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(71) Applicant: DOW GLOBAL TECHNOLOGIES LLC

[US/US]; 2211 H.H. Dow Way, Midland, Michigan 48674 (US).

(72) Inventors: BARBOSA, Bruno Cesar de Moraes; Avenida

das Macoes Unidas, 14171, Diamond Tower, Santo Amaro, 04794-000 Sao Paulo (BR). MAZZOLA, Nicolas Cardoso; Avenida das Macoes Unidas, 14171, Diamond Tower, Santo Amaro, 04794-000 Sao Paulo (BR). BUASZCZYK, Gianna; Avenida das Macoes Unidas, 14171, Diamond Tower, Santo Amaro, 04794-000 Sao Paulo (BR).

(74) Agent: BARTHEL, Ted, J.; Quarles & Brady LLP, 411

East Wisconsin Avenue, Suite 2400, Milwaukee, Wisconsin 53202 (US).

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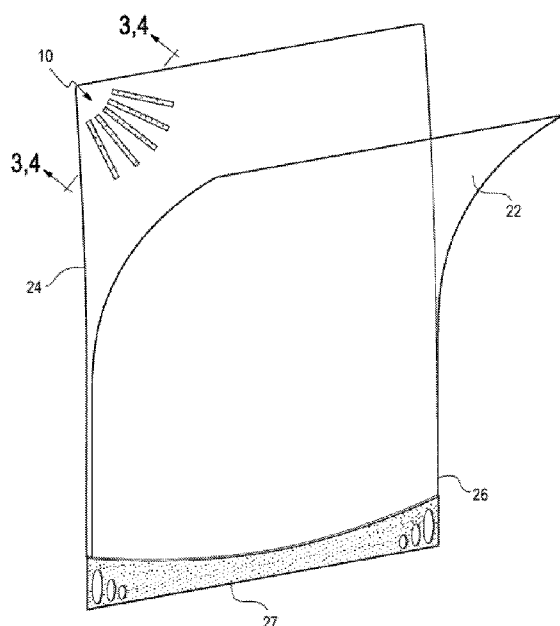
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(54) Title: FLEXIBLE POUCH WITH FLOW CHANNEL

FIG. 1



(57) Abstract: The present disclosure provides a process. In an embodiment, the process includes: (i) providing opposing multilayer flexible films defining a common peripheral edge; (ii) providing a pattern to a seal layer of one of the flexible multilayer films, the pattern composed of a non-stick material adhered to the seal layer, the pattern located along a portion of the common peripheral edge; (iii) applying a heat sealing procedure to the common peripheral edge and the pattern to form a peripheral seal; and (iv) forming, with the pattern of non-stick material, at least one flow channel extending across the peripheral seal. The present disclosure also includes the resulting flexible pouch formed from the process.

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FLEXIBLE POUCH WITH FLOW CHANNEL

BACKGROUND

[0001] Flexible pouches are gaining market acceptance versus rigid packaging in many applications. In the food, home care, and personal care segments, flexible pouches offer the advantages of lower weight, efficient use and access to contents, good visual appeal, and better overall sustainability compared to rigid packaging.

[0002] Utilization of flexible pouches is still limited due to lack of specific functionalities, such as flow control, for example. Thus, flexible pouches are oftentimes used as refill packages where the flexible pouch is opened and its contents poured into a previously used rigid container having a removable nozzle or spout. The nozzle or spout provides the rigid container with precision flow control.

[0003] Attempts for flow control in a flexible pouch is achieved with the addition of a rigid fitment that is assembled to the flexible pouch structure by a heat-sealing process. The heat sealing process requires specialized tooling, is prone to significant amount of failures (leaks), and requires careful quality control. Thus the high final cost of the rigid fitment on a flexible pouch makes it prohibitive for some low cost applications.

[0004] Flexible pouches capable of spray dispensing are desirable but are limited to flexible pouches having rigid fitments. Rigid fitments are disadvantageous because they are heavy, expensive to produce, and the spray component is typically not recyclable.

[0005] The art recognizes the need for a flexible pouch that is capable of delivering its content by way of a spray application and without the need for a rigid fitment or other insert. The art further recognizes the need for versatile, convenient, and inexpensive methods of producing flexible pouches that require no fitment component for spray applications.

SUMMARY

[0006] Disclosed herein is a process comprising: (i) providing opposing multilayer flexible films defining a common peripheral edge; (ii) providing a pattern to a seal layer of one of the flexible multilayer films, the pattern composed of a non-stick material adhered to the seal layer, the pattern located along a portion of the common peripheral edge; (iii)

applying a heat sealing procedure to the common peripheral edge and the pattern to form a peripheral seal; and (iv) forming, with the pattern of non-stick material, at least one flow channel extending across the peripheral seal.

[0007] Also disclosed herein is a flexible pouch comprising: (i) opposing flexible multilayer films, each multilayer film comprising a seal layer, the opposing flexible multilayer films defining a common peripheral edge; (ii) a peripheral seal along at least a portion of the common peripheral edge; and (iii) at least one flow channel extending across the peripheral seal, the channel comprising a coating composed of a non-stick material, the coating adhered to at least one of the seal layers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Figure 1 is perspective view of flexible films with a printed pattern in accordance with an embodiment of the present disclosure.

[0009] Figure 2A is a perspective view of printing a non-stick material onto a flexible film in accordance with an embodiment of the present disclosure.

[0010] Figure 2B is a perspective view of printing a non-stick material onto a flexible film in accordance with another embodiment of the present disclosure.

[0011] Figure 3 is a sectional view of the printed pattern taken along line 3-3 of Figure 1.

[0012] Figure 4 is a sectional view of the printed pattern and opposing films taken along line 4-4 of Figure 1.

[0013] Figure 5 is a plan view of a flexible pouch having sealed opposing flexible films with flow channels in accordance with an embodiment of the present disclosure.

[0014] Figure 6 is an expanded and partially cutaway view of Area 6 of Figure 5.

[0015] Figure 7 is a sectional view of the flow channels taken along line 7-7 of Figure 5.

[0016] Figure 8A is a perspective view of a flexible pouch with a flow channel dispensing system in accordance with an embodiment of the present disclosure.

[0017] Figure 8B is a perspective view of the removal of a release member from a flexible pouch in accordance with an embodiment of the present disclosure.

[0018] Figure 8C is a perspective view of flow channel dispensing from the flexible pouch in accordance with an embodiment of the present disclosure.

[0019] Figure 8D is a sectional view of the dispensing from the flexible pouch taken along line 8D-8D of Figure 8C.

[0020] Figure 8E is a perspective view of a flexible pouch with a flow channel dispensing system in accordance with another embodiment of the present disclosure.

[0021] Figure 8F is a perspective view of a flexible pouch with a pocket segment in accordance with an embodiment of the present disclosure.

[0022] Figure 9A is a perspective view of the removal of a release member from a flexible pouch in accordance with another embodiment of the present disclosure.

[0023] Figure 9B is a perspective view of a flexible pouch with a flow channel dispensing system in accordance with another embodiment of the present disclosure.

[0024] Figure 9C is a perspective view of a flexible pouch with a pocket segment in accordance with another embodiment of the present disclosure.

DEFINITIONS

[0025] All references to the Periodic Table of the Elements herein shall refer to the Periodic Table of the Elements, published and copyrighted by CRC Press, Inc., 2003. Also, any references to a Group or Groups shall be to the Groups or Groups reflected in this Periodic Table of the Elements using the IUPAC system for numbering groups. Unless stated to the contrary, implicit from the context, or customary in the art, all parts and percentages are based on weight. For purposes of United States patent practice, the contents of any patent, patent application, or publication referenced herein are hereby incorporated by reference in their entirety (or the equivalent US version thereof is so incorporated by reference), especially with respect to the disclosure of synthetic techniques, definitions (to the extent not inconsistent with any definitions provided herein) and general knowledge in the art.

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disclosure of definitions (to the extent not inconsistent with any definitions specifically provided in this disclosure) and general knowledge in the art.

[0027] The numerical ranges disclosed herein include all values from, and including, the lower value and the upper value. For ranges containing explicit values (*e.g.*, a range from 1, or 2, or 3 to 5, or 6, or 7) any subrange between any two explicit values is included (*e.g.*, the range 1-7 above includes subranges 1 to 2; 2 to 6; 5 to 7; 3 to 7; 5 to 6; etc.).

[0028] Unless stated to the contrary, implicit from the context, or customary in the art, all parts and percentages are based on weight, and all test methods are current as of the filing date of this disclosure.

[0029] The term "composition," as used herein, refers to a mixture of materials which comprise the composition, as well as reaction products and decomposition products formed from the materials of the composition.

[0030] The terms "comprising," "including," "having," and their derivatives, are not intended to exclude the presence of any additional component, step or procedure, whether or not the same is specifically disclosed. In order to avoid any doubt, all compositions claimed through use of the term "comprising" may include any additional additive, adjuvant, or compound, whether polymeric or otherwise, unless stated to the contrary. In contrast, the term, "consisting essentially of" excludes from the scope of any succeeding recitation any other component, step or procedure, excepting those that are not essential to operability. The term "consisting of" excludes any component, step or procedure not specifically delineated or listed.

[0031] An "ethylene-based polymer," as used herein is a polymer that contains more than 50 mole percent polymerized ethylene monomer (based on the total amount of polymerizable monomers) and, optionally, may contain at least one comonomer.

[0032] An "olefin-based polymer," as used herein is a polymer that contains more than 50 mole percent polymerized olefin monomer (based on total amount of polymerizable monomers), and optionally, may contain at least one comonomer. Nonlimiting examples of olefin-based polymer include ethylene-based polymer and propylene-based polymer.

[0033] A "polymer" is a compound prepared by polymerizing monomers, whether of the same or a different type, that in polymerized form provide the multiple and/or repeating "units" or "mer units" that make up a polymer. The generic term polymer thus embraces the term homopolymer, usually employed to refer to polymers prepared from only one type of monomer, and the term copolymer, usually employed to refer to polymers prepared from at least two types of monomers. It also embraces all forms of copolymer, *e.g.*, random, block, etc. The terms "ethylene/ α -olefin polymer" and "propylene/ α -olefin polymer" are indicative of copolymer as described above prepared from polymerizing ethylene or propylene respectively and one or more additional, polymerizable α -olefin monomer. It is noted that although a polymer is often referred to as being "made of" one or more specified monomers, "based on" a specified monomer or monomer type, "containing" a specified monomer content, or the like, in this context the term "monomer" is understood to be referring to the polymerized remnant of the specified monomer and not to the unpolymerized species. In general, polymers herein are referred to as being based on "units" that are the polymerized form of a corresponding monomer.

[0034] A "propylene-based polymer" is a polymer that contains more than 50 mole percent polymerized propylene monomer (based on the total amount of polymerizable monomers) and, optionally, may contain at least one comonomer.

TEST METHODS

[0035] Density is measured in accordance with ASTM D792 with results reported in grams per cubic centimeter (g/cc) at 25°C.

[0036] Melt index (MI) is measured in accordance with ASTM D 1238, Condition 190°C/2.16 kg with results reported in grams per 10 minutes (g/10 min).

[0037] Melting point, or T_m , is measured by the DSC (Differential Scanning Calorimetry) technique for measuring the melting points or peaks of polyolefins as described in USP 5,783,638. It should be noted that many blends comprising two or more polyolefins will have more than one melting point or peak, and many individual polyolefins will comprise only one melting point or peak.

[0038] Viscosity is measured at 25°C in accordance with ASTM D2196, and is reported in mPa•s.

DETAILED DESCRIPTION

[0039] The present disclosure provides a process. In an embodiment, the process comprises providing opposing multilayer flexible films defining a common peripheral edge. The process includes providing a pattern to a seal layer of one of the flexible multilayer films. The pattern is composed of a non-stick material that is adhered to the seal layer. The pattern is located along a portion of the common peripheral edge. The process includes applying a heat sealing procedure to the common peripheral edge and the pattern to form a peripheral seal. The process includes forming, with the pattern of non-stick material, at least one flow channel through the peripheral seal.

1. Films

[0040] The process includes providing opposing flexible films. Each flexible film includes a seal layer and one or more other layers. In an embodiment, each flexible film is a flexible multilayer film having at least two, or three, or four, or five, or six, or seven, or more layers. The flexible multilayer film is resilient, flexible, deformable, and pliable. The structure and composition for each of the flexible multilayer films may be the same or different. For example, each of the flexible multilayer films can be a separate and distinct film made from a separate web, each web having a unique structure and/or unique composition, finish, or print. Each of the flexible multilayer films can be separate and distinct films having the same composition and structure. Alternatively, the flexible multilayer films can be made from the same piece of web, the films having the same structure and the same composition

[0041] In an embodiment, two opposing flexible multilayer films 22 and 24 are provided, as shown in FIG. 1. Films 22, 24 each is a flexible multilayer film having the same structure and the same composition.

[0042] In an embodiment, two opposing flexible multilayer films are components of a single (folded) sheet 20, as shown in FIGS. 2A, 2B.

[0043] Each flexible multilayer film 20, 22, 24 may be (i) a coextruded multilayer structure or (ii) a laminate, or (iii) a combination of (i) and (ii). In an embodiment, each flexible multilayer film 20, 22, 24 has at least three layers: a seal layer, an outer layer, and a tie layer between. The tie layer adjoins the seal layer to the outer layer. The flexible multilayer film may include one or more optional inner layers disposed between the seal layer and the outer layer.

[0044] In an embodiment, the flexible multilayer film is a coextruded film having at least two, or three, or four, or five, or six, or seven to eight, or nine, or 10, or 11, or more layers. Some methods, for example, used to construct films are by cast co-extrusion or blown co-extrusion methods, adhesive lamination, extrusion lamination, thermal lamination, and coatings such as vapor deposition. Combinations of these methods are also possible. Film layers can comprise, in addition to the polymeric materials, additives such as stabilizers, slip additives, antiblocking additives, process aids, clarifiers, nucleators, pigments or colorants, fillers and reinforcing agents, and the like as commonly used in the packaging industry. It is particularly useful to choose additives and polymeric materials that have suitable organoleptic and or optical properties.

[0045] The flexible multilayer film is composed of one or more polymeric materials.

[0046] Nonlimiting examples of suitable polymeric materials for the seal layer include olefin-based polymer including any ethylene/C₃-C₁₀ α -olefin copolymers linear or branched; ethylene/C₄-C₁₀ α -olefin copolymers linear or branched; propylene-based polymer (including plastomer and elastomer; and random propylene copolymer); ethylene-based polymer (including plastomer and elastomer, high density polyethylene ("HDPE"); low density polyethylene ("LDPE"); linear low density polyethylene ("LLDPE"); medium density polyethylene ("MDPE"), ethylene-acrylic acid, ethylene vinyl acetate; or ethylene-methacrylic acid and their ionomers with zinc, sodium, lithium, potassium, magnesium salts, ethylene vinyl acetate copolymers; and blends thereof.

[0047] In an embodiment, the flexible multilayer film includes a seal layer selected from LLDPE (*e.g.*, DOWLEX™), single-site LLDPE substantially linear, or linear ethylene alpha-

olefin copolymers, (*e.g.*, AFFINITY™ or ELITE™), for example, propylene-based plastomers or elastomers (*e.g.*, VERSIFY™), and blends thereof.

[0048] In an embodiment, the seal layer is composed of an ethylene-based polymer, the ethylene-based polymer has a T_m from 55°C to 115°C and a density from 0.865 to 0.925 g/cc, or from 0.875 to 0.910 g/cc, or from 0.888 to 0.905 g/cc

[0049] In an embodiment, the seal layer has a heat seal initiation temperature (HSIT) from 65°C to less than 125°C. Applicant discovered that the seal layer with an ethylene-based polymer with a HSIT from 65°C to less than 125°C advantageously enables the formation of secure seals and secure sealed edges around the complex perimeter of the flexible container. The ethylene-based polymer with HSIT from 65°C to 125°C enables lower heat sealing pressure/temperature during container fabrication.

[0050] Nonlimiting examples of suitable polymeric material for the outer layer include those used to make biaxially or monoaxially oriented films for lamination as well as coextruded films. Some nonlimiting polymeric material examples are biaxially oriented polyethylene terephthalate (OPET), monoaxially oriented nylon (MON), biaxially oriented nylon (BON), and biaxially oriented polypropylene (BOPP). Other polymeric materials useful in constructing film layers for structural benefit are polypropylenes (such as propylene homopolymer, random propylene copolymer, propylene impact copolymer, thermoplastic polypropylene (TPO) and the like, propylene-based plastomers (*e.g.*, VERSIFY™ or VISTAMAX™)), polyamides (such as Nylon 6, Nylon 6,6, Nylon 6,66, Nylon 6,12, Nylon 12 etc.), polyethylene norbornene, cyclic olefin copolymers, polyacrylonitrile, polyesters, copolyesters (such as PETG), cellulose esters, polyethylene and copolymers of ethylene (*e.g.*, LLDPE based on ethylene octene copolymer (*e.g.*, DOWLEX™)), blends thereof, and multilayer combinations thereof.

[0051] In an embodiment, the seal layer has a first melt temperature less than 115°C, (T_{m1}) and the outer layer has a second melt temperature, (T_{m2}), wherein $T_{m2} - T_{m1} > 15^\circ\text{C}$. The term " $T_{m2} - T_{m1}$ " is the difference between the melt temperature of the polymer in the outer layer and the melt temperature of the polymer in the seal layer, and is

also referred to as “ ΔT_m .” In an embodiment, the ΔT_m is from 5°C, or 8°C, or 10°C to 12°C, or 15°C, or 20°C, or 25°C.

[0052] In an embodiment, the outer layer has a T_m from 110°C to 270°C.

[0053] Nonlimiting examples of suitable polymeric materials for tie layer include LLDPE (*e.g.*, DOWLEX™), functionalized ethylene-based polymers such as ethylene-vinyl acetate (“EVA”), polymers with maleic anhydride-grafted to polyolefins such as any polyethylene, ethylene-copolymers, or polypropylene, and ethylene acrylate copolymers such as ethylene methyl acrylate (“EMA”), glycidyl containing ethylene copolymers, propylene and ethylene based olefin block copolymers (*e.g.*, INFUSE™ and INTUNE™), and blends thereof.

[0054] The flexible multilayer film may include additional layers which may contribute to the structural integrity or provide specific properties. The additional layers may be added by direct means or by using appropriate tie layers to the adjacent polymer layers. Polymers which may provide additional performance benefits such as stiffness, toughness or opacity, as well polymers which may offer gas barrier properties or chemical resistance can be added to the structure.

[0055] Nonlimiting examples of suitable material for the optional barrier layer include copolymers of vinylidene chloride and methyl acrylate, methyl methacrylate or vinyl chloride (*e.g.*, SARAN resins available from The Dow Chemical Company); vinyl ethylene vinyl alcohol (EVOH), metal foil (such as aluminum foil). Alternatively, modified polymeric films such as vapor deposited aluminum or silicon oxide on such films as BON, OPET, or OPP, can be used to obtain barrier properties when used in laminate multilayer film.

[0056] In an embodiment, each of the opposing flexible films (either discrete films or single folded-over film), is a three layer film composed of an ethylene-based seal layer, an ethylene-based tie layer, and an ethylene-based outer (or skin), layer. The ethylene-based polymer of the seal layer is an ethylene/octene copolymer having (i) a density from 0.900 to 0.910 and (ii) a melt index from 0.5 g/10 min to 1.5 g/10 min.

[0057] In an embodiment, flexible films 20, 22, 24 each has a thickness from 50 microns (μm), or 75 μm , or 90 μm to 110 μm , or 200 μm to 250 μm , or 300 μm , or 350 μm ,

or 400 μm . In a further embodiment, flexible films 20, 22, 24 each has a thickness from 50 to 400 μm , or from 75 to 300 μm , or from 90 to 110 μm ; or a thickness of 100 μm .

2. Pattern

[0058] The process includes providing a pattern to a seal layer of one (or both), of the flexible multilayer films. The pattern is provided by applying, or otherwise distributing, the pattern onto the seal layer of one or more flexible multilayer films. The pattern is applied to the seal layer of flexible film 24 as shown in FIG. 1, for example. In an embodiment, the pattern is applied to the seal layer of two flexible films.

[0059] In an embodiment, the pattern is distributed manually. A nonlimiting example of manual distribution includes applying the non-stick material with a brush and a pattern template onto the seal layer, as described herein.

[0060] In an embodiment, the pattern is distributed with a printing device 15 shown in FIG. 2. The printing device 15 can be a component of a printing process. Nonlimiting examples of a suitable printing process include nozzle, inkjet, flexographic printing, direct rotogravure, reverse rotogravure, and off-set printing.

[0061] In an embodiment, the pattern is a line pattern 10 shown in FIGS. 1 and 2A. FIG. 3 shows discrete beads 13 of line pattern 10. The line pattern 10 is a plurality of parallel lines or a plurality of non-parallel lines.

[0062] In an embodiment, the pattern is a shape shown in FIG. 2B. The shape can be a polygon (such as triangle, square, rectangle, trapezoid (*i.e.*, wedge), diamond, pentagon, hexagon, heptagon, octagon, etc.), or an ellipse (such as an ovoid, an oval, or a circle).

[0063] In an embodiment, the pattern is a wedge pattern.

[0064] The pattern is composed of a non-stick material adhered to the seal layer of the flexible film – *i.e.*, adhered to the ethylene-based polymer of the seal layer. The term “non-stick material,” as used herein is a liquid composition that: (i) can be distributed in a liquid carrier to a seal layer composed of an ethylene-based polymer; (ii) can dry to a solid and adhere to the ethylene-based polymer seal layer (“adhered layer”); (iii) as a solid, does not melt when exposed to a heat sealing procedure; (iv) as a solid, does not adhere to the

opposing non-adhered layer during the heat sealing procedure; and (v) as a solid, remains adhered to the adhered layer during the heat sealing procedure.

[0065] The non-stick material is distributed to the seal layer as a liquid composition. The liquid composition includes a liquid carrier and the non-stick material.

[0066] The liquid carrier can be an aqueous (*i.e.*, water-based) liquid or a non-aqueous (*i.e.*, organic solvent-based) liquid.

[0067] In an embodiment, the liquid carrier is an aqueous liquid.

[0068] In an embodiment, the liquid carrier is a non-aqueous liquid. Nonlimiting examples of a suitable non-aqueous liquid carrier include acetone, cyclohexane, ethyl acetate, hexane, methyl ethyl ketone, toluene, and combinations thereof.

[0069] In an embodiment, the non-stick material is a reaction product of two or more non-stick reagents. Each of the non-stick reagents is a separate component having a distinct chemical composition and is chemically reactive with the other. The non-stick material is formed by (i) combining, in a vessel, the non-stick reagents at a prescribed mixing ratio; (ii) obtaining a reaction between the non-stick reagents; and (iii) curing the reaction product formed by the reaction between the non-stick reagents. In an embodiment, one or more of the non-stick reagents includes the liquid carrier. In a further embodiment, the liquid carrier is added to the vessel used to combine the non-stick reagents. The liquid carrier can be added to the vessel before, during, or after any one of the steps (i), (ii), and (iii) used to form the non-stick material. Curing of the reaction product is initiated after the reaction product has vacated the vessel and the non-stick material has been distributed on the seal layer of the flexible multilayer film. In cases where the printing device is used, curing of the reaction product is initiated also after the reaction product has vacated the printing device. Curing of the reaction product occurs while the non-stick material is on the seal layer of the flexible multilayer film. In an embodiment, curing of the reaction product includes reaction of the reaction product of the non-stick reagents with water from the surroundings (*e.g.*, ambient water vapor).

[0070] In an embodiment, the non-stick material is selected from a polyurethane material, a silicon-based material, an acrylic material, a nitrocellulose material, and a combination thereof.

[0071] In an embodiment, the non-stick material is a polyurethane material. The term "polyurethane material," as used herein, is the reaction product of two or more non-stick reagents selected from: (i) a hydroxyl terminated urethane (HO-urethane), or a hydroxyl terminated polyol (HO-polyol); and (ii) an isocyanate-functional prepolymer. In an embodiment, the hydroxyl terminated urethane is a hydroxyl terminated polyether-based urethane, a hydroxyl terminated polyester-based urethane, a hydroxyl terminated polyester-polyether-based urethane, and combinations thereof. In an embodiment, the isocyanate-functional prepolymer is an aromatic isocyanate. Nonlimiting examples of a suitable aromatic isocyanate include any or all isomers of toluene diisocyanate (TDI) and any or all isomers of methylene diphenyl diisocyanate (MDI). In a further embodiment, the isocyanate-functional prepolymer is an aliphatic isocyanate. Nonlimiting examples of a suitable aliphatic isocyanate include any and all isomers of isophorone diisocyanate (IPDI), any and all isomers of hexamethylene diisocyanate (HDI), any and all isomers of xylylene diisocyanate (XDI), any and all isomers of hydrogenated xylylene diisocyanate (H6XDI), and any and all isomers of meta-tetramethylxylylene diisocyanate (TMXDI). Nonlimiting examples of a non-aqueous liquid carrier suitable for use with the polyurethane material include acetone, cyclohexane, ethyl acetate, methyl ethyl ketone, toluene, and a combination thereof.

[0072] In an embodiment, the density of the non-stick reagent used to form the polyurethane material is from 0.88 grams per cubic centimeter (g/cc), or 0.90 g/cc, or 0.93 g/cc, or 0.98 g/cc to 1.02 g/cc, or 1.06 g/cc, or 1.1 g/cc. In a further embodiment, the density of the non-stick reagent used to form the polyurethane material is from 0.88 to 1.1 g/cc, or from 0.98 to 1.06 g/cc.

[0073] In an embodiment, the viscosity, at 25°C, of the non-stick reagent used to form the polyurethane material is from 50 mPa•s, or 75 mPa•s, or 100 mPa•s, or 200 mPa•s, or 500 mPa•s to 1,000 mPa•s, or 3,000 mPa•s, or 5,000mPa•s, or 10,000 mPa•s. In a further

embodiment, the viscosity, at 25°C, of the non-stick reagent used to form the polyurethane material is from 50 to 10,000 mPa•s, or from 100 to 5,000 mPa•s, or from 200 to 3,000 mPa•s.

[0074] In an embodiment, the non-stick material is a silicon-based material. The silicon-based material can be the reaction product of two or more non-stick reagents selected from a siloxane polymer (e.g., a vinyl siloxane polymer) and a polysiloxane crosslinking agent. A nonlimiting example of non-aqueous liquid carrier suitable for use with the silicon-based material is hexane.

[0075] In an embodiment, the density of the non-stick reagent used to form the silicon-based material is from 0.6 g/cc, or 0.7 g/cc, or 0.75 g/cc, or 0.78 g/cc, or 0.85 to 0.9 g/cc, or 0.92 g/cc, or 0.95 g/cc, or 0.99 g/cc, or 1.02 g/cc, or 1.05 g/cc, or 1.1 g/cc. In a further embodiment, the density of the non-stick reagent used to form the silicon-based material is from 0.6 to 1.1 g/cc, or from 0.75 to 1.02 g/cc, or from 0.78 to 0.99 g/cc.

[0076] In an embodiment, the viscosity, at 25°C, of the non-stick reagent used to form the silicon-based material is from 10 mPa•s, or 15 mPa•s, or 17 mPa•s, or 75 mPa•s, or 100 mPa•s, or 1,000 mPa•s, or 3,500 mPa•s to 5,000 mPa•s, or 7,000 mPa•s, or 10,000 mPa•s, or 20,000 mPa•s. In a further embodiment, the viscosity, at 25°C, of the non-stick reagent used to form the silicon-based material is from 10 to 20,000 mPa•s, or from 15 to 10,000 mPa•s, or from 17 to 7,000 mPa•s.

[0077] In an embodiment, the non-stick material includes a mineral filler.

[0078] In an embodiment, two non-stick reagents are combined to form the non-stick material at a mixing ratio from 0.2:1, or 0.4:1, or 0.6:1, or 0.8:1, or 0.9:1 to 1:1, or 1.2:1, or 1.4:1, or 1.6:1, or 1.8:1 or 2:1. In a further embodiment, two non-stick reagents are combined to form the non-stick material at a mixing ratio from 0.2:1 to 2:1, or from 0.9:1 to 1.1:1.

[0079] In an embodiment, the liquid composition of the non-stick material is applied to, or otherwise distributed to, the seal layer of the flexible film at a coat weight from 0.3 grams per square meter (g/m²), or 0.5 g/m², or 1 g/m², or 2 g/m², or 3 g/m² to 4 g/m², or 5 g/m², or 6 g/m², or 8 g/m², or 10 g/m², or 15 g/m². In a further embodiment, the non-stick

material is applied to the seal layer of the film at a coat weight from 0.3 to 15 g/m², or from 0.5 to 10 g/m², or from 0.5 to 4 g/m².

[0080] In an embodiment, the non-stick material is a polyurethane material and the solid and dry non-stick material includes an isocyanate index. The term “isocyanate index,” as used herein, is calculated from values for “HO-equiv” and “NCO-equiv.” HO-equiv is the number of molar equivalents of HO-urethane used, (or HO-polyol, in cases where HO-polyol is used to the exclusion of HO-urethane). NCO-equiv is the number of molar equivalents of isocyanate-functional prepolymer used. The isocyanate index is determined with the expression NCO-equiv/HO-equiv. In an embodiment, the isocyanate index is from 1:3, or 1:2, or 1:1 to 1.2:1, or 1.3:1, or 1.4:1, or 1.5:1, or 2:1, or 3:1. In a further embodiment, the isocyanate index is from 1:3 to 3:1, or from 1:1 to 1.4:1.

[0081] In an embodiment, the solid and dry non-stick material has a thermal resistance greater than, or equal to, 200°C. In a further embodiment, the solid and dry non-stick material has a thermal resistance from 200°C, or 202°C, or 205°C to 210°C, or 215°C, or 220°C. In another embodiment, the solid and dry non-stick material has a thermal resistance from 200 to 220°C, or from 205 to 210°C.

[0082] In an embodiment, the solid and dry non-stick material is a polyurethane material and the solid and dry non-stick material has a thermal resistance from 200°C, or 202°C, or 205°C to 210°C, or 215°C, or 220°C. In another embodiment, the solid and dry non-stick material is a polyurethane material and the solid and dry non-stick material has a thermal resistance from 200 to 220°C, or from 205 to 210°C.

3. Common peripheral edge

[0083] FIG. 4 shows the opposing flexible films 22, 24 superimposed on each other. Discrete portions of the non-stick material are distributed to the seal layer of one of the multilayer films to form the pattern. Discrete beads 13 of the non-stick material are disposed between opposing flexible films 22, 24. The superimposed flexible films 22, 24 form a common peripheral edge 26 shown in FIGS. 4, 5, 7-9. The common peripheral edge 26 defines a shape. The shape can be a polygon (such as triangle, square, rectangle,

diamond, pentagon, hexagon, heptagon, octagon, etc.), or an ellipse (such as an ovoid, an oval, or a circle).

[0084] The process includes locating, or otherwise positioning, the pattern of non-stick material along a portion of the common peripheral edge 26, as shown in FIGS. 1-2A.

[0085] In an embodiment, a bottom seal 27 attaches the first flexible film 22 to the second flexible film 24 prior to the locating step, as shown in FIG. 1.

[0086] In an embodiment, a pouch is partially formed prior to the locating step and includes a bottom gusset to form a stand up pouch.

4. Heat sealing procedure

[0087] The pattern 10 of non-stick material is sealed between the opposing flexible films 22, 24 to form a hermetic seal. The seal is formed by way of ultrasonic sealing procedure, heat sealing procedure, and combinations thereof. In an embodiment, the pattern 10 of non-stick material is sealed between the opposing flexible films 22, 24 by way of a heat sealing procedure. The term "heat sealing," as used herein, is the act of placing two or more films of polymeric material between opposing heat seal bars, the heat seal bars moved toward each other, sandwiching the films, to apply heat and pressure to the films such that opposing interior surfaces (seal layers) of the films contact, melt, and form a heat seal, or weld, to attach the films to each other. Heat sealing includes suitable structure and mechanism to move the seal bars toward and away from each other in order to perform the heat sealing procedure.

[0088] In an embodiment, the seal between the pattern 10 of non-stick material and the flexible films 22, 24 occurs at a seal condition. The seal condition is sufficient to form a hermetic seal between the flexible film 22 and the flexible film 24 along the common peripheral edge where the non-stick material is not present. In other words, the hermetic seal between the flexible films 22, 24 is not formed in the areas of flexible films 22, 24 having the non-stick material.

[0089] In an embodiment, the first seal condition includes a heat seal temperature that (1) is less than the melting temperature, T_m , of the non-stick material and (2) is greater

than the heat seal initiation temperature of the ethylene-based polymer in the seal layer for flexible films 22, 24.

5. Flow Channels

[0090] The heat sealing procedure forms a peripheral seal along the common peripheral edge of the opposing multilayer films. The heat sealing procedure forms a peripheral seal 44 which extends along at least a portion of the common peripheral edge 26.

[0091] The process includes forming at least one flow channel extending into, or extending across, the peripheral seal. The flow channel is formed by the pattern of non-stick material and the act of forming the peripheral seal, upon the non-stick material. Where non-stick material is present, the opposing multilayer films are not sealed together. The term, “extending into,” as used herein, indicates that the proximate end of the flow channel is in fluid communication with the compartment of the flexible pouch, and a distal end of the flow channel is embedded in the peripheral seal. Removal of a portion of the peripheral seal (by cutting or release member), exposes the distal end of the flow channel, as will be described below.

[0092] In an embodiment, the process includes forming at least one flow channel extending across the peripheral seal. The term “extending across,” as used herein, indicates that (i) the flow channel extends through the entire, or substantially the entire, width of the peripheral seal in which the flow channel is located and (ii) the flow channel forms an open conduit through the peripheral seal, the conduit uninterrupted by the peripheral seal. The flow channel is formed by the pattern of non-stick material and the act of forming the peripheral seal upon the non-stick material. Where non-stick material is present, the opposing multilayer films are not sealed together.

[0093] FIG. 5 shows peripheral seal 44 and flow channels 30 formed during the heat sealing procedure of opposing flexible films 22, 24. In FIG. 5, the flow channels 30 extend into the peripheral seal 44. The distal ends of the flow channels 30 are embedded in the peripheral seal 44 and the proximate ends of flow channels 30 are in fluid communications with the compartment.

[0094] FIGS. 6-7 show flow channels 30 disposed between flexible films 22, 24. FIG. 6 is an enlarged and partially cut-away view of Area 6 of FIG. 5. Seal sections 35 alternate between flow channels 30. At seal sections 35, the seal layer of film 22 is sealed to the seal layer of film 24.

[0095] FIG. 7 shows that once applied and dried, the non-stick material is a coating 38 adhered to the seal layer of flexible film 24. It is understood that flexible film 22 may also include its own coating of non-stick material in conjunction with coating 38 that is adhered to flexible film 24.

[0096] The coating 38 of non-stick material has a thickness, T , as shown in FIG. 7. In an embodiment, the thickness, T , is from 0.5 microns (μm), or 1 μm , or 2 μm , or 3 μm , or 4 μm to 5 μm , or 6 μm , or 8 μm , or 10 μm , or 15 μm , or 20 μm . In a further embodiment, the thickness, T , is from 0.5 to 20 μm , or from 1 to 10 μm , or from 2 to 5 μm .

[0097] Flow channel 30 includes five elements: (i) film 22; (ii) film 24; (iii) a heat seal portion 39 between films 22, 24; (iv) the coating 38 of non-stick material adhered to film 24; and (v) void volume 12, as shown in FIG. 7. Void volumes 12 are positioned between the sealed film layers 22, 24 where the coating is present. One or more flow channels 30 are disposed between the sealed film layers 22, 24. The void volumes 12 are the result of the non-sealing of films 22, 24 due to the presence of coating 38 of non-stick material. Void volumes 12 (vis-à-vis the coating 38), create the flow channels 30. The number of flow channels 30 may be varied as desired. Each void volume 12 has a cross-sectional shape. Nonlimiting examples of suitable cross-sectional shapes for the void volumes include oval, ovoid, circle, curvilinear, triangle, square, rectangle, and combinations thereof. the coating 38 of non-stick material creates void volumes 12.

[0098] It is desired that the flow channels 30 and/or coating 38 have low shrink and release properties. In addition, it is recognized that a factor in the retention and/or ease of discharge of the liquid product stored in the flexible container is the surface tension between (i) the flow channel 30 surface; (ii) the coating 38 surface; and (iii) the liquid content of the flexible container. Applicant discovered that altering the surface tension, or otherwise optimizing surface tension, for a particular use may improve performance of the

flexible pouch. Nonlimiting examples of suitable methods to alter surface tension include material selection of the seal layer for flexible films 22, 24 and the coating 38; addition of surface coatings to the seal layer for flexible films 22, 24; surface treatment of the seal layer for flexible films 22, 24 (*e.g.*, corona treatment); and addition of additives either to the seal layer for flexible films 22, 24 and/or the coating 38, or to the liquid to be stored in the flexible container.

[0099] The flow channels 30 have a diameter, D , as shown in FIG. 7. The term “diameter,” as used herein is the longest axis of the flow channel 30, from a cross-sectional view. In an embodiment, the diameter, D , is from 300 μm , or 350 μm , or 400 μm , or 500 μm , or 600 μm , or 700 μm , or 800 μm , or 1000 μm to 2000 μm , or 4500 μm , or 6000 μm , or 8000 μm . In a further embodiment, the diameter, D , is from 300 to 8000 μm , or from 500 to 4500 μm , or from 1000 to 2000 μm .

[00100] The flow channels 30 have an alignment with respect to each other. The alignment of the flow channels 30 is selected from parallel and not parallel, (or non-parallel). The term “parallel,” as used herein indicates a line axis extending through a first flow channel does not intersect a line axis extending through a second flow channel.

[00101] In an embodiment, the flow channels 30 are parallel.

[00102] In an embodiment, the flow channels 30 are not parallel, or are non-parallel.

[00103] A spacing, S , of seal sections 35 is present between the flow channels 30. In an embodiment, the spacing, S , is from 1 μm , or 5 μm , or 10 μm , or 25 μm , or 50 μm , or 100 μm , or 150 μm , or 200 μm to 250 μm , or 300 μm , or 350 μm , or 400 μm , or 500 μm , or 1000 μm , or 2000 μm or 3000 μm . In a further embodiment, the spacing, S , is from 1 to 3000 μm , or from 5 to 1000 μm , or from 200 to 500 μm .

[00104] The flow channels 30 have a width, W as shown in FIG. 6. In an embodiment, the width, W , is from 0.2 centimeters (cm), or 0.5 cm, or 0.8 cm to 1 cm, or 1.5 cm, or 2 cm, or 3 cm. In a further embodiment, the width, W , is from 0.2 to 3 cm, or from 0.5 to 2 cm, or from 0.8 cm to 1.5 cm.

[00105] In an embodiment, the process includes exposing the seal layer of the flexible film to a corona discharge. Exposure to the corona discharge produces a corona-treated

seal layer. Exposure to the corona discharge occurs before the non-stick material is distributed on to the seal layer of the flexible film. Not wishing to be bound by theory, the corona-treated seal layer includes enhanced levels of oxidized moieties that facilitate adhesion of the non-stick material to the surface of the corona-treated seal layer.

[00106] The seal layer of the flexible film is exposed to a corona discharge. In an embodiment, the corona discharge has a power level from 30 dyne/cm, or 34 dyne/cm, or 38 dyne/cm to 42 dyne/cm, or 46 dyne/cm, or 50 dyne/cm. In a further embodiment, the corona discharge has a power level from 30 to 50 dyne/cm, or from 34 to 46 dyne/cm, or from 38 to 42 dyne/cm.

[00107] The process includes distributing the liquid composition of non-stick material onto the corona-treated seal layer. Distributing the liquid composition occurs before the heat sealing procedure is applied. Not wishing to be bound by any particular theory, distribution of the liquid non-stick material occurs more evenly upon a corona-treated seal layer when compared to distribution occurring upon a standard (*i.e.*, not corona-treated), seal layer. The distributed pattern of liquid non-stick material tends to remain intact for longer periods of time upon a corona-treated seal layer when compared to a standard (*i.e.*, not corona-treated), seal layer. The pattern can be distributed with a brush and a pattern template. The pattern template includes open spaces having the shape of the desired pattern. The pattern template is placed on the corona-treated seal layer and a brush is used to manually distribute the pattern through the open spaces of the pattern template. In an embodiment, the pattern template is constructed from a flexible film. In a further embodiment, the pattern template is constructed from a biaxially-oriented polyethylene terephthalate, (*e.g.*, MYLAR®).

[00108] In an embodiment, the pattern is distributed with a printing device, as described herein.

[00109] The process includes adhering the non-stick material to the corona-treated seal layer. The adhering occurs before the heat sealing procedure is applied. Adhering the non-stick material includes drying the liquid composition of non-stick material. In an

embodiment, drying the liquid composition includes the use of elevated temperature, forced air, vacuum atmosphere, or a combination thereof.

[00110] The process includes an optional ultraviolet (UV) treatment step. In an embodiment the UV treatment occurs before the seal layer of the flexible film is exposed to a corona discharge. In a further embodiment, the UV treatment occurs at any stage of the process before the heat sealing procedure is applied.

[00111] The process includes crosslinking the non-stick material to the ethylene-based polymer in the seal layer to form the coating of non-stick material adhered to the seal layer. The crosslinking occurs during the drying of the liquid composition of non-stick material. During the drying, molecules of the non-stick material may also crosslink to one another. Not wishing to be bound by any particular theory, the UV treatment can facilitate the amount of crosslinking between molecules of the non-stick material to the ethylene-based polymer in the seal layer and/or to one another.

6. Pouch

[00112] The process includes applying the heat sealing procedure to the common peripheral edge to form a flexible pouch. In an embodiment, the flexible pouch is formed with a heat sealing procedure that includes sealing, or otherwise forming, a peripheral seal 44 along a portion of the peripheral edge 26. The resultant peripheral seal 44 includes at least one flow channel 30 extending across the peripheral seal 44.

[00113] The process includes forming a flexible pouch that includes a compartment. FIGS. 8A-8B and 9A show flexible pouches 2a, 2b each have a respective compartment 52a, 52b. As the first film 22 and the second film 24 are flexible, so too is each pouch 2a, 2b a flexible pouch.

[00114] In an embodiment shown in FIGS. 8A-8B, flexible pouch 2a includes the common peripheral edge 26 which defines a polygon, such as a 4-sided polygon (rectangle, square, diamond). The common peripheral edge 26 includes a first side 32 and a second side 34. In this embodiment, the first side 32 of the 4-sided polygon intersects the second side 34 of the 4-sided polygon, the intersection being corner 36. The peripheral seal 44 of

flexible pouch 2a includes a sealed channel discharge segment 46a. At least one flow channel is disposed in the sealed discharge segment 46a.

[00115] A proximate end of each flow channel of flexible pouch 2a is in fluid communication with the compartment 52a. The flow channel of flexible pouch 2a includes an inlet 62a (at the flow channel proximate end), and a discharge 64a (at the flow channel distal end). The flow channel discharge 64a is located at corner 36. Compartment 52a includes pouch corner 65. Flow channel inlet 62a is adjacent to pouch corner 65.

[00116] In an embodiment shown in FIG. 9A, flexible pouch 2b includes the common peripheral edge 26 which defines a polygon, such as a 4-sided polygon (rectangle, square, diamond). In this embodiment, the first side 32 of the 4-sided polygon is parallel to, and does not intersect, the second side 34 of the 4-sided polygon. The peripheral seal 44 of flexible pouch 2b includes a sealed channel discharge segment 46b. At least one flow channel is disposed in the sealed discharge segment 46b.

[00117] The flow channel of flexible pouch 2b is in fluid communication with the compartment 52b. The flow channel of flexible pouch 2b includes an inlet 62b and a discharge 64b. Compartment 52b includes face edge 68 (proximate end of flow channels). Flow channel inlet 62b is located along, and adjacent to, face edge 68. Flow channel discharge 64b (distal end of flow channels), is located at a third side of the 4-sided polygon. The third side of the 4-sided polygon is parallel to face edge 68. The third side of the 4-sided polygon is perpendicular to one, or both, of the first side 32 of the 4-sided polygon and the second side 34 of the 4-sided polygon.

[00118] Inlet 62b and discharge 64b may or may not extend along the entire length of one side of the polygon. FIG. 9A shows inlet 62b and discharge 64b extending along only a portion of the length of one side of the polygon.

[00119] The process includes filling of the compartment with a liquid 54. The compartment may be filled during a form-fill-seal procedure, for example. In an embodiment, a fill inlet is located on the peripheral edge. The fill inlet is closable and permits filling of the compartment. Alternatively, a portion of the peripheral edge 26 remains unsealed and a fill member adds liquid into the compartment. After the

compartment is filled with liquid, the unsealed portion of the peripheral edge is subsequently sealed to form a sealed and closed flexible pouch.

[00120] The peripheral seal 44 forms a hermetic seal around the periphery of flexible pouch 2a and 2b. Each of flexible pouch 2a and 2b is a sealed and closed flexible pouch. The peripheral seal 44 forms a sealed and closed flexible pouch 2a and/or 2b each pouch having a compartment. In an embodiment, a liquid is present in the compartment. Nonlimiting examples of suitable liquids include fluid comestibles (beverages, condiments, salad dressings, flowable food), liquid or fluid medicaments, aqueous plant nutrition, household and industrial cleaning fluids, disinfectants, moisturizers, lubricants, surface treatment fluids such as wax emulsions, polishers, floor and wood finishes, personal care liquids (oils, creams, lotions, gels) etc.

7. Release member

[00121] In an embodiment, the flexible pouch includes a release member. The release member may or may not include a portion of the flow channel discharge. Removal of the release member from the flexible pouch exposes the distal end of the flow channel.

[00122] The release member is a detachable portion of the flexible pouch. The release member can be completely (or wholly) detached from the flexible pouch. Alternatively, the release member can be partially detached, with a portion of the release member remaining attached to the flexible pouch. The purpose of the release member is two-fold. First, the release member blocks, or otherwise prevents, the flow of liquid from the compartment during storage of the flexible pouch. Second, detachment, or removal, of the release member from the flexible pouch exposes the flow channels 30, and enables dispensing of the liquid in the flexible pouch therefrom.

[00123] Detachment, or removal, of the release member is actuated by way of hand (manually), tool, machine, or combinations thereof. In an embodiment, the release member is detached with a sharp object such as a blade, a knife, or a scissors. 8B and 9A show the detachment of release member 56a, 56b from respective flexible pouches 2a, 2b by a person cutting a respective portion of the sealed channel discharge segment 46a, 46b with scissors 58.

[00124] In an embodiment, the release member is detached manually (by hand).

[00125] As shown in FIG. 8C, detachment of the release member 56a removes a portion of the sealed channel discharge segment 46a and exposes the flow channels 30 to the external environment. Once a portion of the sealed channel discharge segment 46a, is removed from the pouch 2a, the exposed flow channels 30 place the interior of compartment 52a in fluid communication with exterior of the flexible pouch 2a. Detachment of the release member 56b (FIG. 9A) from the flexible pouch 2b removes a portion of the sealed channel discharge segment 46b to expose flow channels 30 in a similar manner.

[00126] The process includes squeezing the compartment. In an embodiment, a flow of liquid begins when a squeezing force (or a compression force) is imparted upon the compartment of the flexible pouch. The flow of liquid passes through the exposed flow channels 30 and passes out of the flexible pouch.

[00127] The process includes dispensing the liquid from the compartment through at least one flow channel. In an embodiment, a person's hand imparts a squeezing force upon the compartment 52a as shown in FIG. 8C. The squeezing force dispenses the liquid 54 through the flow channels 30 and out of pouch 2a.

[00128] In an embodiment, a squeezing force imparted with a person's hand on the compartment 52a dispenses a spray pattern 60a of the liquid 54a from the flexible pouch 2a as shown in FIG. 8C. The spray pattern 60a can be advantageously controlled by adjusting the amount of squeeze force imparted upon the compartment 52a. In this way, the flexible pouch 2a surprisingly delivers a controlled spray pattern of liquid without the need for a rigid spray component. The profile of spray 60a can be designed by the configuration of the line pattern 10 and the flow channels 30. Flow channels 30 with a relatively smaller diameter D, shown in FIG. 7, will dispense a fine spray of the liquid when compared to flow channels 30 with a relatively larger diameter D. FIG. 8C shows the dispensing of a low viscosity liquid 56a, (such as a water-based beverage), as a fine and controlled spray 60a and received in a container 61 (such as a cup).

[00129] FIG. 8D shows the liquid 54a within at least a portion of the void volumes 12. FIG. 8D shows a spray pattern 60a of the liquid 54a dispensing from the flexible pouch through flow channels 30. The coating 38 of non-stick material, located under liquid 54a and spray pattern 60a, is adhered to film 24 and of the flow channels 30.

[00130] In an embodiment, detachment of the release member 56b (Figure 9A) from the flexible pouch 2b removes a portion of the sealed channel discharge segment 46b to expose flow channels 30 in a similar manner.

8. Edge offset distance

[00131] The present disclosure provides another flexible pouch. In an embodiment, a flexible pouch is provided and includes opposing flexible multilayer films. Each opposing flexible multilayer film comprising a seal layer. The opposing flexible films define a common peripheral edge. A peripheral seal extends along at least a portion of the common peripheral edge. At least one flow channel extends across the peripheral seal. The channel including a coating composed of a non-stick material. The coating is adhered to at least one of the seal layers.

[00132] In an embodiment, the peripheral seal includes a flow channel discharge.

[00133] Flexible pouch 102 (FIGS. 8E-8F) and flexible pouch 202 (FIGS. 9B-9C) each include flow channels 130 and a flow channel discharge located at an edge offset distance. The edge offset distance, or EOD, is a length from the peripheral edge to an interior portion of the flexible films.

[00134] The flow channels 130 have an alignment with respect to each other. The alignment of the flow channels 130 is selected from parallel and not parallel, (or non-parallel).

[00135] In an embodiment, the flow channels 130 are parallel.

[00136] In an embodiment, the flow channels 130 are not parallel, or are non-parallel.

[00137] FIGS. 8E-8F show the opposing flexible films 122, 124 define a common peripheral edge 126 as previously disclosed herein. A flow channel discharge 164a is located at an edge offset distance, EOD, between opposing flexible films 122, 124. The distance from the corner 136 to an outer edge of the flow channel discharge 164a is the

edge offset distance shown as length EOD. The EOD is perpendicular to the flow channel discharge 164a.

[00138] In an embodiment, the EOD is from 1 millimeter (mm), or 1.5 mm, or 2 mm, or 2.5 mm, or 3 mm, or 3.5 mm to 4 mm, or 4.5 mm, or 5 mm, or 6 mm, or 7 mm, or 9 mm, or 10 mm, or 15 mm, or 20 mm, or 40 mm, or 60 mm, or 80 mm, or 90 mm, or 100 mm. In an embodiment, the EOD is from 1 to 100 mm, or from 2 to 80 mm, or from 3 to 20 mm.

[00139] The common peripheral edge 126 defines a 4-sided polygon (rectangle, square, diamond). In an embodiment, a first side 132 of the 4-sided polygon intersects a second side 134, the intersection being corner 136.

[00140] The flow channel discharge 164a, located at the edge offset distance, forms a compartment 152 and a corner pocket 153 shown in FIG. 8E. The flow channels 130 and the flow channel discharge 164a separate the compartment 152 from the corner pocket 153. A peripheral seal 144 forms a closed and sealed flexible pouch 102. The peripheral seal 144 includes at least one flow channel 130.

[00141] The corner pocket 153 functions as the release member for the pouch 102. Hence, the corner pocket 153 is a detachable portion of the flexible pouch 102. The corner pocket 153 has the same two-fold purpose as previously discussed for the release member. Since the corner pocket 153 is the result of the edge offset distance between the flow channel discharge 164a and the peripheral edge 126, the corner pocket 153 may or may not include a portion of the flow channel discharge 164a.

[00142] In an embodiment, the corner pocket 153 includes a portion of the peripheral seal 144 but does not include a portion of the flow channel discharge 164a.

[00143] In an embodiment, the pocket 153 includes cut-outs (or notches) 155 in the peripheral seal 144. Cut-outs 155 enable ready removal of the corner pocket 153. In this way, corner pocket 153 enables, or otherwise promotes, tearing, by hand, the corner pocket 153 from the flexible pouch 102. It is understood corner pocket 153 also may be removed by cutting with a blade or scissors, for example.

[00144] FIGS. 9B-9C show flexible pouch 202 includes first flexible film 222 and second flexible film 224. The flexible films 222, 224 define a common peripheral edge 226 as

previously disclosed herein. A flow channel discharge 264a is located at an edge offset distance, EOD, between opposing flexible films 222, 224.

[00145] The common peripheral edge 226 defines a 4-sided polygon (rectangle, square, diamond), as shown in FIGS. 9B-9C. In an embodiment, the first end 228 of the flow channel discharge 264a is located at a first side 230 of the 4-sided polygon. The second end 232 of the flow channel discharge 264a is located at a second side 238 of the 4-sided polygon. The second side 238 of the 4-sided polygon is parallel to, and does not intersect the first side 230 of the 4-sided polygon.

[00146] The flow channel discharge 264a has an outer edge 240. The distance from the common peripheral edge 226, to the outer edge of 240 is the edge offset distance, shown as distance EOD.

[00147] In an embodiment, the EOD is from 1 millimeter (mm), or 1.5 mm, or 2 mm, or 2.5 mm, or 3 mm, or 3.5 mm to 4 mm, or 4.5 mm, or 5 mm, or 6 mm, or 7 mm, or 9 mm, or 10 mm, or 15 mm, or 20 mm, or 40 mm, or 60 mm, or 80 mm, or 90 mm, or 100 mm. In an embodiment, the EOD is from 1 to 100 mm, or from 2 to 80 mm, or from 3 to 20 mm.

[00148] The flow channel discharge 264a, located at the edge offset distance, EOD, forms a compartment 252 and a long pocket 253. The flow channel discharge 264a separates the compartment 252 from the long pocket 253. A peripheral seal 244 forms a closed and sealed flexible pouch 202. The peripheral seal 244 includes at least one flow channel 130.

[00149] The long pocket 253 functions as the release member for the pouch 202. Hence, the pocket 253 is a detachable portion of the flexible pouch 202. The long pocket 253 has the same two-fold purpose as previously discussed for the release member. Since the long pocket 253 is the result of the edge offset distance between the flow channel discharge 264a and the peripheral edge 226, the long pocket 253 may or may not include a portion of the flow channel discharge 264a.

[00150] In an embodiment, the long pocket 253 includes a portion of the peripheral seal 244, but does not include a portion of the flow channel discharge 264a.

[00151] In an embodiment, the long pocket 253 includes cut-outs (or notches) 255 in the peripheral seal 244. Cut-outs 255 enable ready removal of the long pocket 253. In this way, long pocket 253 enables, or otherwise promotes, tearing, by hand, the long pocket 253 from the flexible pouch 202.

[00152] In an embodiment, any of the foregoing flexible pouches may include a closure. The closure covers the exposed channels after the release member is removed or the outer edge of the flow channel discharge is otherwise exposed to the external environment. Nonlimiting examples of suitable closures for the present flexible pouch include a Ziploc-type closure, hook and loop material (i.e., Velcro), an adhesive strip (such as packaging tape, for example), and flexible material hingedly attached to the flexible pouch for placement over the exposed channels. The release member may also be configured to include a closure.

[00153] Any of the foregoing flexible pouches provided herein have a compartment volume. In an embodiment, the compartment volume is from 1 milliliter (mL), or 10 mL, or 100 mL, or 500 mL to 1 liter (L), or 10 L, or 100 L, or 1000 L. In a further embodiment, the compartment volume is from 1 mL to 1000 L, or from 10 mL to 100 L, or from 100 mL to 1 L.

[00154] By way of example, and not limitation, examples of the present disclosure are provided.

EXAMPLES

[00155] The non-stick reagent starting materials used to formulate the liquid compositions of the non-stick materials are provided in Table 1 below.

Table 1

Reagents for Liquid Composition A					
Trade Name	Description	Density (g/cc)	Viscosity (mPa·s)		Supplier
Opulux HGT 2021	Components	1.03	200	Wt %	Dow Inc.
	Triisopropylanolamine			20.3	
	Toluene diisocyanate			17.8	
	polyether diol with average mol. wt. of 425			13.9	
	polyether polyol of propylene glycol with average mol. wt. of 1000			21.4	
	ethyl acetate			26.6	
	Total composition			100.0	
Opulux HGT 2020	Components	1.03	3000	Wt %	Dow Inc.
	Trimethylolpropane			11.5	
	Toluene diisocyanate			43.6	
	Synaceti 125 wax			1.2	
	Refined corn oil			1.2	
	Cyclohexane			18.4	
	Ethyl acetate			24.0	
	Benzoyl chloride			0.1	
	Total composition			100.0	
Reagents for Liquid Composition B					
Trade Name	Description	Density (g/cc)	Viscosity (mPa·s)	Wt %	Supplier
SYL-OFF 7046	Vinyl Siloxane polymer in hexane	0.78 neat	7000 neat	30	Dow Inc.
SYL-OFF 7016	Polysiloxane crosslinking agent	0.99	17	100	Dow Inc.

[00156] Liquid composition A is prepared by combining 23.5 grams (g) Opulux HGT 2020, 23.5 g Opulux HGT 2021 and 53 g ethyl acetate and stirring for two minutes to homogenize the composition. The solids content of liquid composition A is 30 weight percent. Liquid composition B is prepared by combining 50 g SYL-OFF 7046 and 50 g SYL-OFF 7016 at room temperature and stirring for two minutes to homogenize the composition. The solids content of liquid composition B is less than 65 weight percent.

[00157] The structures of the multilayer flexible films used to produce the flexible pouches are provided in Table 2 below. The multilayer flexible films are produced with a 5 Layer Collin Coex Blown Film Line. The film thickness is 100 μm .

Table 2

Trade Name	Composition		Density (g/cm ³)	Melt Index (g/10 min)	Tm (°C)	Thickness (μm)
Dowlex™ TG 2085B	LLDPE (Z-N HEC*)	Outer Layer	0.919	0.95	121	20
Dowlex™ 2050B	LLDPE (Z-N HEC*)	Tie Layer	0.950	0.95	128	60
AFFINITY 1888G	Ethylene/octene copolymer; 3000 ppm antiblock, 1500 ppm slip	Seal Layer	0.904	1.0	110	20
						Total: 100
* Ziegler-Natta High Efficiency catalyst						

[00158] The multilayer flexible film is exposed to corona treatment at 38 dyne/cm to oxidize the seal layer of the multilayer flexible film. The corona treatment is a flash treatment that occurs for less than 1 second. A pattern template constructed from MYLAR® sheet is placed on the corona-treated film.

[00159] Two pouches are formed. Pouch A is produced using liquid composition A. Pouch B is produced using liquid composition B. A brush is used to distribute the liquid composition (either liquid composition A or liquid composition B), onto the corona-treated seal layer through the open spaces of the pattern template. For each of Pouch A and Pouch B the liquid composition is distributed on to the corona-treated seal layer at a coat weight of 0.5 g/m².

[00160] For each of Pouch A and Pouch B the liquid composition of non-stick material is dried at a temperature from 60°C to 90°C to create the pattern of non-stick material, as shown in FIGS. 1, 2A-2B. For each of Pouch A and Pouch B the thickness of the dried non-stick material is 10 microns. When liquid composition A is used to form Pouch A, the isocyanate index of the dried non-stick material is 1.4:1.

[00161] For each of Pouch A and Pouch B the corona-treated film having the pattern of non-stick material on the seal layer is arranged with a second multilayer flexible film to form a common peripheral edge. The seal layers of the two films face each other, as shown in FIG. 4. A portion of the common peripheral edge of the arranged film is placed in a Brugger HSG-C heat sealer equipped with a Teflon coated heat seal bar measuring 6 mm by 150 mm

and heat sealed for one second at 120°C with 900 Newton (N) force corresponding to a pressure of 100 N/cm². The heat sealing process results in complete fusion of the portion of the films' peripheral edge placed in the heat sealer and forms a partial pouch A and a partial Pouch B. Through a non-sealed portion of partial pouch A and a non-sealed portion of partial Pouch B, tap water is added to fill 75% of the volume of the partial pouches. The partial pouches are closed by heat sealing the films' peripheral edge in the same Brugger HSG-C heat sealer equipped with a Teflon coated heat seal bar measuring 6 mm by 150 mm at 130°C and 900 N of seal force corresponding to a pressure of 100 N/cm². The second heat sealing process results in complete fusion of the films' peripheral edge to form a pouch 2a, as shown in FIGS. 5, 8A-8C. The pouch 2a has a square shape with each of the four sides of the pouch having a side length of 10 cm. The volume of the pouch 2a is 150 milliliters. The width W of the flow channels 30 is 3 centimeters (cm), as shown in FIGS. 5, 6. The diameter D of the flow channels 30 is 0.45 cm, as shown in FIG. 7.

[00162] The release member at the corner of the pouch 2a is removed using a scissors, thereby exposing the flow channels 30. The pouch 2a is gently squeezed by hand and a spray pattern 60a of the tap water is discharged from the pouch 2a, as shown in FIGS. 8C-8D.

[00163] It is specifically intended that the present disclosure not be limited to the embodiments and illustrations contained herein, but include modified forms of those embodiments including portions of the embodiments and combinations of elements of different embodiments as come within the scope of the following claims.

CLAIMS

1. A process comprising:
 - providing opposing multilayer flexible films defining a common peripheral edge;
 - providing a pattern to a seal layer of one of the flexible multilayer films, the pattern composed of a non-stick material adhered to the seal layer, the pattern located along a portion of the common peripheral edge;
 - applying a heat sealing procedure to the common peripheral edge and the pattern to form a peripheral seal; and
 - forming, with the pattern of non-stick material, at least one flow channel extending across the peripheral seal.
2. The process of claim 1 wherein the seal layer is composed of an ethylene-based polymer, the process comprising
 - before the applying, exposing the seal layer to a corona discharge to form a corona-treated seal layer;
 - distributing the non-stick material onto the corona-treated seal layer, the non-stick material is a liquid composition; and
 - adhering the non-stick material to the corona-treated seal layer.
3. The process of claim 2 comprising
 - drying the liquid composition; and
 - crosslinking the non-stick material to the ethylene-based polymer in the seal layer.
4. The process of claim 1 comprising
 - applying the heat sealing procedure to the common peripheral edge to form a pouch having a compartment; and
 - providing a liquid in the compartment.
5. The process of claim 4 comprising
 - squeezing the compartment; and
 - dispensing the liquid from the compartment through the at least one flow channel.

6. A flexible pouch comprising:
 - opposing flexible multilayer films, each multilayer film comprising a seal layer, the opposing flexible multilayer films defining a common peripheral edge;
 - a peripheral seal along at least a portion of the common peripheral edge; and
 - at least one flow channel extending across the peripheral seal, the channel comprising a coating composed of a non-stick material, the coating adhered to at least one of the seal layers.
7. The flexible pouch of claim 6 wherein the non-stick material is selected from the group consisting of a polyurethane material, a silicon-based material, an acrylic material, a nitrocellulose material, and a combination thereof.
8. The flexible pouch of any of claims 6-7 wherein
 - the coating has a thickness from 0.5 microns to 10 microns, and
 - the non-stick material is the polyurethane material.
9. The flexible pouch of any of claims 6-7 wherein
 - the coating has a thickness from 0.5 microns to 10 microns, and
 - the non-stick material is the silicon-based material.
10. The flexible pouch of any of claims 6-9, wherein
 - the common peripheral edge defines a 4-sided polygon;
 - the pouch has a compartment and the at least one flow channel has an inlet and a discharge, the flow channel in fluid communication with the compartment.
11. The flexible pouch of claim 10, wherein
 - the compartment has a corner, the flow channel located at the corner; and
 - the pouch comprises a release member, the release member exposing the flow channel discharge when the release member is removed from the flexible pouch.
12. The flexible pouch of claim 11, wherein the flow channel discharge is located at an edge offset distance from a corner of the 4-sided polygon.

13. The flexible pouch of claim 10, wherein
the compartment has a face edge, the flow channel inlet located along the face edge;
the flow channel discharge is located at a side of the 4-sided polygon that is parallel to the face edge; and
the pouch comprises a release member, the release member exposing the flow channel discharge when the release member is removed from the flexible pouch.
14. The flexible pouch of claim 13, wherein the flow channel discharge is located at an edge offset distance from the side of the 4-sided polygon.
15. The flexible pouch of any of claims 8-14, comprising at least two flow channels, the flow channels having an alignment with respect to each other, the alignment is selected from the group consisting of parallel and not parallel.

FIG. 1

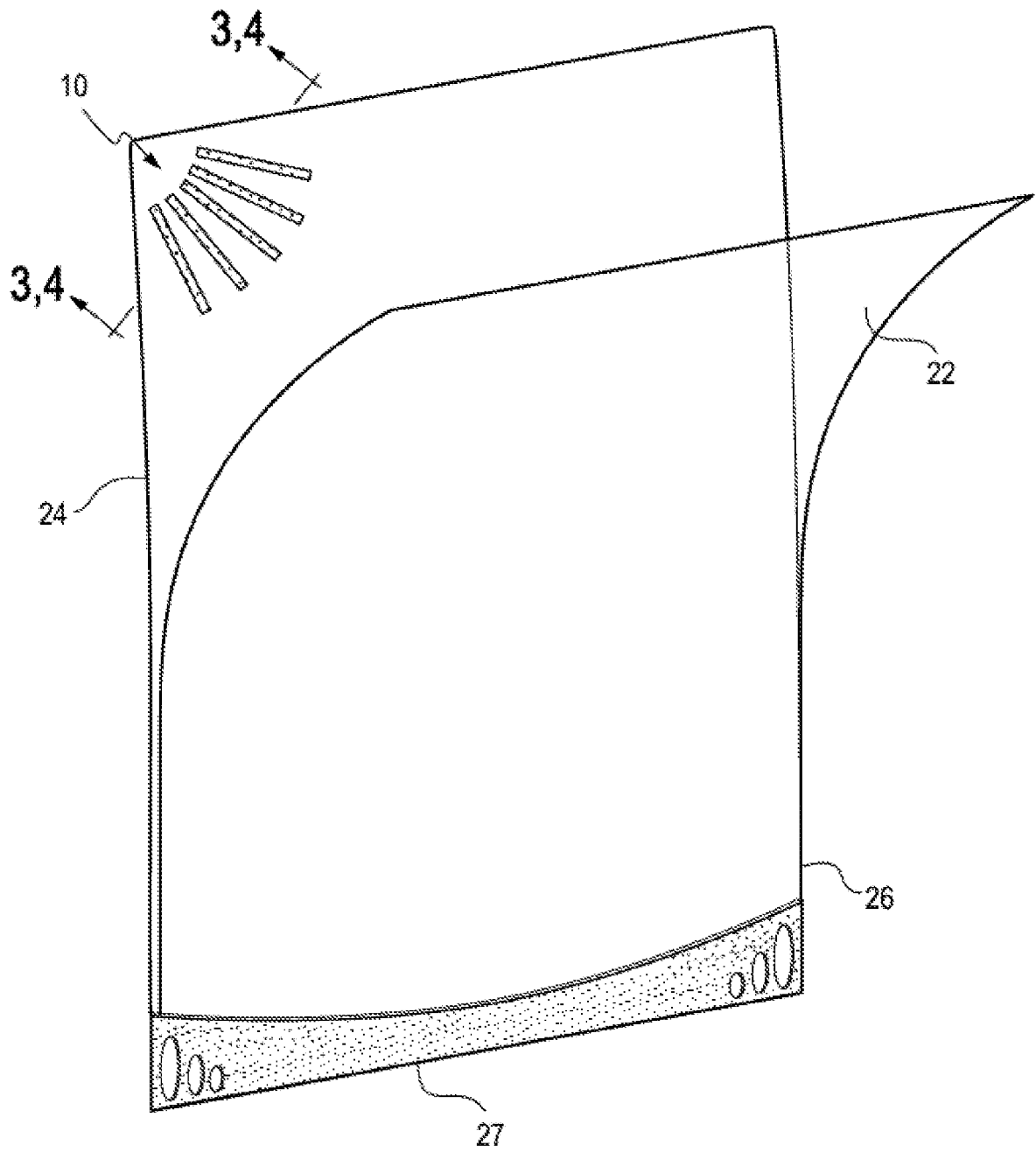


FIG. 2A

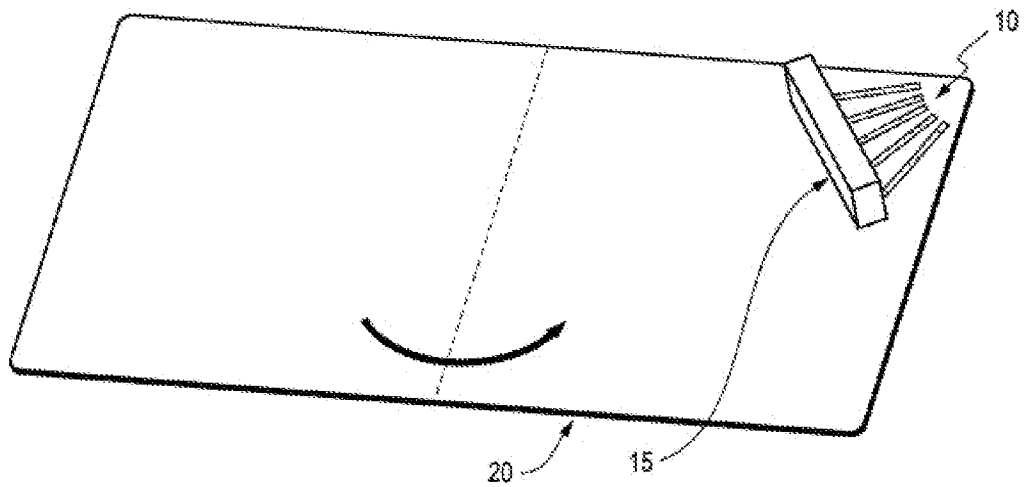
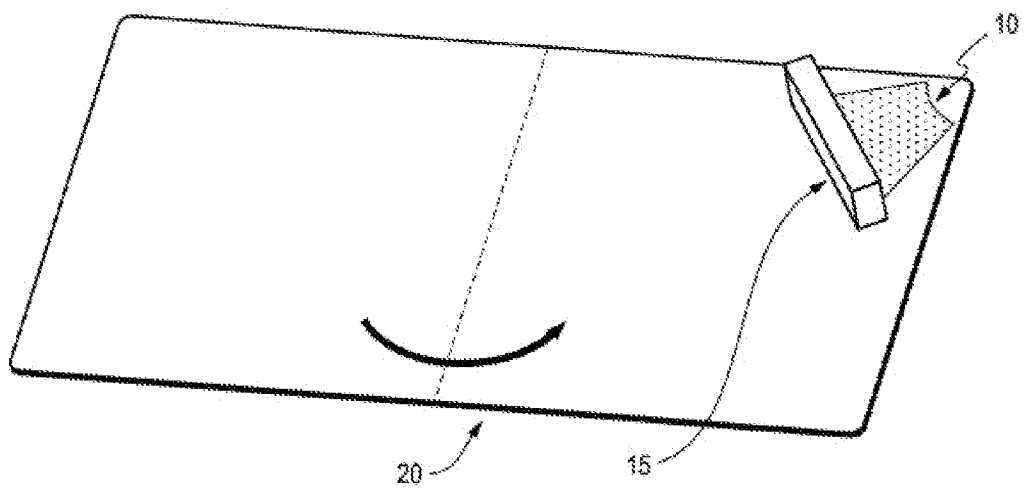


FIG. 2B



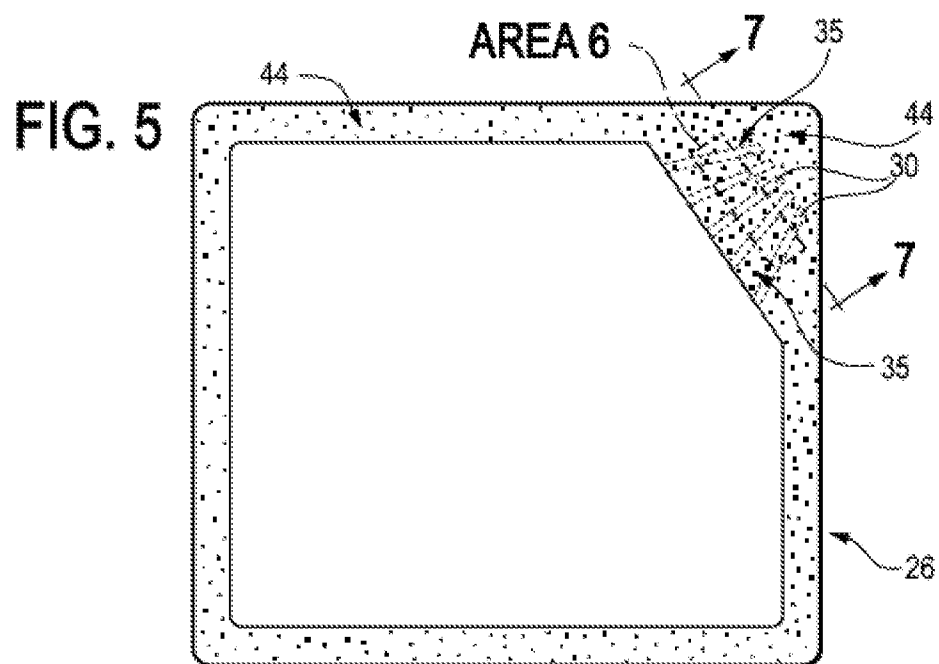
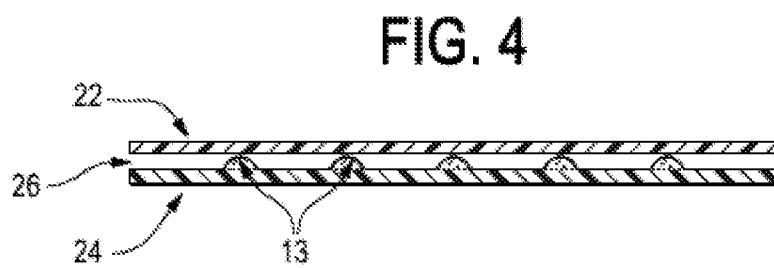
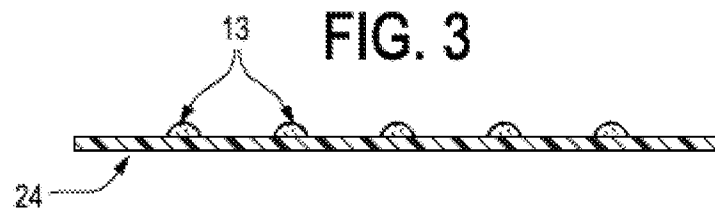


FIG. 6

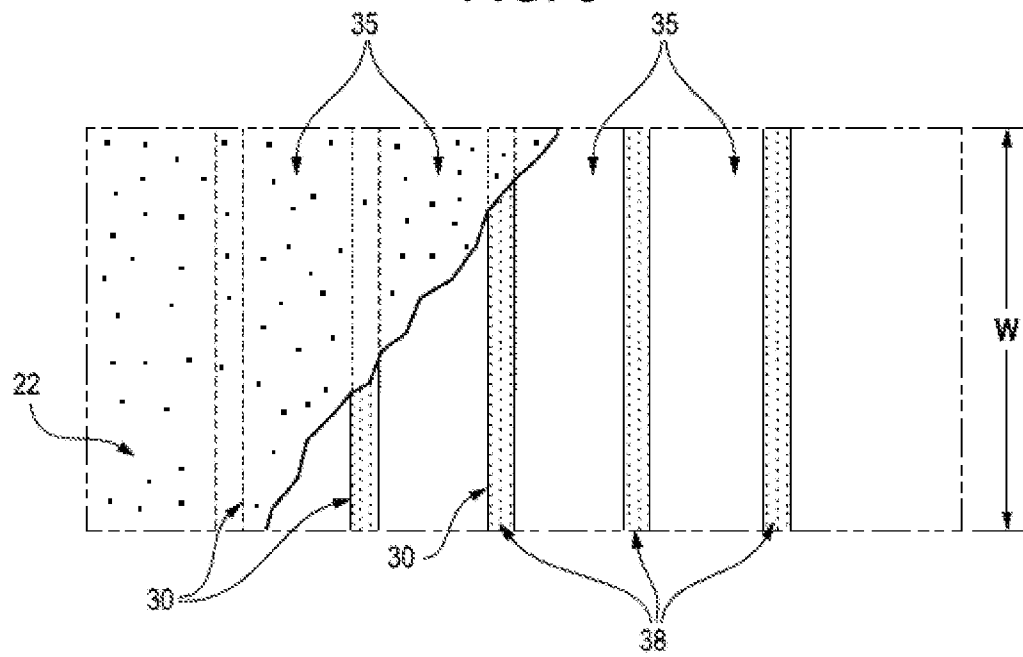


FIG. 7

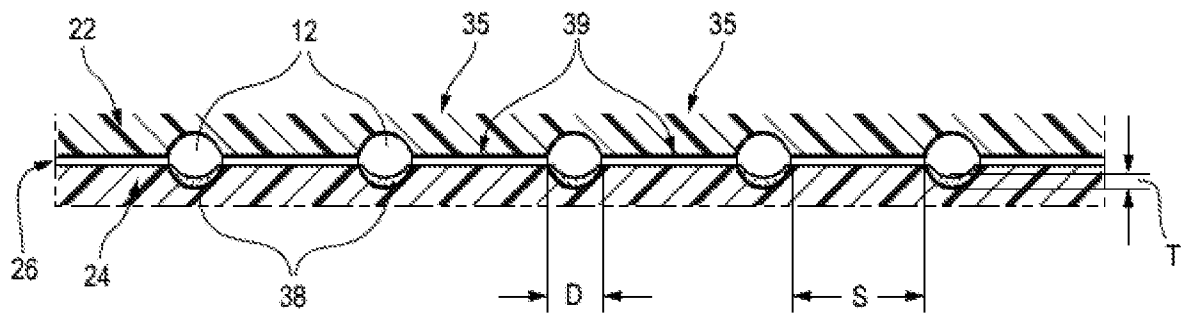


FIG. 8A 5/9

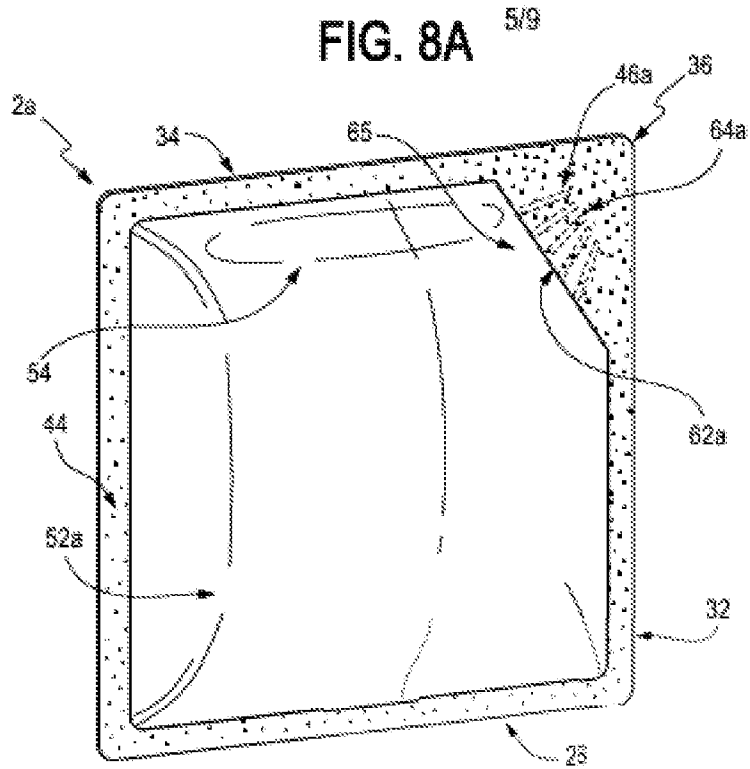


FIG. 8B

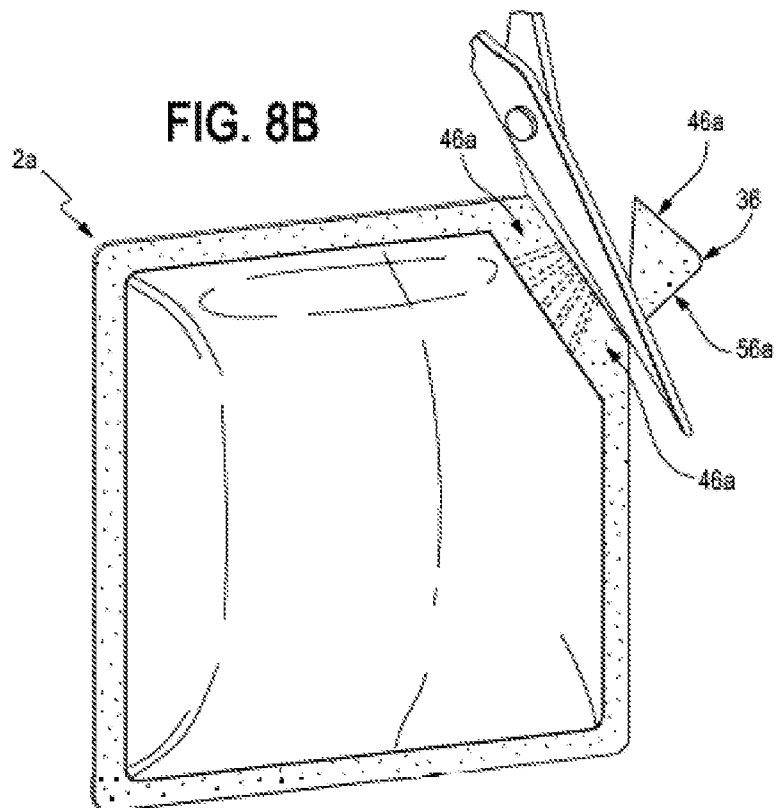


Fig. 8C

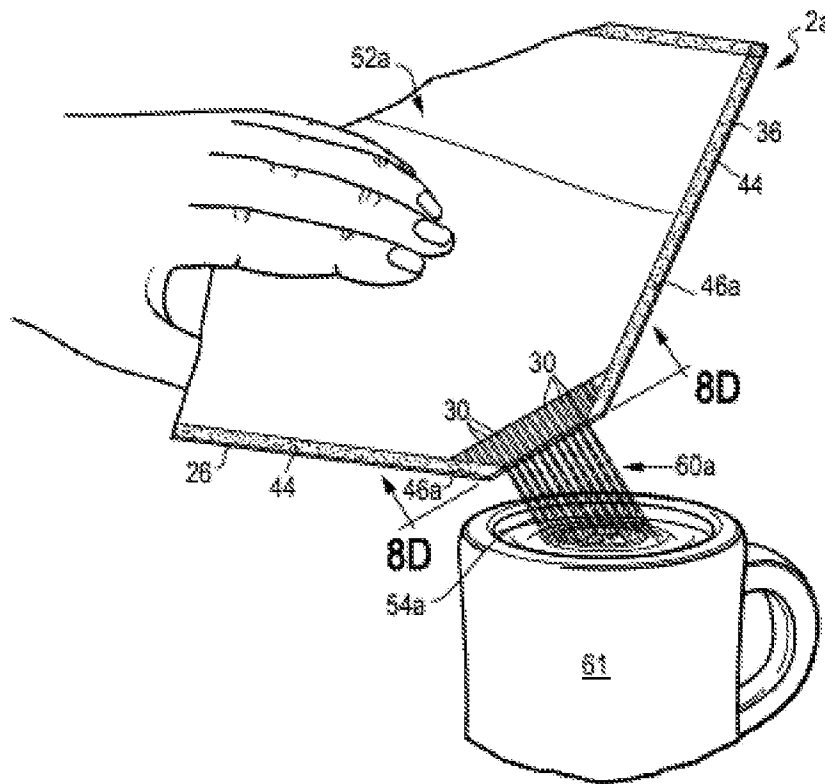
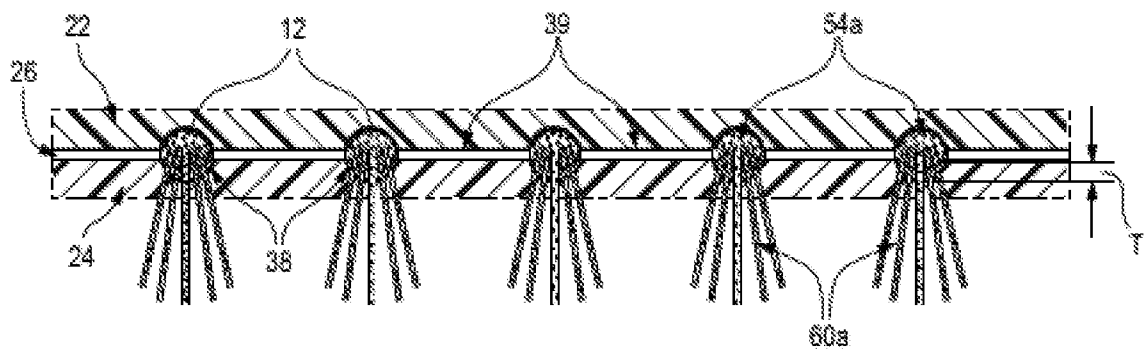


FIG. 8D



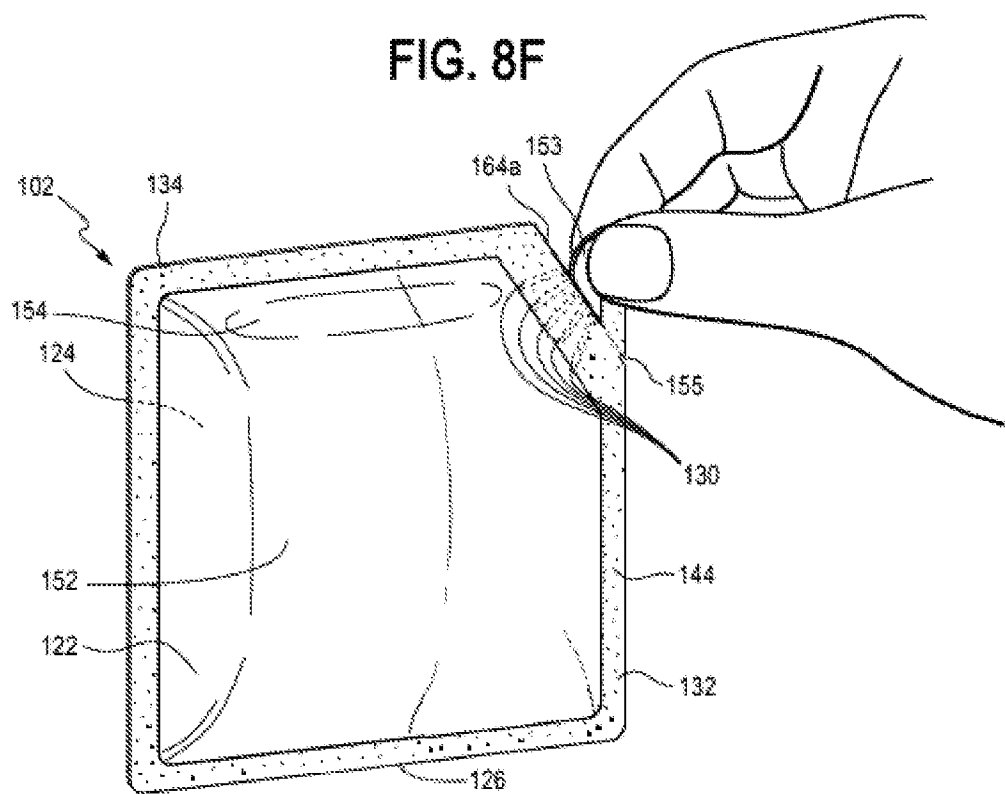
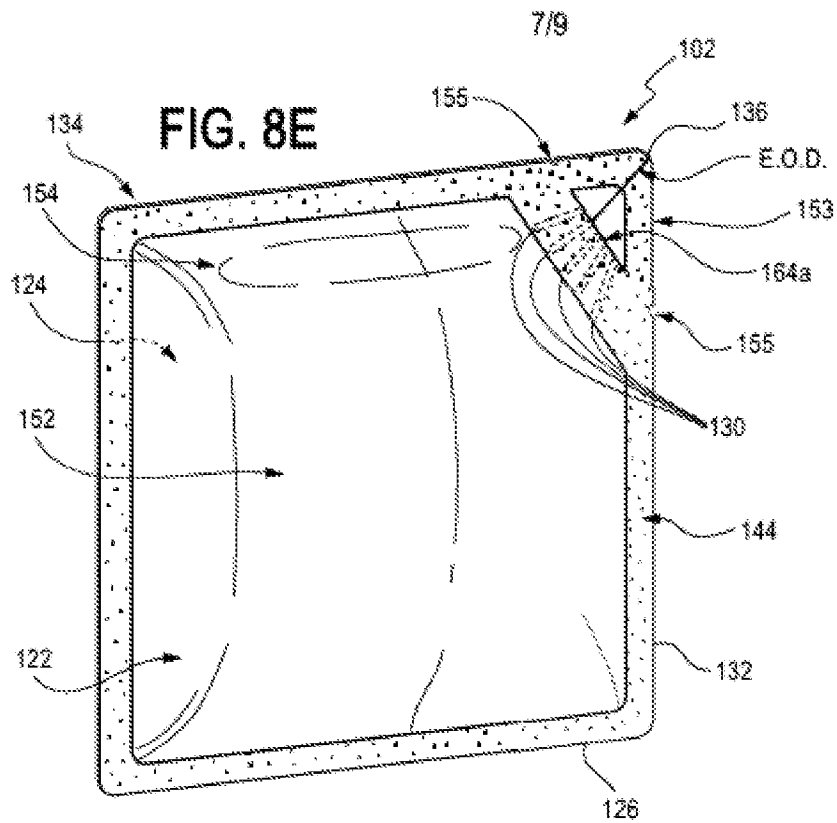


FIG. 9A

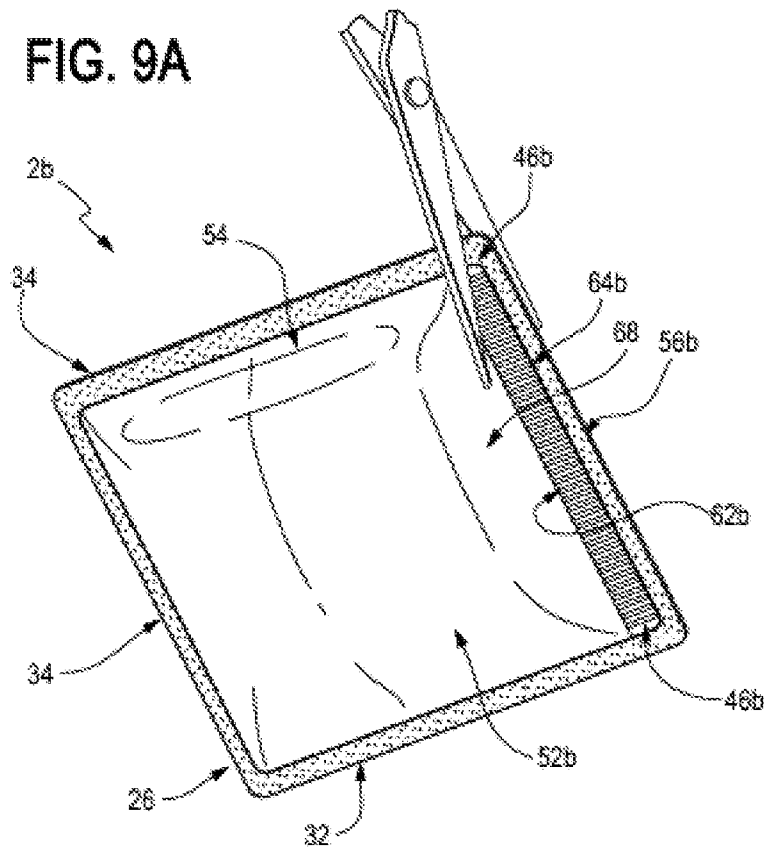


FIG. 9B

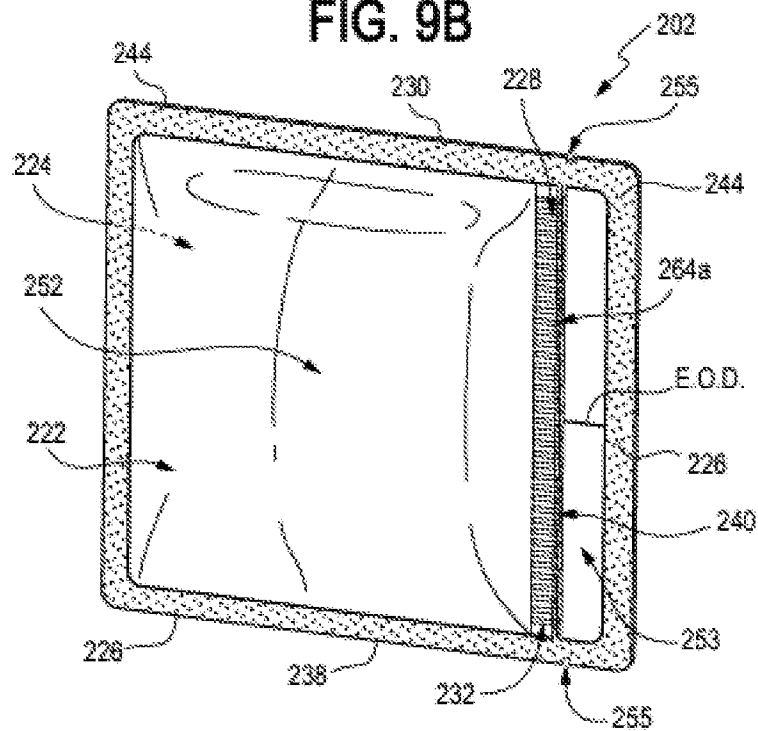
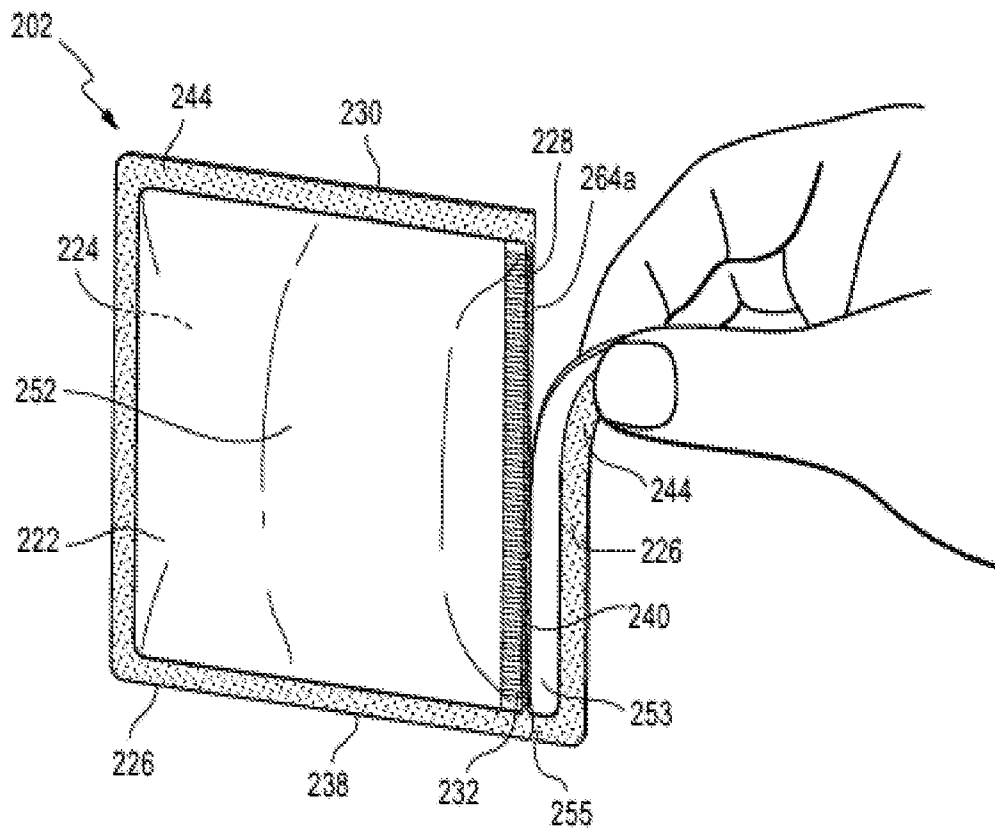


FIG. 9C



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2020/032802

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D75/58
ADD.

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

B. FIELDS SEARCHED

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

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	CA 3 029 439 A1 (DOW GLOBAL TECHNOLOGIES LLC [US]) 4 January 2018 (2018-01-04) paragraph [00007]; figures 1-19 -----	1-15
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Further documents are listed in the continuation of Box C.



See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

19 August 2020

Date of mailing of the international search report

04/09/2020

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Dominois, Hugo

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2020/032802

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