 and/or the sealing bars to create the seals 2430. The sealing bars may have a shape or outline corresponding to the shape of the seal, including the straight portion and the converging portion.

[0111] An advantage of forming the side seals and the converging portions in a single, simultaneous, and repetitive step as just described is that the number of processing steps and the amount of equipment may be reduced. Additionally, because the continuous seal comprising the side edge and the converging portion may be formed in one simultaneous step, in contrast to a multistep process, the seal may have better integrity. However, in other embodiments in which the seals are formed by other methods, the seal bars may be replaced with ultrasonic or adhesive applying equipment.

[0112] To apply a pattern, in those embodiments in which such a pattern is included, the web 2400 may be directed between a pair of cylindrical rollers 2452 that may be located in between the adjacent edges 2410, 2412 and the edge 2422 and to correspond with the location of the portions 2432 along the widths 2426 of the web. The cylindrical rollers 2452 may be arranged with their cylindrical axes perpendicular to the machine direction. The surfaces of these rollers 2452 may include raised surfaces that impart the pattern 2454 into the thermoplastic material as the webs pass between the rollers. Due to the orientation of the rollers 2452, the applied pattern may run in parallel with the machine direction 2406. Additional equipment may include a notch forming apparatus 2456 such as a rotating or oscillating punch or the like that forms the notches 2458 into the portions 2432 of the seals 2430. To separate individual bags from the processed webs, the processing equipment may include a cutting device 2460 arranged perpendicular to the machine direction 2406. The cutting device 2460 may cut along the seals 2430 so that individual bags may be separated from the processed web 2400. In another embodiment, the web may be folded one or more times before the web is cut. In those embodiments in which retention strips are included on the bags, the retention strips may be applied to the webs. Moreover, the retention strips may be applied so as to correspond with the location of the portions 2432 and may extend in parallel with the machine direction. Additional processing equipment that may be located along the processing line includes an apparatus for applying draw strings. The individual bags 2462 may be packaged for distribution. For example, the bags 2462 may be wound into a roll 2464 for packaging and distribution. For example, the roll 2464 may be placed in a box or bag for sale to a customer. The bags 2462 may be interleaved prior to winding into the roll 2464. In another embodiment, the bags 2462 may be positioned in a box or bag, and not onto the roll 2464. The bags 2462 may be interleaved prior to positioning in the box or bag.

[0113] In another embodiment, a perforating device 2470 may replace the cutting device as shown in FIG. 30. The perforating device 2470 may form perforations 2472 in the web along the side seals so that individual bags may be separated from the web. In another embodiment, the web may be folded one or more times before the web is perforated along the seals. The perforated web may be rolled to create a

roll 2474 of bags for the user. The roll 2474 may be placed in a box or bag for sale to a customer. The user may then detach the bags from the roll 2474 along the perforations.

[0114] These manufacturing embodiments may be used with any of the manufacturing embodiments described herein, as appropriate.

[0115] Referring to FIG. 31, there is illustrated another automated manufacturing environment for processing bags of the foregoing type. The illustrated process may utilize multiple webs of pliable thermoplastic material including a first web 2500 provided from a first roll 2502 and a second web 2520 provided from a second roll 2522. The first web 2500 may be unwound from the first roll 2502 and may be directed along the machine direction 2506 by the processing equipment. When unwound, the first web has a first side edge 2510 and a second side edge 2512 that define a width 2514 perpendicular to the machine direction 2506.

[0116] The second web 2520 may be unwound from the second roll 2522 and may have a first side edge 2524 and a second side edge 2526 that delineate a width 2528. The widths of the first and second webs may be equal. The second web 2520 may be movingly directed to be parallel and adjacent to the first web 2500 such that the respective first edges 2510, 2524 and the respective second edges 2512, 2526 may be aligned together. Accordingly, the webs may be both directed by the processing equipment in the machine direction 2506. Alignment of the webs 2500, 2520 may be accomplished by appropriately placed rollers 2508 and/or bars.

[0117] After the first and second webs 2500, 2520 are aligned, they may be directed through a sealing operation 2540 to form the side seals 2530. As described herein, the sealing bars may have a shape that has the shape or outline of the seal to be formed. As the webs 2500, 2520 pass through the sealing operation, the seal bars may form intermittent seals 2530 including the converging portions 2532 into the webs. Subsequent to forming the seals 2530, the webs may be directed between a second pair of opposed rollers 2550 that are oriented toward the adjacent second edges 2512, 2526. The second pair of rollers may form a continuous seal between the adjacent second edges 2512, 2526 of the webs 2500, 2520 that is parallel to the machine direction 2506. The sealed side edges 2512, 2526 may correspond to the closed bottom of the bag. In another embodiment, the bottom may be sealed before the side seals 2530.

[0118] The manufacturing environment may include additional processing equipment to add additional features to the bag. For example, the processing equipment can include rollers 2552 for imparting patterns 2554 onto the bag. Other equipment may include a notch forming apparatus 2556 that disposes the notches 2558 into the webs 2500, 2520. Other processing equipment as described herein may be included to produce the finished bags 2562.

[0119] Referring to FIG. 32, there is illustrated another embodiment of a thermoplastic bag 2600 adapted for use as a trash canister liner. The bag 2600 may include a first sidewall 2602 and a second sidewall 2604 and that may be overlaid and joined to each other along a first side edge 2610, a second side edge 2612, and a bottom edge 2614. The joined together first and second sidewalls 2602, 2604 may provide an interior volume 2606 for accommodating trash. To access the interior volume 2606 to insert trash and refuse, the top edges 2620, 2622 of the respective sidewalls 2602, 2604 that are spaced apart from the bottom edge 2614 remain un-joined to provide an opening 2624.

[0120] The bag 2600 may include a draw tape 2680 proximate the opening 2624. The bag 2600 may include a first hem 2682 and a second hem 2684 to accommodate the draw tape 2680. The hems may include a hem edge 2689. The bag may include a hem seal 2691. The draw tape may include a lower draw tape edge 2681. The draw tape 2680 may be accessible through notches 2686, 2688. The draw tape may be pulled through notches 2686, 2688 to close the opening 2624 when disposing of the bag 2600.

[0121] To help secure the bag 2600 to a canister, as discussed herein, the bag may be provided with a retention feature of first and second converging portions. The converging portions may be a first inward seal 2630 and a second inward seal 2632 which are located inward from the side edges 2610, 2612. The seals 2630, 2632 may be separate from the side seals that otherwise extend along the side edges 2610, 2612. The seals 2630, 2632 may be in the shape of ovals. In other embodiments, the seals may have other shapes, such as circles, ovals, teardrops, curves, polygons, lines straight or accurate in nature and combinations thereof, or any of the shapes described herein, as appropriate. The seals 2630, 2632 may be positioned over the hem seal 2691. In other embodiments, the seals may be positioned below the hem seal 2691. The seals 2630, 2632 may be positioned over the hem edge 2689. In other embodiments, the seals may be positioned above or below the hem edge 2689.

[0122] The seal 2630 may have a width 2666. The width 2666 may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.2 inches (0.508 cm) to about 4 inches (10.16 cm), and a third range from about 0.3 inches (0.762 cm) to about 2 inches (5.08 cm). In one embodiment, the width 2666 may be about 0.5 inches (1.268 cm). The seal 2630 may have a height 2667. The height 2667 may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.2 inches (0.508 cm) to about 4 inches (10.16 cm), and a third range from about 0.3 inches (0.762 cm) to about 2 inches (5.08 cm). In one embodiment, the height 2667 may be about 1 inch (2.54 cm). The seal 2630 may be a distance 2668 from the side seal. The distance 2668 may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.2 inches (0.508 cm) to about 5 inches (12.68 cm), and a third range from about 0.25 inches (0.634 cm) to about 2.5 inches (6.34 cm). In one embodiment, the distance 2668 may be about 1 inch (2.54 cm). The seal 2630 may be a distance 2669 from the top edge. The distance 2669 may have a first range from about 0.1 inches (0.254 cm) to about 12 inches (30.5 cm), a second range from about 0.75 inches (1.902 cm) to about 6 inches (15.24 cm), and a third range from about 1 inch (2.54 cm) to about 5 inches (12.68 cm). In one embodiment, the distance 2669 may be about 1.75 inches (4.44 cm). The seal 2632 may have the same dimensional information as seal 2630. In another embodiment, the seal 2632 may have different dimensional information as seal 2630.

[0123] The seals 2630, 2632 form a throat 2634 that has a reduced dimension or perimeter compared to a lower portion of the bag. As discussed herein, when the first and second top edges 2620, 2622 are folded over the rim of a canister, the throat 2634 may grip about the rim and secure the bag 2600 to the canister. The bag 2600, seals 2630, 2632 and throat 2634 may have the same dimensional information as the bag, converging portions, and throat in FIG. 2 or any other embodiment described herein, as appropriate. For example, the dis-

tance between seals 2630 and 2632 corresponding to throat 2634 may correspond to the distance 142 in FIG. 2. In another embodiment, the bag may have only one seal, such as, seal 2630. In this example, the distance between seal 2630 and the farthest side edge 1612 may be of the same order as the distance 142 in FIG. 2.

[0124] The bag 2600 may include a pattern 2670 in the form of a strainable or yieldable network as discussed herein. The pattern 2670 may extend between the seals 2630, 2632 as discussed herein. The pattern 2670 may include vertical ribs which may allow that portion of the bag to stretch in the horizontal direction. The pattern 2670 may allow the bag to stretch in order to fit over the rim of a canister. The pattern 2670 may have a shape memory which allows the throat 2634 to grip the canister. The pattern may be any as previously or afterward described, for example, the patterns described with reference to FIGS. 1, 2, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17.

[0125] Referring to FIG. 33, there is illustrated another embodiment of a bag. The bag 2700 may be similar to bag 2600 in FIG. 32 except that the sidewalls 2702, 2704 of the bag 2700 may include a pattern 2771. The pattern 2771 may be located below the throat 2734. The pattern 2771 may be located below the pattern 2770. The pattern 2771 may be similar to the pattern 371 in FIG. 8. In other embodiments, the pattern 2771 may be any of the patterns described herein, as appropriate. In another embodiment, the bag 2700 may have only one seal, such as, seal 2730.

[0126] Referring to FIG. 34, there is illustrated another embodiment of a bag. The bag 2800 may be similar to bag 2600 in FIG. 32 except that the bag 2800 may include one or more retention strips 2892. One or more retention strips 2892 may be attached to the interior and/or exterior of the first sidewall 2802 and/or second sidewall 2804 and may be positioned between the seals 2830, 2832. The retention strip 2892 may be similar to retention strip 270 in FIG. 7. The retention strip 2892 may have similar dimensional information and other information as retention strip 270 in FIG. 7. In another embodiment, the bag 2800 may have only one seal, such as, seal 2830. In another embodiment, the bag 2800 may have a pattern similar to the pattern 371 in FIG. 8.

[0127] Referring to FIG. 35, there is illustrated another embodiment of a bag. The bag 2900 may be similar to the bag 2600 in FIG. 32 except that the bag 2900 may have a first upper inward seal 2930, a first lower inward seal 2931, a second upper inward seal 2932, and a second lower inward seal 2933. The seals 2930, 2931, 2932, 2933 may be in the shape of ovals. In other embodiments, the seals may have other shapes, such as circles, ovals, teardrops, curves, polygons, lines straight or accurate in nature and combinations thereof, or any of the shapes described herein, as appropriate. In other embodiments, the seals may have other shapes, such as circles, teardrop, curves, polygons, lines straight or accurate in nature and combinations thereof, or any of the shapes described herein, as appropriate. The upper seals 2930, 2932 may be positioned over the hem seal 2991. In other embodiments, the upper seals may be positioned below the hem seal 2991. The upper seals 2930, 2932 may be positioned above the hem edge 2989. The lower seals 2931, 2933 may be positioned below the hem edge 2989. The upper seals 2930, 2932 may seal four layers of material together, for example, the first sidewall, the first hem, the second hem and the second sidewall. The lower seals 2931, 2933 may seal two layers of material together, for example, the first sidewall and the second sidewall. The sealing of two layers may be performed

with a different amount of heat than the sealing of four layers. Thus, by separating the seal into an upper seal and lower seal, the different amounts of heat may be used for each seal.

[0128] The seal **2930** may have a width **2966**. The width **2966** may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.2 inches (0.508 cm) to about 4 inches (10.16 cm), and a third range from about 0.3 inches (0.762 cm) to about 2 inches (5.08 cm). In one embodiment, the width **2966** may be about 0.4 inches (1.02 cm). The seal **2930** may have a height **2967**. The height **2967** may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.2 inches (0.508 cm) to about 4 inches (10.16 cm), and a third range from about 0.3 inches (0.762 cm) to about 2 inches (5.08 cm). In one embodiment, the height **2967** may be about 0.6 inches (1.52 cm). The seal **2930** may be a distance **2968** from the side seal. The distance **2968** may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.2 inches (0.508 cm) to about 5 inches (12.68 cm), and a third range from about 0.25 inches (0.634 cm) to about 2.5 inches (6.34 cm). In one embodiment, the distance **2968** may be about 1 inch (2.54 cm). The seal **2930** may be a distance **2969** from the top edge. The distance **2969** may have a first range from about 0.1 inches (0.254 cm) to about 12 inches (30.5 cm), a second range from about 0.75 inches (1.902 cm) to about 6 inches (15.24 cm), and a third range from about 1 inch (2.54 cm) to about 5 inches (12.68 cm). In one embodiment, the distance **2969** may be about 1.5 inches (3.81 cm). The seals **2931**, **2932**, **2933** may have the same dimensional information as seal **2930**. In another embodiment, the seals **2931**, **2932**, **2933** may have different dimensional information as seal **2930**.

[0129] The seals **2930**, **2931** may be separated by a distance **2973**. The distance **2973** may have a first range from about 0.1 inches (0.254 cm) to about 5 inches (12.68 cm), a second range from about 0.2 inches (0.508 cm) to about 2 inches (5.08 cm), and a third range from about 0.2 inches (0.508 cm) to about 1 inch (2.54 cm). In one embodiment, the distance **2973** may be about 0.5 inches (1.268 cm).

[0130] The bag **2900**, seals **2930**, **2931**, **2932**, **2933** and throat **2934** may have the same dimensional information as the bag, converging portions, and throat in FIG. 2 or any other embodiment described herein, as appropriate. In another embodiment, the bag may have only one upper seal and one lower seal, such as, seals **2930**, **2931**.

[0131] Referring to FIG. 36, there is illustrated another embodiment of a bag. The bag **3000** may be similar to bag **2900** in FIG. 35 except that the sidewalls **3002**, **3004** of the bag **3000** may include a pattern **3071**. The pattern **3071** may be located below the throat **3034**. The pattern **3071** may be located below the pattern **3070**. The pattern **3071** may be similar to the pattern **371** in FIG. 8. In other embodiments, the pattern **3071** may be any of the patterns described herein, as appropriate. In another embodiment, the bag **3000** may have only one seal, such as, seal **3030**.

[0132] Referring to FIG. 37, there is illustrated another embodiment of a bag. The bag **3100** may be similar to bag **2900** in FIG. 35 except that the bag **3100** may include one or more retention strips **3192**. One or more retention strips **3192** may be attached to the interior and/or exterior of the first sidewall **3102** and/or second sidewall **3104** and may be positioned between the seals **3130**, **3131**, **3132**, **3133**. The retention strip **3192** may be similar to retention strip **270** in FIG. 7. The retention strip **3192** may have similar dimensional infor-

mation and other information as retention strip **270** in FIG. 7. In another embodiment, the bag **3100** may have only one seal, such as, seal **3130**. In another embodiment, the bag **3100** may have a pattern similar to the pattern **371** in FIG. 8.

[0133] Referring to FIG. 38, there is illustrated another embodiment of a bag. The bag **3200** may be similar to bag **2600** in FIG. 32 except that the bag **3200** may have seals **3230**, **3232** which are part of the side seals **3210**, **3212**. The seals **3230**, **3232** may be similar to converging portions **130**, **132** in FIG. 1 except at a different location. The seals **3230**, **3232** may be positioned over the hem seal **3291**. In other embodiments, the seals **3230**, **3232** may be positioned below the hem seal **3291**. The seals **3230**, **3232** may be positioned over the hem edge **3289**, but not over the hem seal **3291**. In other embodiments, the seals **3230**, **3232** may be positioned below the hem edge **3289**. In other embodiments, the seals may have other shapes, such as circles, ovals, teardrops, curves, polygons, lines straight or accurate in nature and combinations thereof, or any of the shapes described herein, as appropriate. In other embodiments, the bag may have notches, such as, the notches **136** in FIG. 1.

[0134] The seal **3230** may have a width **3266**. The width **3266** may have a first range from about 0.03 inches (0.076 cm) to about 0.5 inches (1.268 cm), a second range from about 0.06 inches (0.15 cm) to about 0.4 inches (1.02 cm), and a third range from about 0.09 inches (0.23 cm) to about 0.25 inches (0.63 cm). In one embodiment, the width **3266** may be about 0.16 inches (0.41 cm). The seal **3230** may have a height **3267**. The height **3267** may have a first range from about 0.5 inches (1.268 cm) to about 10 inches (25.4 cm), a second range from about 0.75 inches (1.91 cm) to about 6 inches (15.24 cm), and a third range from about 1 inch (2.54 cm) to about 4 inches (10.16 cm). In one embodiment, the height **3267** may be about 1.5 inches (3.81 cm). The seal **3230** may be a distance **3268** from the side seal. The distance **3268** may have a first range from about 0.25 inches (0.634 cm) to about 6 inches (15.24 cm), a second range from about 0.5 inches (1.268 cm) to about 4 inches (10.16 cm), and a third range from about 1 inch (2.54 cm) to about 3 inches (7.62 cm). In one embodiment, the distance **3268** may be about 2 inches (5.08 cm). The seal **3230** may be a distance **3269** from the top edge. The distance **3269** may have a first range from about 0.5 inches (1.268 cm) to about 12 inches (30.5 cm), a second range from about 1 inch (2.54 cm) to about 6 inches (15.24 cm), and a third range from about 1.5 inches (3.81 cm) to about 5 inches (12.68 cm). In one embodiment, the distance **3269** may be about 2.75 inches (6.99 cm). The seal **3232** may have the same dimensional information as seal **3230**. In another embodiment, the seal **3232** may have different dimensional information as seal **3230**.

[0135] The bag **3200**, seals **3230**, **3232** and throat **3234** may have the same dimensional information as the bag, converging portions, and throat in FIG. 2 or any other embodiment described herein, as appropriate. In another embodiment, the bag may have only one seal, such as, seal **3230**.

[0136] Referring to FIG. 39, there is illustrated another embodiment of a bag. The bag **3300** may be similar to bag **3200** in FIG. 38 except that the sidewalls **3302**, **3304** of the bag **3300** may include a pattern **3371**. The pattern **3371** may be located below the throat **3334**. The pattern **3371** may be located below the pattern **3370**. The pattern **3371** may be similar to the pattern **371** in FIG. 8. In other embodiments, the pattern **3371** may be any of the patterns described herein, as

appropriate. In another embodiment, the bag 3300 may have only one seal, such as, seal 3330.

[0137] Referring to FIG. 40, there is illustrated another embodiment of a bag. The bag 3400 may be similar to bag 3200 in FIG. 38 except that the bag 3400 may include one or more retention strips 3492. One or more retention strips 3492 may be attached to the interior and/or exterior of the first sidewall 3402 and/or second sidewall 3404 and may be positioned between the seals 3430, 3432. The retention strip 3492 may be similar to retention strip 270 in FIG. 7. The retention strip 3492 may have similar dimensional information and other information as retention strip 270 in FIG. 7. In another embodiment, the bag 3400 may have only one seal, such as, seal 3430. In another embodiment, the bag 3400 may have a pattern similar to the pattern 371 in FIG. 8.

[0138] Referring to FIG. 41, there is illustrated another embodiment of a bag. The bag 3500 may be similar to bag 2800 in FIG. 38 except the bag 3500 may have seals 3530, 3532 with a different shape. The seals 3530, 3532 may have a tear drop shape. The seals 3530, 3532 may have a first portion 3561, a second portion 3563 and a third portion 3565. The first portion 3561 may extend inward and upward from the side seals 3510, 3512. The second portion 3563 may extend downward toward the bottom edge 3514 of the bag. The third portion 3565 may extend outward and upward toward the side seals 3510, 3512.

[0139] The seals 3530, 3532 may be positioned over the hem seal 3591. In other embodiments, the seals 3530, 3532 may be positioned below the hem seal 3591. The seals 3530, 3532 may be positioned over the hem edge 3589. In other embodiments, the seals 3530, 3532 may be positioned above the hem edge 3589. In other embodiments, the seals may have other shapes, such as, any of the shapes described herein, as appropriate. In other embodiments, the seals may have other shapes, such as circles, ovals, curves, polygons, lines straight or accurate in nature and combinations thereof, or any of the shapes described herein, as appropriate. The seal 3530 may have a width 3566. The width 3566 may have a first range from about 0.1 inches (0.254 cm) to about 6 inches (15.24 cm), a second range from about 0.2 inches (0.508 cm) to about 3 inches (7.62 cm), and a third range from about 0.25 inches (0.634 cm) to about 2 inches (5.08 cm). In one embodiment, the width 3566 may be about 0.5 inches (1.268 cm). The seal 3530 may have a height 3567. The height 3567 may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.25 inches (0.634 cm) to about 6 inches (15.24 cm), and a third range from about 0.5 inches (1.268 cm) to about 4 inches (10.16 cm). In one embodiment, the height 3567 may be about 1 inch (2.54 cm). The seal 3530 may be a distance 3568 from the side seal. The distance 3568 may have a first range from about 0.25 inches (0.634 cm) to about 6 inches (15.24 cm), a second range from about 0.5 inches (1.268 cm) to about 4 inches (10.16 cm), and a third range from about 1 inch (2.54 cm) to about 3 inches (7.62 cm). In one embodiment, the distance 3568 may be about 2 inches (5.08 cm). The seal 3530 may be a distance 3569 from the top edge. The distance 3569 may have a first range from about 0.5 inches (1.268 cm) to about 12 inches (30.5 cm), a second range from about 1 inch (2.54 cm) to about 6 inches (15.24 cm), and a third range from about 1.5 inches (3.81 cm) to about inches (12.68 cm). In one embodiment, the distance 3569 may be about 2.75 inches (6.99 cm). The seal 3532 may have the same dimensional

information as seal 3530. In another embodiment, the seal 3532 may have different dimensional information as seal 3530.

[0140] The bag 3500, seals 3530, 3532 and throat 3534 may have the same dimensional information as the bag, converging portions, and throat in FIG. 2 or any other embodiment described herein, as appropriate. In another embodiment, the bag may have only one seal, such as, seal 3530.

[0141] Referring to FIG. 42, there is illustrated another embodiment of a bag. The bag 3600 may be similar to bag 3500 in FIG. 41 except that the sidewalls 3602, 3604 of the bag 3600 may include a pattern 3671. The pattern 3671 may be located below the throat 3634. The pattern 3671 may be located below the pattern 3670. The pattern 3671 may be similar to the pattern 371 in FIG. 8. In other embodiments, the pattern 3671 may be any of the patterns described herein, as appropriate. In another embodiment, the bag 3600 may have only one seal, such as, seal 3630.

[0142] Referring to FIG. 43, there is illustrated another embodiment of a bag. The bag 3700 may be similar to bag 3500 in FIG. 41 except that the bag 3700 may include one or more retention strips 3792. One or more retention strips 3792 may be attached to the interior and/or exterior of the first sidewall 3702 and/or second sidewall 3704 and may be positioned between the seals 3730, 3732. The retention strip 3792 may be similar to retention strip 270 in FIG. 7. The retention strip 3792 may have similar dimensional information and other information as retention strip 270 in FIG. 7. In another embodiment, the bag 3700 may have only one seal, such as, seal 3730. In another embodiment, the bag 3700 may have a pattern similar to the pattern 371 in FIG. 8.

[0143] Referring to FIG. 44, there is illustrated another embodiment of a bag. The bag 3800 may be similar to the bag 2600 in FIG. 32 except that the bag 3800 may have a first inward seal 3830 and a second inward seal 3832. The seals 3830, 3832, may be in the shape of semi-circles. In other embodiments, the seals may have other shapes, such as circles, ovals, teardrops, curves, polygons, lines straight or accurate in nature and combinations thereof, or any of the shapes described herein, as appropriate. The seal 3830 may have a radius 3863. The radius 3863 may have a first range from about 0.1 inches (0.254 cm) to about 5 inches (12.68 cm), a second range from about 0.2 inches (0.508 cm) to about 3 inches (7.62 cm), and a third range from about 0.3 inches (0.762 cm) to about 2 inches (5.08 cm). In one embodiment, the radius 3863 may be about 0.75 inches (1.91 cm). The seal 3830 may have a width 3866. The width 3866 may have a first range from about 0.01 inches (0.025 cm) to about 1 inch (2.54 cm), a second range from about 0.02 inches (0.051 cm) to about 0.5 inches (1.268 cm), and a third range from about 0.03 inches (0.076 cm) to about 0.1 inches (0.254 cm). In one embodiment, the width 3866 may be about 0.075 inches (0.19 cm). The seal 3830 may be a distance 3868 from the side seal. The distance 3868 may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.2 inches (0.508 cm) to about 5 inches (1.268 cm), and a third range from about 0.25 inches (0.634 cm) to about 2.5 inches (6.34 cm). In one embodiment, the distance 3868 may be about 0.75 inches (1.91 cm). The seal 3830 may be a distance 3869 from the top of the bag. The distance 3869 may have a first range from about 0.1 inches (0.254 cm) to about 12 inches (30.5 cm), a second range from about 0.5 inches (1.268 cm) to about 6 inches (15.4 cm), and a third range from about 0.75 inches (1.91 cm) to about 3

inches (7.62 cm). In one embodiment, the distance **3869** may be about 1.35 inches (3.43 cm). The seal **3832** may have the same dimensional information as seal **3830**. In another embodiment, the seal **3832** may have different dimensional information as seal **3830**.

[0144] The seals **3830**, **3832** may be positioned over the hem seal **3891**. In other embodiments, the seals **3830**, **3832** may be positioned below the hem seal **3891**. The seals **3830**, **3832** may be positioned over the hem edge **3889**, but not over the hem seal **3891**. In other embodiments, the seals **3830**, **3832** may be positioned below the hem edge **3889**.

[0145] The bag **3800** may include a pattern **3870**. The pattern **3870** may include a first row **3873** of ribs and a second row **3875** of ribs. In other embodiments, the pattern **3870** may have one row of ribs, three rows of ribs, or four or more rows of ribs. In other embodiments, the pattern **3870** may be any of the patterns described herein, as appropriate.

[0146] The bag **3800**, seals **3830**, **3832** and throat **3834** may have the same dimensional information as the bag, converging portions, and throat in FIG. 2 or any other embodiment described herein, as appropriate. In another embodiment, the bag may have only one seal, such as, seal **3830**.

[0147] Referring to FIG. 45, there is illustrated another embodiment of a bag. The bag **3900** may be similar to bag **3800** in FIG. 44 except that the sidewalls **3902**, **3904** of the bag **3900** may include a pattern **3971**. The pattern **3971** may be located below the throat **3934**. The pattern **3971** may be located below the pattern **3970**. The pattern **3971** may be similar to the pattern **371** in FIG. 8. In other embodiments, the pattern **3971** may be any of the patterns described herein, as appropriate. In another embodiment, the bag **3900** may have only one seal, such as, seal **3930**.

[0148] Referring to FIG. 46, there is illustrated another embodiment of a bag. The bag **4000** may be similar to bag **3800** in FIG. 44 except that the bag **4000** may include one or more retention strips **4092**. One or more retention strips **4092** may be attached to the interior and/or exterior of the first sidewall **4002** and/or second sidewall **4004** and may be positioned between the seals **4030**, **4032**. The retention strip **4092** may be similar to retention strip **270** in FIG. 7. The retention strip **4092** may have similar dimensional information and other information as retention strip **270** in FIG. 7. In another embodiment, the bag **4000** may have only one seal, such as, seal **4030**. In another embodiment, the bag **4000** may have a pattern similar to the pattern **371** in FIG. 8.

[0149] Referring to FIG. 47, there is illustrated another embodiment of a bag. The bag **4100** may be similar to the bag **3800** in FIG. 44 except that the bag **4100** may have a different pattern **4170**. The pattern **4170** may include a first row **4173** of ribs, a second row **4175** of ribs, a third row **4177** of ribs and a fourth row **4179** of ribs. The bag **4100**, seals **4130**, **4132** and throat **4134** may have the same dimensional information as the bag, converging portions, and throat in FIG. 2, or any other embodiment described herein, as appropriate. In another embodiment, the bag may have only one seal, such as, seal **4130**.

[0150] Referring to FIG. 48, there is illustrated another embodiment of a bag. The bag **4200** may be similar to bag **4100** in FIG. 47 except that the sidewalls **4202**, **4204** of the bag **4200** may include a pattern **4271**. The pattern **4271** may be located below the throat **4234**. The pattern **4271** may be located below the pattern **4270**. The pattern **4271** may be similar to the pattern **371** in FIG. 8. In other embodiments, the pattern **4271** may be any of the patterns described herein, as

appropriate. In another embodiment, the bag **4200** may have only one seal, such as, seal **4230**.

[0151] Referring to FIG. 49, there is illustrated another embodiment of a bag. The bag **4300** may be similar to bag **4100** in FIG. 47 except that the bag **4300** may include one or more retention strips **4392**. One or more retention strips **4392** may be attached to the interior and/or exterior of the first sidewall **4302** and/or second sidewall **4304** and may be positioned between the seals **4330**, **4332**. The retention strip **4392** may be similar to retention strip **270** in FIG. 7. The retention strip **4392** may have similar dimensional information and other information as retention strip **270** in FIG. 7. In another embodiment, the bag **4300** may have only one seal, such as, seal **4330**. In another embodiment, the bag **4300** may have a pattern similar to the pattern **371** in FIG. 8.

[0152] Referring to FIG. 50, there is illustrated another embodiment of a bag. The bag **4400** may be similar to the bag **4100** in FIG. 47 except that the bag **4400** may have a first inward seal **4430** and a second inward seal **4432** with different shapes. The seals **4430**, **4432** may be in the shape of the letter "J". The seals may have a curved portion **4460** and a straight portion **4461**. The curved portion **4460** may have the shape of a quarter of a circle. The curved portion **4460** may have a radius **4463**. The radius **4463** may have a first range from about 0.1 inches (0.254 cm) to about 6 inches (15.24 cm), a second range from about 0.2 inches (0.508 cm) to about 3 inches (7.62 cm), and a third range from about 0.3 inch (0.762 cm) to about 1 inch (2.54 cm). In one embodiment, the radius **4463** may be about 0.675 inches (1.71 cm). The seals **4430**, **4432** may have a thickness **4466**. The thickness **4466** may have a first range from about 0.01 inches (0.025 cm) to about 1 inches (2.54 cm), a second range from about 0.02 inches (0.051 cm) to about 0.5 inches (1.268 cm), and a third range from about 0.03 inches (0.076 cm) to about 0.1 inches (0.254 cm). In one embodiment, the thickness **4466** may be about 0.075 inches (0.19 cm). The straight portion **4461** may have a length **4467**. The length **4467** may have a first range from about 0.1 inches (0.254 cm) to about 6 inches (15.24 cm), a second range from about 0.2 inches (0.508 cm) to about 3 inches (7.62 cm), and a third range from about 0.3 inches (0.762 cm) to about 1 inch (2.54 cm). In one embodiment, the length **4467** may be about 0.75 inches (1.91 cm). The seal **4430** may be a distance **4468** from the side seal. The distance **4468** may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.2 inches (0.508 cm) to about 5 inches (12.68 cm), and a third range from about 0.25 inches (0.634 cm) to about 2.5 inches (6.34 cm). In one embodiment, the distance **4468** may be about 0.85 inches (2.16 cm). The seal **4430** may be a distance **4469** from the top edge. The distance **4469** may have a first range from about 0.1 inches (0.254 cm) to about 12 inches (30.5 cm), a second range from about 0.5 inches (1.268 cm) to about 6 inches (15.4 cm), and a third range from about 0.75 inches (0.634 cm) to about 3 inches (7.62 cm). In one embodiment, the distance **4469** may be about 1.35 inches (3.43 cm). The seal **4432** may have the same dimensional information as seal **4430**. In another embodiment, the seal **4432** may have different dimensional information as seal **4430**.

[0153] The seals **4430**, **4432** may be positioned over the hem seal **4491**. In other embodiments, the seals may be positioned below the hem seal **4491**. The seals **4430**, **4432** may be positioned over the hem edge **4489**, but not over the hem seal **4491**. In other embodiments, the seals **4430**, **4432** may be positioned below the hem edge **4489**. The bag **4400** may

include a pattern **4470**. In other embodiments, the pattern **4470** may be any of the patterns described herein, as appropriate.

[0154] The bag **4400**, seals **4430**, **4432** and throat **4434** may have the same dimensional information as the bag, converging portions, and throat in FIG. 2 or any other embodiment described herein, as appropriate. In another embodiment, the bag may have only one seal, such as, seal **4430**.

[0155] Referring to FIG. 51, there is illustrated another embodiment of a bag. The bag **4500** may be similar to bag **4400** in FIG. 50 except that the sidewalls **4502**, **4504** of the bag **4500** may include a pattern **4571**. The pattern **4571** may be located below the throat **4534**. The pattern **4571** may be located below the pattern **4570**. The pattern **4571** may be similar to the pattern **371** in FIG. 8. In other embodiments, the pattern **4571** may be any of the patterns described herein, as appropriate. In another embodiment, the bag **4500** may have only one seal, such as, seal **4530**.

[0156] Referring to FIG. 52, there is illustrated another embodiment of a bag. The bag **4600** may be similar to bag **4400** in FIG. 50 except that the bag **4600** may include one or more retention strips **4692**. One or more retention strips **4692** may be attached to the interior and/or exterior of the first sidewall **4602** and/or second sidewall **4604** and may be positioned between the seals **4630**, **4632**. The retention strip **4692** may be similar to retention strip **270** in FIG. 7. The retention strip **4692** may have similar dimensional information and other information as retention strip **270** in FIG. 7. In another embodiment, the bag **4600** may have only one seal, such as, seal **4630**. In another embodiment, the bag **4600** may have a pattern similar to the pattern **371** in FIG. 8.

[0157] Referring to FIG. 53, there is illustrated another embodiment of a bag. The bag **4700** may be similar to the bag **4400** in FIG. 50 except that the bag **4700** may have a first inward seal **4730** and a second inward seal **4732** with different shapes. The seals **4730**, **4732** may be in the shape of the letter "J". The seals may have a curved portion **4760** and a straight portion **4761**. The curved portion **4760** may have the shape of a portion of a circle. The curved portion **4760** may extend along an angle **4762**. The angle **4762** may have a first range from about 1 degree to about 270 degrees, a second range from about 10 degrees to about 200 degrees, and a third range from about 50 degrees to about 150 degrees. In one embodiment, the angle **4762** may be about 115 degrees. The curved portion **4760** may have a radius **4763**. The radius **4763** may have a first range from about 0.1 inches (0.254 cm) to about 6 inches (15.26 cm), a second range from about 0.2 inches (0.508 cm) to about 3 inches (7.62 cm), and a third range from about 0.3 inches (0.762 cm) to about 1 inch (2.54 cm). In one embodiment, the radius **4763** may be about 0.675 inches (1.71 cm). The seal **4730** may have a thickness **4766**. The thickness **4766** may have a first range from about 0.01 inches (0.025 cm) to about 1 inch (2.54 cm), a second range from about 0.02 inches (0.051 cm) to about 0.5 inches (1.268 cm), and a third range from about 0.03 inches (0.076 cm) to about 0.1 inches (0.254 cm). In one embodiment, the thickness **4766** may be about 0.075 inches (0.19 cm). The straight portion **4761** may have a length **4767**. The length **4767** may have a first range from about 0.1 inches (0.254 cm) to about 5 inches (12.68 cm), a second range from about 0.2 inches (0.508 cm) to about 2 inches (5.08 cm), and a third range from about 0.3 inches (0.762 cm) to about 1.5 inches (3.43 cm). In one embodiment, the length **4767** may be about 0.75 inches (1.91 cm). The seal **4730** may be a distance **4768** from the side

seal. The distance **4768** may have a first range from about 0.1 inches (0.254 cm) to about 10 inches (25.4 cm), a second range from about 0.2 inches (0.508 cm) to about 5 inches (12.68 cm), and a third range from about 0.25 inches (0.634 cm) to about 2.5 inches (6.34 cm). In one embodiment, the distance **4768** may be about 0.75 inches (1.91 cm). The seal **4730** may be a distance **4769** from the top edge. The distance **4769** may have a first range from about 0.1 inches (0.254 cm) to about 12 inches (30.5 cm), a second range from about 0.5 inches (1.268 cm) to about 6 inches (15.4 cm), and a third range from about 0.75 inches (1.91 cm) to about 3 inches (7.62 cm). In one embodiment, the distance **4769** may be about 1.35 inches (3.43 cm). The seal **4732** may have the same dimensional information as seal **4730**. In another embodiment, the seal **4732** may have different dimensional information as seal **4730**.

[0158] The seals **4730**, **4732** may be positioned over the hem seal **4791**. In other embodiments, the seals **4730**, **4732** may be positioned below the hem seal **4791**. The seals **4730**, **4732** may be positioned over the hem edge **4789**, but not over the hem seal **4791**. In other embodiments, the seals **4730**, **4732** may be positioned below the hem edge **4789**.

[0159] The bag **4700** may include a pattern **4770**. In other embodiments, the pattern **4770** may be any of the patterns described herein, as appropriate.

[0160] The bag **4700**, seals **4730**, **4732** and throat **4734** may have the same dimensional information as the bag, converging portions, and throat in FIG. 2 or any other embodiment described herein, as appropriate. In another embodiment, the bag may have only one seal, such as, seal **4730**.

[0161] Referring to FIG. 54, there is illustrated another embodiment of a bag. The bag **4800** may be similar to bag **4700** in FIG. 53 except that the sidewalls **4802**, **4804** of the bag **4800** may include a pattern **4871**. The pattern **4871** may be located below the throat **4834**. The pattern **4871** may be located below the pattern **4870**. The pattern **4871** may be similar to the pattern **371** in FIG. 8. In other embodiments, the pattern **4871** may be any of the patterns described herein, as appropriate. In another embodiment, the bag **4800** may have only one seal, such as, seal **4830**.

[0162] Referring to FIG. 55, there is illustrated another embodiment of a bag. The bag **4900** may be similar to bag **4700** in FIG. 53 except that the bag **4900** may include one or more retention strips **4992**. One or more retention strips **4992** may be attached to the interior and/or exterior of the first sidewall **4902** and/or second sidewall **4904** and may be positioned between the seals **4930**, **4932**. The retention strip **4992** may be similar to retention strip **270** in FIG. 7. The retention strip **4992** may have similar dimensional information and other information as retention strip **270** in FIG. 7. In another embodiment, the bag **4900** may have only one seal, such as, seal **4930**. In another embodiment, the bag **4900** may have a pattern similar to the pattern **371** in FIG. 8.

[0163] The bags shown in FIGS. 32-37 and 44-55 may be made using the manufacturing processes described with respect to FIGS. 29-31 except that the converging portions, such as, seals **2630**, **2632** may be located inward from the side seals. The bags shown in FIGS. 38-43 may be made using the manufacturing processes described with respect to FIGS. 29-31.

[0164] All references, including publications, patent applications, and patents, cited herein are hereby incorporated by reference to the same extent as if each reference were indi-

vidually and specifically indicated to be incorporated by reference and were set forth in its entirety herein.

**[0165]** The use of the terms “a” and “an” and “the” and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms “comprising,” “having,” “including,” and “containing” are to be construed as open-ended terms (i.e., meaning “including, but not limited to;”) unless otherwise noted. Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein may be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., “such as”) provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.

**[0166]** Exemplary embodiments are described herein. Variations of those embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventor(s) expect skilled artisans to employ such variations as appropriate, and the inventor(s) intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

What is claimed is:

1. A thermoplastic bag intended for use as a trash receptacle liner comprising:
  - a first flexible sidewall of thermoplastic material;
  - a second flexible sidewall of thermoplastic material overlying and joined to the first sidewall along a first side seal, a second side seal, and a bottom extending between the first and second side seals, the first and second sidewalls unsealed along respective top edges located opposite the bottom to provide an opening for accessing the interior volume;
  - wherein the first and second side seals are continuous seals between the bottom and the top edges, the first and second side seals proceed substantially parallel to each other between the bottom toward the opening, the first side seal includes a first converging portion and the first converging portion converges toward the second side seal proximate the opening.
2. The thermoplastic bag of claim 1 wherein the second side seal includes a second converging portion wherein the first and second converging portions converge toward each other proximate the opening.
3. The thermoplastic bag of claim 1, wherein the first side seal and the second side seal each maintain a constant width proceeding from the bottom edge to the opening.

4. The thermoplastic bag of claim 1, wherein the first sidewall includes a notch proximate the first converging portion.

5. The thermoplastic bag of claim 1, wherein at least one of the first and second sidewalls is formed with a pattern.

6. The thermoplastic bag of claim 6, wherein the pattern is located between the first converging portion and the second side seal.

7. The thermoplastic bag of claim 1, wherein attached to the first sidewall is a first retention strip, the retention strip located between the first converging portion and the second side seal.

8. The thermoplastic bag of claim 7, wherein the first retention strip is comprised of an elastic material.

9. The thermoplastic bag of claim 1, further comprising a draw tape proximate the opening for drawing closed the opening during disposal.

10. A thermoplastic bag intended for use as a trash receptacle liner comprising:

- a first flexible sidewall of thermoplastic material;
- a second flexible sidewall of thermoplastic material overlying and joined to the first sidewall along a first side seal, a second side seal, and a bottom extending between the first and second side seals, the first and second sidewalls unsealed along respective top edges located opposite the bottom to provide an opening for accessing the interior volume;

wherein the first and second side seals are continuous seals between the bottom and the top edges, the first and second side seals proceed substantially parallel to each other between the bottom toward the opening, the bag having a hem with a hem seal and a hem edge along the first and second sidewall top edges and a draw tape within the hem, wherein there is a first inward seal separate from the side seals near the sidewall top edges.

11. The thermoplastic bag of claim 10, wherein the bag includes a second inward seal separate from the side seals and opposite the first inward seal.

12. The thermoplastic bag of claim 10, wherein the first inward seal covers part of the hem seal.

13. The thermoplastic bag of claim 10, wherein the first inward seal is below the hem seal.

14. The thermoplastic bag of claim 10, wherein the first inward seal is below the hem edge.

15. The thermoplastic bag of claim 10, wherein at least one of the first and second sidewalls is formed with a pattern adjacent to the first inward seal.

16. The thermoplastic bag of claim 11, wherein at least one of the first and second sidewalls is formed with a pattern between the first and second inward seals.

17. A thermoplastic bag intended for use as a trash receptacle liner comprising:

- a first flexible sidewall of thermoplastic material;
- a second flexible sidewall of thermoplastic material overlying and joined to the first sidewall along a first side seal, a second side seal, and a bottom extending between the first and second side seals, the first and second sidewalls unsealed along respective top edges located opposite the bottom to provide an opening for accessing the interior volume;

wherein the first and second side seals include first and second converging portions and there is a pattern between the first and second converging portions.

18. The thermoplastic bag of claim 17, wherein the pattern has a first region, a second region and a third region, the first region is adjacent the second region, the second region is



adjacent the third region, the first region has ribs oriented in a first direction, the second region has ribs oriented in a second direction, the third region has ribs oriented in a third direction, the first direction is different than the second direction, the first direction is the same as the third direction.

**19.** The thermoplastic bag of claim **17**, wherein there are notches in the first and second side seals.

**20.** The thermoplastic bag of claim **17**, wherein there are no notches in the first and second side seals.

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