



**WO 2011/084492 A1**



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SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, **Published:**  
GW, ML, MR, NE, SN, TD, TG).

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

**TITLE: TRASH BAG WITH MALODOR CONTROL**

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**CROSS REFERENCE TO RELATED APPLICATIONS**

[0001] This application claims the benefit of U.S. Provisional Application No. 61/292,347, filed January 5, 2010, which is hereby incorporated by reference in its entirety.

**FIELD OF THE INVENTION**

[0002] The present invention relates generally to trash bags, and particularly to trash bags with malodor control features, and more particularly to draw tape trash bags with malodor control features.

**BACKGROUND OF THE INVENTION**

[0003] Plastic trash bags have long been used to line trash receptacles. The trash bags encourage sanitary conditions by preventing the refuse from contacting the receptacle. Trash bags also provide a convenient way to remove trash from a receptacle for transport or disposal. Because trash often contains food scraps and other malodor producing items, attempts have been made to produce fragranced trash bags to hide the malodors produced by the bag contents. It is easy to apply volatile fragrance components directly to malodors in the air, for example with the active immediate use of a spray or aerosol air freshening composition. It is much more difficult to control malodors using passive diffusion from plastic trash bags. One of the difficulties is that many fragrance and malodor control agents are not soluble in the typical polyethylene composition of plastic trash bags. Another difficulty is that much of the fragrance and malodor control agents that can be volatilized at ambient temperatures to control malodor formed by trash are substantially volatilized during the trash bag production process, which involves high temperature melt extrusion of

polyethylene or other plastics. This volatilization during the production process causes environmental issues within the manufacturing plant, wastes valuable volatile fragrance and odor control agents, and changes the notes of the fragrance and odor control agents as the components are differentially volatilized. These difficulties are particularly apparent in the production of draw tape trash bags, where the bags are large, the production process is complex, and the bags are used in an open configuration.

#### BRIEF SUMMARY OF THE INVENTION

[0004] In one embodiment, the bag may further comprise a front wall, a back wall, and a hem, the hem defining the rim. The hem may further define a passageway, which is at least partially enclosed. The hem may include a first opening and a second opening. The bag may comprise a draw tape, which is disposed within the passageway. The draw tape may be accessible via the first and second openings in the hem. The hem, the hem passageway, and the draw tape may comprise a hem area. The hem may include a fragrance, a malodor control agent and a fragrance release inhibitor. If the first and second hem openings are small relative to the total hem area, then any fragrance released in the interior of the hem may be trapped and effectively build up in concentration within the hem interior. This may also be the case if the film layer on the hem exterior has a composition such that it is a barrier to fragrance transmission.

[0005] In another embodiment, the bag may comprise a bag body including a first portion. The first portion may include an upper rim, which defines a mouth. The bag may further comprise a second portion disposed below the first portion, the second portion defining a closed bottom to the bag. The bag body may be thicker in the first portion than in the second portion.

[0006] In another embodiment, the bag may comprise a bag body, the bag body having an inside surface and an outside surface. The bag may comprise a rim, which defines a mouth. The bag may further comprise a hem that defines the rim. The hem area may define a passageway, the passageway being at least partially enclosed. The hem area may further include an inside surface, an outside surface, a first opening,

and a second opening. The bag may also comprise a draw tape disposed within the passageway. The draw tape may be accessible via the first and second openings in the hem. The draw tape may contain a fragrance, a malodor control agent, and a fragrance release inhibitor.

[0007] When the hem has a length shorter than the length of the bottom of the bag, the hem may fit snugly at the top of the trash can or may limit the volume of air circulating into and out of the trash bag and effectively control malodors inside the bag from being offensive at the bag opening. When the hem is patterned, the interior of the hem may contain restricted areas for the build-up of fragrance concentration. This may also help to effectively control malodors inside the bag from being offensive at the bag opening.

[0008] In another embodiment, the bag may comprise a bag body having an inside surface and an outside surface. The bag may comprise an undulating rim, the rim defining a mouth. The rim may include at least two flaps, wherein the flaps may be tied together to at least partially close the bag.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0009] FIG. 1 is a cross sectional view of a film of an embodiment of the invention.

[0010] FIG. 2 is a cross sectional view of a film of an embodiment of the invention.

[0011] FIG. 3 is a cross sectional view of a film of an embodiment of the invention.

[0012] FIG. 4 is a perspective view of a draw tape bag of the invention.

[0013] FIG. 5 is a cross sectional view taken along line 44-44 of the bag of FIG. 4.

[0014] FIG. 6 is a perspective view of the bag of FIG. 4 wherein the draw tapes have been drawn to close the bag.

[0015] FIG. 7 is a perspective view of the bag of FIG. 4 inserted into a trash receptacle.

[0016] FIG. 8 is a partial front view of a bag of the invention.

- [0017] FIG. 9A is a cross sectional view of a bag of the invention.
- [0018] FIG. 9B is a cross sectional view of a bag of the invention.
- [0019] FIG. 9C is a cross sectional view of a bag of the invention.
- [0020] FIG. 10 is a perspective view of a bag of the invention.
- [0021] FIG. 11A is a cross sectional view of a bag of the invention.
- [0022] FIG. 11B is a cross sectional view of a bag of the invention.
- [0023] FIG. 12 is a cross sectional view of a bag of the invention.
- [0024] FIG. 13 is a perspective view of a bag of the invention.
- [0025] FIG. 14 is a perspective view of a bag of the invention.
- [0026] FIG. 15 is a front view of a bag of the invention.
- [0027] FIG. 16 is a process of the invention.
- [0028] FIG. 17 is a process of the invention.
- [0029] FIG. 18 is a process of the invention.
- [0030] FIG. 19 is a front view of a bag of the invention.
- [0031] FIG. 20 is a process of the invention.

#### DETAILED DESCRIPTION OF THE INVENTION

[0032] These films can be made by a conventional flat or tubular cast extrusion or coextrusion, or other suitable process such as a blown film process to produce monolayer, bilayer, trilayer or multilayer films. If desired for a given end use, these films can be oriented by tenterframe, or other suitable process. They can thereafter optionally be annealed. The films of the present invention are typically produced by the blown film or cast film process. The blown or cast film is formed by extrusion. For the blown film process, the film can be collapsed to double the plies of the film or the film can be cut and folded or cut and unfolded. The extruder is a conventional one using a die, which will provide the desired gauge. Some useful extruders are described in U.S. Pat. Nos. 4,814,135; 4,857,600; 5,076,988; 5,153,382; each of which are incorporated herein by reference. The gauge of the films of interest here can be in the range of about 0.1 to about 10 mils, suitably from about 0.2 to about 4 mils, and suitably in the range of about 0.3 to about 2 mils. Examples of various extruders, which can be used in producing the film of the present invention, are the

single screw type modified with a blown film die and air ring and continuous take off equipment.

**[0033]** Using a blown film extrusion or co-extrusion process, the fragrance, malodor control agents, or combination can be either dispersed in equivalent concentration throughout the bag or can be concentrated in one area of the bag or in one or more layers of the bag. A suitable method of concentrating the fragrance or malodor control agents within a specific area of the bag can involve localized delivery of the fragrance, malodor control agent, or the combination to one area of one or more layers of the film through individual extruders and the same die or by producing a thicker film in one area of the die or one of the film layers. In the blown film extrusion or co-extrusion process, the film is typically slit to form a flat film which becomes the bag. If the film is slit consistently in the area of film adjacent to higher concentrations of fragrance, malodor control agent, or the combination, then there would be higher concentrations of fragrance, malodor control agent, or the combination near the top of the bag, and in the hem area, if the hem area was formed from the top of the bag. The hem, the hem passageway, and the draw tape may comprise a hem area. If the film is slit consistently in the area of film opposite to higher concentrations of fragrance, malodor control agent, or the combination, then there would be higher concentrations of fragrance, malodor control agent, or the combination near the bottom of the bag. Using blown film co-extrusion, the fragrance, malodor control agent, or the combination could also be localized by layer. For example, the fragrance, malodor control agent, or the combination could be in the outside layer, the inner layer, or one or more of the core layers, as described below. Additionally, a hem may be attached to the bag after extrusion of the bag film, which would allow the fragrance, malodor control agent, or the combination to be concentrated in the hem area.

**[0034]** The film materials may be any thermoplastic material, typically LLDPE (linear low density polyethylene), and the film compositions may differ slightly according to their use or where there is a multilayer film, the film layers may differ from each other. For example, the film layers may have different strength or barrier

properties, or properties designed for better sealing. The fragrance, malodor control agent, or the combination may be concentrated in a core layer or may be entirely within a core layer. The core layer, or other layers, for example two or more exterior layers may also contain reclaimed thermoplastic material and a fragrance release inhibitor, such as titanium dioxide. Additional fragrance release inhibitors include starch, clays and nanoclays, talc, and microcapsules.

**[0035]** An example of a bilayer film 10 is shown in Fig. 1 where the film 10 contains a first layer 11 and a second layer 12. The first layer 11 may form the outside layer and the second layer 12 may form the inner layer of a trash bag, as will be discussed below. An example of a multilayer film 20 is shown in Fig. 2 where the film 20 contains a first exterior layer 21, a second exterior layer 22, and a middle core layer 23. The first exterior layer 21 may form the outside layer and the second exterior layer 22 may form the inner layer of a trash bag as shown in Fig. 4. Fig. 3 shows an example of a film 30 with four layers, exterior layers 31, 32 and core layers 33, 34. The four layer film 30 can be formed with four separate extruders or by the collapse of a two layer tube of a blown film process to give a four layer film, which could be laminated together, as discussed below. The outside layer of the bag, or outside and inside layers of multilayer bags may contain a barrier polymer that inhibits fragrance release, for example polyvinylidene chloride (Dow) and copolymers, EVOH (ethylenevinyl alcohol) and copolymers, chitosan based polymers including quaternary hydroxypropyl chitosan, and nylon polymers.

**[0036]** Fragrance is typically introduced as thermoplastic pellets, the fragrance master batch, suitably containing 5 to 50% fragrance, or 10 to 40% fragrance, or 20-30% fragrance. This fragrance master batch can also contain 1 to 40%, or 5 to 30%, or 10 to 20% of malodor control agents. The fragrance master batch is mixed in the extruder with other thermoplastic pellets, of different or similar material, either virgin plastic or recycled or reclaimed plastic, and optionally a fragrance release inhibitor, such as titanium dioxide. In addition, other additives may be included. The final concentration of the fragrance in the film may be 0.01 to 0.5%, or 0.02 to 0.4, or 0.05 to 0.3%, or 0.1 to 0.2%. The final concentration of the malodor control agent in the

film may be 0.01 to 0.5%, or 0.02 to 0.4, or 0.05 to 0.3%, or 0.1 to 0.2%. The final concentration of the fragrance release inhibitor in the film may be 0.5 to 10%, or 1 to 8% or 2 to 6%. The final concentration of the fragrance in a layer of a multilayer film may be 0.01 to 0.5%, or 0.02 to 0.4, or 0.05 to 0.3%, or 0.1 to 0.2%. The final concentration of the malodor control agent in a layer of a multilayer the film may be 0.01 to 0.5%, or 0.02 to 0.4, or 0.05 to 0.3%, or 0.1 to 0.2%. The final concentration of the fragrance release inhibitor in a layer of a multilayer the film may be 0.5 to 10%, or 1 to 8% or 2 to 6%. The fragrance containing film layer may be a core layer or an outside layer. Where the fragrance containing film layer is a core layer, the core layer or layers may comprising 20 to 90%, or 40 to 80%, or 50 to 60% of the multilayer film.

**[0037]** A draw tape bag includes of two layers of plastic film which are sealed on three sides and open on the remaining side to form an opening in the bag. A hem securing the draw tape is provided at the periphery of the open end whereby the tape is accessed through openings in the hem. By pulling the draw tape, the opening in the bag closes. Consequently, the draw tape serves as a handle whereby the bag may be grasped to be subsequently transported. The hem in a draw tape bag is formed by two layers of film which are fused together to create a hem seal. The hem seal is typically created by heating the film until it melts and then fusing the two layers together. Heat sealing operations typically create a strong bond which cannot be separated without destroying the film, otherwise known as a destructive bond. Draw tape bags and methods for making draw tape bags are shown in U.S. Pat. Nos. 4,867,735, 4,966,059, and 5,006,380 which are incorporated herein by reference. In one embodiment, the draw tape may include a single layer. In one embodiment, the draw tape may include a first exterior layer, a second exterior layer, and at least one core layer disposed between the exterior layers as described in PCT App. WO2008156952 to O'Donnell et al. The draw tape may contain a fragrance, a malodor control agent, and a fragrance release inhibitor in either an exterior layer or a core layer.

**[0038]** Referring to Figs. 4 and 6, the bag 400 may include a left side seam 414 and a right side seam 416. The front wall 418 and the back wall 420 may be joined at both the left and right seams 414, 416. The bag 400 may include a hem 470 and the

hem may define the rim 408. The hem 470 may further define a passageway 472, which is at least partially enclosed, as show in Fig. 5. Referring to Fig. 5, the hem 570 may be formed by folding an upper portion 592 of the back wall 520 of the bag 400 onto the inside surface 404 of the bag 400, and sealing it thereto at the hem seal 458. Alternately, the hem may be formed by sealing to the outside surface of the bag (not shown). The draw tape 478 is disposed within the passageway 472 thus created. The hem 470, the hem passageway 472, and the draw tape 478 may comprise a hem area. Referring to Fig. 4, the hem 470 may include a first opening 474 and a second opening 476. The bag 400 may comprise a draw tape 478, which is disposed within the passageway 472. The draw tape 478 may be accessible via the first and second openings 474, 476 in the hem 470. Referring to Fig. 6, the draw tape 478 allows a user to at least partially close the bag 400 by pulling on the two loops 480, 482 of the draw tape 478. In this configuration, any fragrance or malodor control agent concentrated in the hem area or the draw tape is localized near the source of malodors.

[0039] Referring to Fig. 7, the bag 500 may be arranged inside a trash receptacle 510. As the upper portions of the bag 500 are folded over the rim 514 of the trash receptacle 510, the hem 520 and hem seal 558 may become exposed on the outside 512 of the receptacle 510. Accordingly, the hem 520 will be visible outside the receptacle 510, possibly even when a lid is placed over the receptacle. The width 522 of the hem may correspond to a predetermined amount of the bag 500 to be folded over the rim of the trash receptacle 510 when the bag 500 is being arranged in the receptacle 510. A user of the bag 500 may be instructed to this correlation in order to achieve optimal use of the bag 500. Optimal use of the bag may be when a sufficient amount of bag 500 is folded over the rim 514 of the receptacle 510 such that it will not slip back inside the receptacle 510, but yet with sufficient bag remaining inside the receptacle to utilize the full trash receiving volume of the receptacle 510. With the hem 520 at the opening of the trash receptacle 510, the hem 520 is situated between the malodors generated inside the bag and the user environment. In this configuration, any fragrance or malodor control agent concentrated in the hem area or the draw tape is localized near the escape of malodors even if the trash receptacle 510 is covered.

[0040] In another embodiment in Fig. 8 showing a partial cutaway of the top of a bag 800, the hem 820 and hem seal 824 will include a notch 822 such that the end 832 of the draw tape 830 does not enter the side seal 802. The left side seam may be constructed in the same manner.

[0041] Referring to Fig. 9A, there is shown another embodiment of the present invention. The bag 900 may include a fragrance and malodor strip 902, wherein the strip 902 is attached to the hem 920 below the hem seal 922 facing the bag sidewall 904. The draw tape 978 is in the hem 920. The other half of the bag 900 may be constructed as a mirror image. Referring to Fig. 9B, there is shown another embodiment of the present invention. The bag 900 may include a fragrance and malodor strip 902, wherein the strip 902 is attached at the hem seal 922. The fragrance and malodor strip 902 in the hem seal 922 may allow an easier seal to be formed, for example with a lower melting film or with a film having a pressure sensitive adhesive. Strip 902 in hem seal 922 may provide increased seal strength or improved sealing process consistency with utilization of specialized sealing layer resins, for example those offered as for adhesives and lamination by Dow Chemical Company. The draw tape 978 is in the hem 920. The other half of the bag 900 may be constructed as a mirror image. Referring to Fig. 9C, there is shown another embodiment of the present invention. The bag 900 may include a fragrance and malodor strip 902, wherein the strip 902 is within the hem 920. The draw tape 978 is within the hem 920. The other half of the bag 900 may be constructed as a mirror image.

[0042] Referring to Fig. 10, there is shown another embodiment. The bag 1000 may include a front wall 1052, a back wall 1054, a hem 1056 and a draw tape 1058. The bag body 1064 has been subjected to an embossing process wherein the majority of the bag now includes an embossing pattern 1068. The embossing pattern 1068 may be an arrangement of diamond shaped regions 1070 where the bag lower body 1064 has been plastically deformed. In another embodiment the pattern 1068 may be formed by a stretching operation described below. The embossing pattern 1068 may better permit the bag to stretch or yield to accommodate cumbersome or bulky objects

without puncturing, thereby further preventing leaks. The embossing pattern 1068 may extend to below the hem 1056 and the hem seal 1062. The embossing pattern may be a product or process consistent with those described in U.S. Patent No. 6,139,185; U.S. Publication No. 2004/0134923; U.S. Patent No. 6,394,651; U.S. Patent No. 6,394,652; U.S. Patent No. 6,150,647; U.S. Patent No. 6,513,975; or U.S. Patent No. 6,695,476; which are hereby incorporated herein by reference in their entirety.

**[0043]** Referring to Fig. 11A, there is shown another embodiment. Fig. 11A shows a cross sectional view of the back wall 1140 of the bag 1142 wherein the front wall may be a mirror image. The bag 1142 may include a hem 1144 wherein the hem 1144 is a separate piece of material. Opposing ends 1146, 1148 of the hem 1144 may be attached to the outside 1150 and inside 1152 of the bag 1142 at a hem seal 1154. The hem 1144 defines a passageway 1156. A draw tape 1158 may be disposed in the passageway 1156. The hem 1144 may be of thicker material than the bag body 1162. The hem may have different properties than other portions of the bag such as containing a fragrance, malodor control agent, and a fragrance release inhibitor. Fig. 11B shows a cross sectional view of the back wall 1140 of the bag 1142 wherein the front wall may be a mirror image. The bag 1142 may include a hem 1144 wherein the hem 1144 is a separate piece of material. Opposing ends 1146, 1148 of the hem 1144 may be attached to the outside 1150 at a hem seal 1154 and inside 1152 of the bag 1142 at a hem seal 1155. The hem 1144 defines a passageway 1156. A draw tape 1158 may be disposed in the passageway 1156. The hem 1144 may be of thicker material than the bag body 1162. The hem may have different properties than other portions of the bag such as containing a fragrance, malodor control agent, and a fragrance release inhibitor.

**[0044]** Referring to Fig. 12, there is shown another embodiment. Fig. 12 shows a cross sectional view of the back wall 1270 of the bag 1272 wherein the front wall may be a mirror image. The bag 1272 may include a hem 1274 wherein the hem 1274 is attached to the inside surface 1276 of the bag 1272 along a hem seal 1278. The hem 1274 defines a passageway 1280. A draw tape 1282 may be disposed in the

passageway 1280. The draw tape 1282 may contain two exterior layers 1284, 1286 and a core layer 1288, containing a fragrance, malodor control agent, and a fragrance release inhibitor.

[0045] Referring to Fig. 13, there is shown another embodiment. The bag 1330 comprises a bag body 1332, the bag body 1332 including a hem 1334. The hem 1334 includes an upper rim 1336, which defines a mouth 1338. The bag body 1332 further includes a lower body portion 1340 disposed below the hem 1334. The lower body portion 1340 defines a closed bottom 1342 to the bag 1330. The first portion 1334 may be thicker than in the second portion 1340. The bag 1330 may have a draw tape 1348 disposed within a hem passageway 1346, the draw tape 1348 being accessible at first and second openings 1350, 1352 in the hem 1334.

[0046] The hem 1334 may have increased thickness to improve the strength of the bag at the hem 1334, an area where the bag 1330 may experience increased stresses due to the user holding the bag 1330 at the rim 1336 or by the draw tape 1348. In other suitable embodiments, the hem 1334 may be patterned 1360.

[0047] Referring to Fig. 14, there is shown another embodiment. The bag 1450 for receiving refuse comprises a bag body 1452, the bag body 1452 including a first portion 1454. The first portion 1454 includes an upper rim 1456, which defines a mouth 1458. The bag body 1452 further includes a second portion 1460 disposed below the first portion 1454. The second portion 1460 defines a closed bottom 1462 to the bag 1450. The bag body 1452 may be thicker in the first portion 1454 than in the second portion 1460. The rim 1456 of the first portion 1454 may be an undulating rim. The rim 1456 may include four flaps 1464, 1466, 1468, 1470. The four flaps 1464, 1466, 1468, 1470 may be separated by four valleys 1472, 1474, 1476, 1478. The flaps 1464, 1466, 1468, 1470 may be tied together to at least partially close the bag 1450. In other embodiments, the bag may have two, three, five, six, seven, or eight flaps. In suitable embodiments, the flaps or the first portion may have different properties than other portions of the bag such as containing a fragrance, malodor control agent, and a fragrance release inhibitor.

[0048] In a suitable embodiment in Fig. 15, when the bag 1500 is laid flat in the relaxed condition, it may have a first width 1501 as measured along the bottom edge 1514 from the first side edge 1510 to the second side edge 1512. Because the width 1501 represents the front side of the bag, the perimeter at that location is twice the width 1501 to account for the front side and the rear side of the bag. The width 1501 may have a first range from about 8 inches (20.32 cm) to about 40 inches (101.6 cm), a second range from about 23 inches (58.42 cm) to about 31 inches (78.74 cm), and a third range from about 23 inches (58.42 cm) to about 25 inches (63.5 cm). In one embodiment, the width 1501 may be about 24 inches (60.96 cm). The bag 1500 may have a second width 1502 as measured along the top edges 1520, 1522 delineating the opening 1524. The second width includes both the bag opening and any side seals. Because the width 1502 represents the front side of the bag, the perimeter at that location is twice the width 1502 to account for the front side and the rear side of the bag. The width 1502 may have a first range from about 6.5 inches (16.51 cm) to about 38.5 inches (97.79 cm), a second range from about 20 inches (50.8 cm) to about 29 inches (73.66 cm), and a third range from about 20 inches (50.8 cm) to about 22 inches (55.88 cm). In one embodiment, the width 1502 may be about 21.5 inches (54.61 cm). Thus, the second width is less than the first width and the bag is narrower at its top than its bottom. Because of the difference in the first and second widths, the side edges 1510, 1512 are each pulled towards each other along the top edges 1520, 1522 a distance 1504. In one embodiment, an elastic draw tape 1530 is attached to the bag at the first and second side edges 1510, 1512, the edges are physically pulled towards each other by contraction of the tape. The distance 1504 is the difference between the first width 1501 and the second width 1502. Because the distance 1504 represents the front side of the bag, the perimeter at that location is reduced by twice the distance 1504 to account for the front side and the rear side of the bag. The distance 1504 may have a first range from about 0.5 inch (1.27 cm) to about 8 inches (20.32 cm), a second range from about 1.5 inches (3.81 cm) to about 6 inches (15.24 cm), and a third range from about 1.5 inches (3.81 cm) to about 3.5 inches (8.89 cm). In one embodiment, the distance 1504 may be about 2.50 inches (6.35 cm) and thus, the perimeter is reduced by 5 inches (12.7 cm). The hem 1544 can also be width

1502. The decreased width 1502 compared to the bottom width 1501 may allow greater interaction between malodors in the bag and fragrance or malodor control agents in the hem 1544. When the hem area or the draw tape contains an elastic element, the hem area in its relaxed state may have less width than the bottom of the bag, but in its stretched state may be of equal or greater width than the bottom of the bag.

[0049] Bags may be produced in a high speed, automated manufacturing process such as the one illustrated in Figs. 16 and 17. The illustrated manufacturing process 1700 includes automated equipment that may convert continuous sheet-like webs and thin film strips of planar thermoplastic material into the finished bags. For example, a web 1701 of thermoplastic material may initially be provided on a roll 1702 that may be unwound and movingly directed along a machine direction 1706 by the processing equipment. When unwound, the web 1701 may have a first side edge 1710 and a second side edge 1712 that define a width 1714 that is perpendicular to the machine direction 1706.

[0050] To provide the interior volume of the finished bag, the web 1701 may be folded in half orthogonally about the machine direction 1706 by a folding operation 1718 so that the web is arranged as first and second opposing, adjacent webs halves 1720, 1722 being advanced in parallel along the machine direction 1706. When folded in half, the first and second side edges 1710, 1712 are moved adjacent to each other. The width 1716 of the folded web 1701 may be half of the width 1714 of the unfolded web. Moreover, once folded, the center of the web 1701 provides a crease 1724 that may correspond to the bottom edge of the finished bag. In another embodiment, the roll 1702 may include a pre-folded web and the folding operation is not necessary. In another embodiment, a first web from a first roll and a second web from a second roll may be provided and advanced in parallel along the machine direction. The first and second webs may be joined along one edge to form the bottom portion of the bags.

[0051] In the embodiments, where a pattern may be imparted proximate to the top of the bag, the process may include one or more rollers 1726 to impart the pattern to the bag.

[0052] The hems may be formed along the adjacent edges 1710, 1712 by a hem forming operation 1730 in which hem flaps may be tucked or folded into the web 1701. A hem may be formed for each of the adjacent edges 1710, 1712. The hemming operation may add notches 1732. The notches 1732 may be of any suitable shape or size and may be made through the advancing web 1701 intermittently along the adjacent edge 1710, 1712.

[0053] To provide the draw tape, a continuous strip 1740 of thermoplastic thin-film material may be unwound from a roll 1742 of such material. The strip 1740 is directed by various rollers and/or nips toward the advancing web where it may be inserted into the hems.

[0054] The manufacturing process 1700 may include equipment to pre-stretch the strip 1740 prior to installation in the bag. For example, the processing equipment may include a pair of opposing cylindrical rollers 1743 that are located before and spaced from a pair of rollers 1744. The strip material 1740 may be directed between the pair of rollers 1743 and then onto the pair of opposing cylindrical rollers 1744. If the pair of rollers 1744 are rotated at a faster relative speed than the pair of rollers 1743, the differential roller speeds will place the thermoplastic strip under tension and may thereby stretch or elongate it. This process of stretching may be referred to as pre-stretching. In a further embodiment, the relative speed of the pairs of rollers 1743, 1744 may be adjusted to vary the amount and location of the pre-stretching induced onto the strip 1740. For example, where the relative speed of the rollers is equal, the tape will undergo little or no stretching. If the differential speed is increased, the tape will be stretched and possibly neck down in width. Thus, varying the relative speed of the roller pairs with respect to each other may produce draw tapes with sections that may be pre-stretched and sections that may not be pre-stretched, the pre-stretched sections may be narrower than the sections that are not pre-stretched.

[0055] Referring to Fig. 16, to impart the pattern into the strip, the processing equipment may include a pair of opposing rollers 1745 that may have intermeshing ridges 1746 and grooves 1747 formed on their surfaces. When the strip 1740 is directed between the rollers 1745 rotating in opposite directions, the ridges 1746 and grooves 1747 may impart the pattern 1748 onto the thermoplastic material. Moreover, the surfaces of the opposing rollers 1745 may be configured so that the pattern 1748 is only imparted onto intermittent lengths of the strip 1740.

[0056] To keep the strip 1740 including the pattern 1748 in a predetermined stretched or expanded condition, a second pair of opposing rollers 1749 may be provided downward from the patterning rollers 1745 and may be rotated at a speed necessary to maintain the predetermined stretched condition.

[0057] The stretched strip 1740 may then be directed toward the adjacent edges 1710, 1712 of the advancing web 1701 where the strip 1740 may be inserted in the hemming operation 1730. Once inserted, the strip 1740 is accessible through the notches 1732. A second roll of strip material may be similarly provided for insertion into the remaining hem of the two adjacent edges. It should be appreciated that in other embodiments of the manufacturing process, the order and/or presence of the hemming, notching and strip insertion operations may be altered or changed.

[0058] In another embodiment, the strip 1740 may not be stretched by rollers 1743, 1744, but may be processed by the rollers 1745 to receive the pattern. The strip 1740 may then be inserted under tension in the hem. The tension may or may not be sufficient to stretch or expand the pattern.

[0059] In another embodiment, rollers similar to rollers 1726 may be used, after the hem forming operation, in order to impart a pattern to the hem and draw tape, and/or the bag side wall while the draw tape is in the hem, such as, the rollers 2226 in Fig. 18. These rollers may be used at any location after the hemming operation and before the web is separated into bags or rolled for consumer use. Thus, in this other embodiment, the rollers 1726 and rollers 1745 may not be necessary.

**[0060]** The web 1701 and strip 1740 may be directed through various other processing steps to produce the finished bag. For example, the web 1701 may be directed through a heat sealing operation 1750 in which heat seals 1752 are formed at intermittent spaces along the web between the adjacent edges 1710, 1712 and the folded crease 1724 so as to be perpendicular to the machine direction 1706. The heat sealing operation 1750 may melt together and thereby attach the two folded web halves and the strip 1740 within the region of the heat seal 1752. The heat seals 1752 may be performed while the strip 1740 is in the stretched state. The web 1701 may be directed through a perforating operation 1754 in which perforations 1758 are made between or into the heat seals 1752 between the adjacent edges 1710, 1712 and the crease 1724. The perforation may be disposed through both the folded web and strip 1740. As may be appreciated, the heat seals 1752 and perforations 1758 may correspond to the side edges of the finished bags 1760. To prevent the strip 1740 from unintentionally recovering and distorting the web 1701 advancing through the processing machinery, the web may be kept under tension along the machine direction 1706. In another embodiment, the web may be folded one or more times before the folded web may be directed through the perforating operation. The web 1701 embodying the finished bags 1760 may be wound into a roll 1762 for packaging and distribution.

**[0061]** In another embodiment of the process which is illustrated in Fig. 17, the web may be directed through a cutting operation 1768 which cuts the web at location 1770 into individual bags 1760 prior to winding onto a roll 1772. Cutting the bags 1760 from the web along location 1770 allows the draw tape to relax or contract and thereby constricts the top edges of the bag corresponding to the opening, as shown in Fig. 17, prior to winding into a roll 1772. The bags may be interleaved prior to winding into the roll 1772. In another embodiment, the web may be folded one or more times before the folded web is cut into individual bags.

**[0062]** Referring another embodiment in Fig. 18, the web 2201 may be folded in half orthogonally about the machine direction 2206 by a folding operation 2218 so that the web may be arranged as first and second opposing, adjacent webs halves

2220, 2222 being advanced in parallel along the machine direction 2206. The web 2201 may provide a crease 2224 that may correspond to the bottom edge of the finished bag. In another embodiment, the roll 2202 may include a pre-folded web and the folding operation is not necessary. In another embodiment, a first web from a first roll and a second web from a second roll may be provided and advanced in parallel along the machine direction. The first and second webs may be joined along one edge to form the bottom portion of the bags.

[0063] The hems may be formed along the adjacent edges 2210, 2212 by a hem forming operation 2230 in which hem flaps may be tucked and folded into the web 2201. A hem may be formed for each of the adjacent edges 2210, 2212. The hem forming operation may add notches 2232.

[0064] To provide the draw tape, a continuous strip 2240 of thermoplastic thin-film material may be unwound from a roll 2242 of such material. The strip 2240 is directed by various rollers and/or nips toward the advancing web where it may be inserted into the hems.

[0065] Referring to Fig. 18, to impart the pattern 2248 into the strip, the processing equipment may include a pair of opposing rollers 2245 that may have intermeshing ridges 2246 and grooves 2247 formed on their surfaces. The surfaces of the opposing rollers 2245 may be configured so that the pattern 2248 is only imparted onto intermittent lengths of the strip 2240. A second pair of opposing rollers 2249 may be provided downward from the patterning rollers 2245 and may be rotated at a speed necessary to maintain the strip 2240 in a relaxed condition.

[0066] The strip 2240 may be in a relaxed state when the strip is inserted into the hem. A second roll of strip material may be similarly provided for insertion into the remaining hem of the two adjacent edges. It should be appreciated that in other embodiments of the manufacturing process, the order and/or presence of the hemming, notching and strip insertion operations may be altered or changed.

[0067] In another embodiment, the strip 2240 may not be stretched by rollers 2243, 2244, but may be processed by the rollers 2245 to receive the pattern 2248. The strip 2240 may be in a relaxed state when the strip is inserted into the hem.

[0068] Rollers 2226 may be used, after the hemming operation, in order to impart a pattern to the hem and draw tape, and/or the bag side wall while the draw tape is in the hem. These rollers may be used at any location after the hemming operation and before the web is separated into bags or rolled for consumer use. In another embodiment, the rollers 2245 with the pattern may not be necessary because the rollers 2226 may impart the pattern to the hem and strip at the same time.

[0069] The web 2201 and strip 2240 may be directed through various other processing steps to produce the finished bag. For example, the web 2201 may be directed through a heat sealing operation 2250 in which heat seals 2252 are formed at intermittent spaces along the web. The process may include the application of the inward seals during the sealing operation 2250, or at another location in the process, as appropriate.

[0070] The heat seals 2252 may be performed while the strip 2240 is in the relaxed state. The web 2201 may be directed through a perforating operation 2254 in which perforations 2258 are made between or into the heat seals 2252. The perforation may be disposed through both the folded web and strip 2240. As may be appreciated, the heat seals 2252 and perforations 2258 may correspond to the side edges of the finished bags 2260. In another embodiment, the web may be folded one or more times before the folded web may be directed through the perforating operation. The web 2201 embodying the finished bags 2260 may be wound into a roll 2262 for packaging and distribution.

[0071] The films of the invention can typically undergo one or more film stretching processes. During these stretching processes, the film thickness may be significantly decreased. Therefore referring again to Fig. 10, it may be advantageous to thin the bag 1000 out in the bag lower body 1064 but not the bag hem area 1056 in order to maintain a more highly fragranced hem area 1056. There are three common ways to stretch thermoplastic films. One is referred to as machine direction orientation (MDO) which involves stretching the film between two pairs of rollers. The film is pinched in the nip of a first pair of rollers, which are running at a relatively slow speed, and a second pair of rollers, downstream from the first pair, which are operating faster than the first pair. Because of the difference in run speeds, the film in between the roller pairs must either stretch or break to accommodate the difference. The ratio of the roller speeds will roughly determine the amount that the film is stretched. For example, if the first pair is running at 100 feet per minute (fpm) and the second pair is running at 300 fpm, the film will be stretched to roughly three times its original length. The MDO method stretches the film in the machine direction (MD) only. The MDO stretching method is used to create an oriented film.

[0072] A second method of stretching is called tentering. In simplest terms, the tentering method involves grabbing the sides of the film and stretching it sideways. For many years this was the only way to stretch film from side to side, or in the transverse direction (TD). The tentering method tended to be slow and, because the forces are concentrated on the edges of the film, often the film did not stretch evenly. U.S. Pat. No. 4,704,238 discloses a tentering apparatus having a pre-heating zone and a stretching zone, followed by a heat setting zone to facilitate the stretching of a preformed blown or cast film.

[0073] A third method of stretching involves incremental stretching of thermoplastic film. This method is described in the early patent literature, for example, U.S. Pat. Nos. 4,153,751; 4,116,892; 4,289,832 and 4,438,167. In the practice of this method, the film is run between grooved or toothed rollers. The grooves or teeth on the rollers intermesh without touching when the rollers are brought together and, as the film passes between the rollers, it is stretched. Incremental stretching has the advantage of causing the film to stretch in many small

increments that are evenly spaced over the entire film. This results in a more evenly stretched film, something that is not always true for MDO stretching and is almost never true for tentering. Incremental stretching allows one to stretch the film in the MD, TD and at angle (DD or diagonal direction) or any combination of these three directions. The depth at which the intermeshing teeth engage controls the degree of stretching. Often, this incremental method of stretching is simply referred to as TD, MD, TD/MD or DD ring rolling. A number of U.S. patents have issued for incrementally stretching thermoplastic films and laminates. An early example of the patent art which discloses a method of incrementally stretching film is U.S. Pat. No. 5,296,184. Other relevant patents regarding the incremental stretching of thermoplastic films and laminates include U.S. Pats. Nos. 6,265,045; 6,214,147; 6,013,151; 5,865,926; 5,861,074; 5,851,937; 5,422,172 and 5,382,461.

**[0074]** The diagonal intermeshing stretcher consists of a pair of left hand and right hand helical gear-like elements on parallel shafts. The shafts are disposed between two machine side plates, the lower shaft being located in fixed bearings and the upper shaft being located in bearings in vertically slidable members. The slidable members are adjustable in the vertical direction by wedge shaped elements operable by adjusting screws. Screwing the wedges out or in will move the vertically slidable member respectively down or up to further engage or disengage the gear-like teeth of the upper intermeshing roll with the lower intermeshing roll. Micrometers mounted to the side frames are operable to indicate the depth of engagement of the teeth of the intermeshing roll.

**[0075]** The intermeshing rolls closely resemble fine pitch helical gears. In the preferred embodiment, the rolls have 5.935" diameter, 45° helix angle, a 0.100" normal pitch, 30 diametral pitch, 14½° pressure angle, and are basically a long addendum topped gear. This produces a narrow, deep tooth profile which allows up to about 0.090" of intermeshing engagement and about 0.005" clearance on the sides of the tooth for material thickness. The teeth are not designed to transmit rotational torque and do not contact metal-to-metal in normal intermeshing stretching operation.

[0076] The TD intermeshing stretching equipment is identical to the diagonal intermeshing stretcher with differences in the design of the intermeshing rolls and other minor areas noted below. Since the TD intermeshing elements are capable of large engagement depths, it is important that the equipment incorporate a means of causing the shafts of the two intermeshing rolls to remain parallel when the top shaft is raising or lowering. This is necessary to assure that the teeth of one intermeshing roll always fall between the teeth of the other intermeshing roll and potentially damaging physical contact between intermeshing teeth is avoided. This parallel motion is assured by a rack and gear arrangement wherein a stationary gear rack is attached to each side frame in juxtaposition to the vertically slidable members. A shaft traverses the side frames and operates in a bearing in each of the vertically slidable members. A gear resides on each end of this shaft and operates in engagement with the racks to produce the desired parallel motion.

[0077] The drive for the TD intermeshing stretcher must operate both upper and lower intermeshing rolls except in the case of intermeshing stretching of materials with a relatively high coefficient of friction. The drive need not be antibacklash, however, because a small amount of machine direction misalignment or drive slippage will cause no problem. The reason for this will become evident with a description of the TD intermeshing elements.

[0078] The TD intermeshing elements are machined from solid material but can best be described as an alternating stack of two different diameter disks. In the preferred embodiment, the intermeshing disks would be 6" in diameter, 0.031" thick, and have a full radius on their edge. The spacer disks separating the intermeshing disks would be 5½" in diameter and 0.069" in thickness. Two rolls of this configuration would be able to be intermeshed up to 0.231" leaving 0.019" clearance for material on all sides. As with the diagonal intermeshing stretcher, this CD intermeshing element configuration would have a 0.100" pitch.

[0079] The MD intermeshing stretching equipment is identical to the diagonal intermeshing stretch except for the design of the intermeshing rolls. The MD intermeshing rolls closely resemble fine pitch spur gears. In the preferred

embodiment, the rolls have a 5.933" diameter, 0.100" pitch, 30 diametral pitch, 14½° pressure angle, and are basically a long addendum, topped gear. A second pass was taken on these rolls with the gear hob offset 0.010" to provide a narrowed tooth with more clearance. With about 0.090" of engagement, this configuration will have about 0.010" clearance on the sides for material thickness.

[0080] The film may additionally be embossed with a pattern that provides texture to the film, but with no additional overall stretching. The film may be embossed by feeding between two rolls, one or both of which have an embossing pattern. The rolls may be heated or unheated. In one embodiment in Fig. 19, it may be suitable to emboss or to pattern the hem area 1920 only of a bag 1900 as the embossing or patterning may signal to the consumer that the hem area 4020 is targeted with the consumer benefit, for example fragrance and malodor control.

[0081] Laminating two or more film layers together may allow coating of actives on the surface of a film that can then be laminated to another film to result in the actives being concentrated on the interior of the laminate, as shown in the process in Fig. 20, one example of a high speed manufacturing process 2000 that may process multiple plies of continuous thermoplastic film into the finished bags. A first film 2001 may be initially provided in a roll or film forming process as described above. The film 2001 is directed along a machine direction 2006 by the processing equipment. The film 2001 may have an initial width 2008 between a first edge 2010 and a second edge 2012 of the film 2001. The web may be processed in a stretching operation 2014, for example using a pair of MD stretching rollers 2016, 2018, or any of the stretching operations as described herein. A second film 2002 may be initially provided in a roll or film forming process as described above. The film 2002 is directed along a machine direction 2006 by the processing equipment. The film 2002 may have an initial width 2008 between a first edge 2010 and a second edge 2012 of the film 2002. The web may be processed in a stretching operation 2015, for example using a pair of TD stretching rollers 2017, 2019, or any of the stretching operations as described herein. The first film 2001 and the second film 2002 may be overlaid for laminate processing.

**[0082]** To impart or form the lamination of the films 2001, 2002, the processing equipment may include a cylindrical roller 2030 and an adjacent second cylindrical roller 2032 between which the films 2001, 2002 may be directed by the processing equipment. The rollers 2030, 2032 may be arranged so that their longitudinal axes may be perpendicular to the machine direction 2006 and may be adapted to rotate about their longitudinal axes in opposite rotational directions. In various embodiments, motors may be provided that power rotation of the rollers 2030, 2032 in a controlled manner. The first and second rollers 2030, 2032 may be made from any suitable material including, for example, metal, such as, steel or titanium. The rollers 2030, 2032 may have discontinuous ridges on the rollers which may impart the discontinuous patterns into the film layers during the process of discontinuous lamination. After the film layers 2001, 2002 have passed between the rollers 2030, 2032, the laminate film 2050 includes discontinuous patterns 2076 of bonded areas with unbonded areas 2078 in between.

**[0083]** To provide the two opposing sidewalls of the finished bag, the film laminate 2050 may be folded by a folding operation 2020. During the folding operation 2020, the first edge 2010 of the laminate 2050 is moved adjacent to the second edge 2012 so as to form a fold edge 2026 that may run parallel with the machine direction 2006. The folded laminate 2052 may have a width 2028 that is half of the original width 2008. The processing equipment may further process the folded laminate 2052 after it passes through the folding operation 2020. For example, referring to Fig. 20, to form the side edges of the finished bag, the folded laminate 2052 may proceed through a sealing operation 2080 by which heat seals 2082, perpendicular to the machine direction 2006 and spaced intermittently along the laminate, are formed between the fold edge 2026 and the adjacent edges 2010, 2012. The heat seals 2082 may fuse together the adjacent halves of the folded laminate 2052. After sealing the web halves together, a perforating operation 2084 may form perforations along the heat seals 2082 to simplify detaching individual bags from the remainder of the laminate. The perforations may pierce through the laminate but allow the individual bags to remain attached to each other. In another embodiment, the film laminate may be folded one or more times prior to the perforation operation.

The film laminate of processed bags may be wound up into a roll 2092 for packaging and distribution. For example, the roll 2092 may be placed into a box or bag for sale to a customer. In another embodiment, folded laminate 2052 may be cut into individual bags along the heat seals 2082 by cutting operation. In another embodiment, the folded laminate may be folded one or more times prior to the cutting operation. In another embodiment, the side sealing operation may be combined with the cutting operation.

**[0084]** The film may be coated or printed with an ink, adhesive, or other functional compound, such as a fragrance to film layer 2002 by process 2022 before lamination in rollers 2030, 2032. Depending upon the composition, various coating and printing process may be appropriate for process 2022. For instance, in addition to ink jet printing and other non-impact printers, the composition can be used in screen printing processes, offset lithographic processes, flexographic printing processes, rotogravure printing processes, and the like. In other cases, a coating process may be appropriate. In the gravure coating process, an engraved roller runs in coating bath which fills the engraved recesses in engraved roller with excess additive delivery slurry. The excess slurry on engraved roller is wiped off engraved roller by doctor blade, with engraved roller thereafter depositing additive delivery slurry layer onto substrate film as substrate film passes between engraved roller and pressure roller. In the 3-roll reverse roll coating process, additive delivery slurry is measured onto application roller by gap between upper metering roller and application roller. The coating is "wiped off" application roller by substrate film as substrate passes around support roller, leaving a desired layer of slurry on substrate. Additive delivery slurry is confined on metering roller by doctor blade. In the Meyer rod coating process, an excess coating of the additive delivery slurry is deposited onto substrate film as substrate film passes over bath roller, which is immersed in bath containing the additive delivery slurry. Wire-wound Meyer rod allows a desired quantity of the coating to remain on substrate film. The quantity of coating remaining is determined by the diameter of the wire used on Meyer rod, as well as the distance of the surface of the wire from the substrate film. Although the wire can be in contact with substrate film, alternatively the wire can be spaced from substrate film by, for example, 1 to 10

mils, or 2 to 6 mils. In the extrusion coating process, additive delivery slurry is extruded through slot, forming coating on substrate. In the curtain coating process, a bath containing additive delivery slurry has slot in its base, allowing continuous curtain of additive delivery slurry to fall towards gap between conveyors. Substrate is passed along the conveyors at a controlled speed, receiving coating thereon. In the air knife coating process, excess coating is applied to substrate, with the excess coating being reduced to a desired coating by the gas flow emanating from blower. In the rotary screen printing process, a squeegee presses additive delivery slurry through holes in rotary screen. Substrate is passed through a nip between rotary screen and counter pressure roller, resulting in printed substrate.

**[0085]** Many of the above earlier embodiments may be combined with each other to create further embodiments of the bag. Accordingly, all of the features discussed in the earlier described embodiments may be included in any of the other embodiments disclosed herein, as appropriate.

**[0086]** The bag and bag components may be made of thermoplastic. The materials are suitably hydrophobic polymers not derivatized by actives, such as fragrance components and malodor control agents. Useful materials in the inventive films include but are not limited to thermoplastic polyolefins, including polyethylene and copolymers thereof and polypropylene and copolymers thereof. Suitable polyethylenes include high density polyethylene, medium density polyethylene, low density polyethylene, very low density polyethylene, and linear low density polyethylene.

**[0087]** The olefin based polymers include the most common ethylene or propylene based polymers such as polyethylene, polypropylene, and copolymers such as ethylene vinylacetate (EVA), ethylene methyl acrylate (EMA) and ethylene acrylic acid (EAA), or blends of such polyolefins. Other examples of polymers suitable for use as films include elastomeric polymers. Suitable elastomeric polymers may also be biodegradable or environmentally degradable. Suitable elastomeric polymers for the film include poly(ethylene-butene), poly(ethylene-hexene) , poly(ethylene-octene), poly(ethylene-propylene), poly(styrene-butadiene-styrene), poly(styrene-isoprene-

styrene), poly(styrene-ethylene-butylene-styrene), poly(ester-ether), poly(ether-amide), poly(ethylene-vinylacetate), poly(ethylene-methylacrylate), poly(ethylene-acrylic acid), poly(ethylene butylacrylate), polyurethane, poly(ethylene-propylene-diene), ethylene-propylene rubber. This new class of rubber-like polymers may also be employed and they are generally referred to herein as metallocene polymers or polyolefins produced from single-site catalysts. The most preferred catalysts are known in the art as metallocene catalysts whereby ethylene, propylene, styrene and other olefins may be polymerized with butene, hexene, octene, etc., to provide elastomers suitable for use in accordance with the principles of this invention, such as poly(ethylene-butene), poly(ethylene-hexene), poly(ethylene-octene), poly(ethylene-propylene), and/or polyolefin terpolymers thereof. It can be suitable to blend into the resin a suitable amount of a cling agent, such as polyisobutylene, to control the level of lamination during the lamination process.

**[0088]** Fragrance technology is intended to include fragranting compounds and compositions as well as malodor control agents and compositions (regardless of whether these malodor control agents themselves are fragrances). Fragrance technology compositions can be chosen so as to have relatively low solubility in water and be hydrophobic. They should be chosen so as to maximize those with low levels of solubility and minimize low levels of those which are relatively soluble or immiscible in water. Suitably, the fragrance technology compositions also have a low rate of evaporation.

**[0089]** For covering malodors, grapefruit fragrance character was found to be more suitable than lemon citrus fragrance character. Especially suitable is grapefruit fragrance which may contain Limonene, Geraniol, Citral, Citronellal, or Neral. The grapefruit fragrance can also contain 1,1-Dimethoxy-2,2,5-trimethylhex-4-ene, N-methyl-N-phenyl-2-methylbutanamide, 1-p-methene-8-thiol, thiobenzoic acids, 2,4,6-trimethyl-4-phenyl-1,3-dioxane, 2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclo-hex-2-enone, 2,4,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone, 2,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-3-enone, 2,6-Dimethyl-2-(3-methyl-but-2-enyl)-cyclohexanone, 1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 6-methoxy-

1,5,6-trimethyl-5-(3-methyl-but-2-enyl)-cyclohexene, 1,2,4,6-Tetramethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-1-vinyl-cyclohex-2-enol, 2,6-Dimethyl-1-ethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohexa-2,4-dienol, and 2-(2,3-Dimethyl-but-2-enyl)-2,6-dimethyl-cyclohexanone

**[0090]** For covering malodors, a synthetic vanilla fragrance character was found to be more suitable than natural vanilla fragrance character. The vanilla fragrance can contain acetanisole, anisyl acetate, anisyl alcohol, anisyl propionate, benzoin, cinnamaldehyde, ethyl vanillin, 2-methoxy-4-methylphenol, 1-(p-methoxyphenyl)-2-propanone, propenyl guaethol, veratraldehyde, vanillylacetone, vanillin isobutyrate, veratrole, and acetovanillone compounds.

**[0091]** Fragrances and fragrance oils comprise perfume raw materials ("PRMs") as well as other less volatile materials. PRMs are characterized by their boiling point (B.P.) and their octanol/water partitioning coefficient (P). The boiling points of many fragrance ingredients are reported in, e.g., "Perfume and Flavor Chemicals (Aroma Chemicals)," Steffen Arctander, published by the author, 1969. The octanol/water partitioning coefficient of a material is the ratio between its equilibrium concentrations in octanol and in water. The octanol/water partitioning coefficient can alternatively be reported on a base 10 logarithmic scale, as logP, and when the calculated value is reported, as ClogP. The logP of many perfume ingredients has been reported; for example, the Pomona92 database, available from Daylight Chemical Information Systems, Inc. (Daylight CIS), Irvine, Calif., contains many, along with citations to the original literature. However, the logP values are most conveniently calculated by the "CLOGP" program, also available from Daylight CIS. This program also lists experimental logP values when they are available in the Pomona92 database. The "calculated logP" (ClogP) is determined by the fragment approach of Hansch and Leo (cf., A. Leo, in Comprehensive Medicinal Chemistry, Vol. 4, C. Hansch, P. G. Sammens, J. B. Taylor and C. A. Ramsden, Eds., p. 295, Pergamon Press, 1990). The fragment approach is based on the chemical structure of

each perfume ingredient, and takes into account the numbers and types of atoms, the atom connectivity, and chemical bonding. The ClogP values, which are the most reliable and widely used estimates for this physicochemical property, are preferably used instead of the experimental logP values in the selection of perfume ingredients which are useful in the present invention.

**[0092]** Suitably, at least 30%, or at least 40%, or at least 50% of the perfume ingredients for use in this invention typically have ClogP of greater than 3.5.

Suitably, at least 30%, or at least 40%, or at least 50% of the perfume ingredients for use in this invention have a boiling point greater than 250 ° C. Below in Table 1 are listed typical suitable fragrance ingredients.

Table 1

| <b>Fragrance Ingredients</b>    | <b>Approx. BP (° C.)</b> | <b>Approx. ClogP</b> |
|---------------------------------|--------------------------|----------------------|
| allo-Ocimene                    | 192                      | 4.362                |
| Benzyl Butyrate                 | 240                      | 3.698                |
| Camphene                        | 159                      | 4.192                |
| cis-3-Hexenyl Tiglate           | 101                      | 3.700                |
| Citronellyl Acetate             | 229                      | 3.670                |
| Citronellyl Isobutyrate         | 249                      | 4.937                |
| Citronellyl Propionate          | 242                      | 4.628                |
| Decyl Aldehyde                  | 209                      | 4.008                |
| Delta Damascone                 | 242                      | 3.600                |
| Dihydromyrcenyl Acetate         | 225                      | 3.879                |
| Dimethyl Octanol                | 213                      | 3.737                |
| gamma Methyl Ionone             | 230                      | 4.089                |
| Geranyl Acetate                 | 245                      | 3.715                |
| Geranyl Isobutyrate             | 245                      | 4.393                |
| Hexyl Neopentanoate             | 224                      | 4.374                |
| Hexyl Tiglate                   | 231                      | 3.800                |
| beta-Ionone                     | 239                      | 3.960                |
| gamma-Ionone                    | 240                      | 3.780                |
| alpha-Irone                     | 250                      | 3.820                |
| Isononyl Acetate                | 200                      | 3.984                |
| Lauric Aldehyde (Dodecanal)     | 249                      | 5.066                |
| d-Limonene                      | 177                      | 4.232                |
| alpha-iso "gamma" Methyl Ionone | 230                      | 4.209                |
| Methyl Nonyl Acetaldehyde       | 232                      | 4.846                |
| Methyl Octyl Acetaldehyde       | 228                      | 4.317                |
| Myrcene                         | 167                      | 4.272                |
| Neryl Acetate                   | 231                      | 3.555                |
| Nonyl Acetate                   | 212                      | 4.374                |

| <b>Fragrance Ingredients</b>           | <b>Approx. BP (° C.)</b> | <b>Approx. ClogP</b> |
|----------------------------------------|--------------------------|----------------------|
| Octyl Aldehyde                         | 223                      | 3.845                |
| Orange Terpenes (d-Limonene)           | 177                      | 4.232                |
| para-Cymene                            | 179                      | 4.068                |
| alpha-Pinene                           | 157                      | 4.122                |
| beta-Pinene                            | 166                      | 4.182                |
| alpha-Terpinene                        | 176                      | 4.412                |
| gamma-Terpinene                        | 183                      | 4.232                |
| Terpinolene                            | 184                      | 4.232                |
| Tetrahydro Linalool                    | 191                      | 3.517                |
| Tetrahydro Myrcenol                    | 208                      | 3.517                |
| Undecenal                              | 223                      | 4.053                |
| Verdox                                 | 221                      | 4.059                |
| Vertenex                               | 232                      | 4.060                |
| Allyl Cyclohexane Propionate           | 267                      | 3.935                |
| Ambrettolide                           | 300                      | 6.261                |
| Amyl Benzoate                          | 262                      | 3.417                |
| Amyl Cinnamate                         | 310                      | 3.771                |
| Amyl Cinnamic Aldehyde                 | 285                      | 4.324                |
| Amyl Cinnamic Aldehyde Dimethyl Acetal | 300                      | 4.033                |
| iso-Amyl Salicylate                    | 277                      | 4.601                |
| Aurantiol                              | 450                      | 4.216                |
| Benzyl Salicylate                      | 300                      | 4.383                |
| Cadinene                               | 275                      | 7.346                |
| Cedrol                                 | 291                      | 4.530                |
| Cedryl Acetate                         | 303                      | 5.436                |
| Cinnamyl Cinnamate                     | 370                      | 5.480                |
| Cyclohexyl Salicylate                  | 304                      | 5.265                |
| Cyclamen Aldehyde                      | 270                      | 3.680                |
| Diphenyl Methane                       | 262                      | 4.059                |

| Fragrance Ingredients    | Approx. BP (° C.) | Approx. ClogP |
|--------------------------|-------------------|---------------|
| Ethylene Brassylate      | 332               | 4.554         |
| Ethyl Undecylenate       | 264               | 4.888         |
| Exaltolide               | 280               | 5.346         |
| Galaxolide               | 260               | 5.482         |
| Geranyl Anthranilate     | 312               | 4.216         |
| Hexadecanolide           | 294               | 6.805         |
| Hexenyl Salicylate       | 271               | 4.716         |
| Hexyl Cinnamic Aldehyde  | 305               | 5.473         |
| Hexyl Salicylate         | 290               | 5.260         |
| Linalyl Benzoate         | 263               | 5.233         |
| Musk Indanone            | 250               | 5.458         |
| Musk Tibetine            | M.P. = 136        | 3.831         |
| Oxahexadecanolide-10     | 300               | 4.336         |
| Oxahexadecanolide-11     | M.P. = 35         | 4.336         |
| Patchouli Alcohol        | 285               | 4.530         |
| Phenyl Ethyl Benzoate    | 300               | 4.058         |
| Phenylethylphenylacetate | 325               | 3.767         |
| alpha-Santalol           | 301               | 3.800         |
| Thibetolide              | 280               | 6.246         |
| delta-Undecalactone      | 290               | 3.830         |
| gamma-Undecalactone      | 297               | 4.140         |
| Vetiveryl Acetate        | 285               | 4.882         |

**[0093]** Suitable fragrance ingredients include extracts from natural raw materials such as essential oils, concretes, absolutes, resins, resinoids, balsams, tinctures such as for example ambergris tincture; amyris oil; angelica seed oil; angelica root oil; aniseed oil; valerian oil; basil oil; tree moss absolute; bay oil; armoise oil; benzoe resinoid; bergamot oil; beeswax absolute; birch tar oil; bitter almond oil; savory oil; buchu leaf oil; cabreuva oil; cade oil; calamus oil; camphor oil; cananga oil; cardamom oil; cascarilla oil; cassia oil; cassie absolute; castoreum absolute; cedar leaf oil; cedar wood oil; cistus oil; citronella oil; lemon oil; copaiba balsam; copaiba balsam oil; coriander oil; costus root oil; cumin oil; cypress oil; davana oil; dill weed oil; dill seed oil; eau de brouts absolute; oakmoss absolute; elemi oil; estragon oil; eucalyptus citriodora oil; eucalyptus oil (cineole type); fennel oil; fir needle oil; galbanum oil; galbanum resin; geranium oil; grapefruit oil; guaiacwood oil; gurjun balsam; gurjun balsam oil; helichrysum absolute; helichrysum oil; ginger oil; iris root absolute; iris root oil; jasmine absolute; calamus oil; blue camomile oil; Roman

camomile oil; carrot seed oil; cascarilla oil; pine needle oil; spearmint oil; caraway oil; labdanum oil; labdanum absolute; labdanum resin; lavandin absolute; lavandin oil; lavender absolute; lavender oil; lemon-grass oil; lovage oil; lime oil distilled; lime oil expressed; linaloe oil; Litsea cubeba oil; laurel leaf oil; mace oil; marjoram oil; mandarin oil; massoi (bark) oil; mimosa absolute; ambrette seed oil; musk tincture; clary sage oil; nutmeg oil; myrrh absolute; myrrh oil; myrtle oil; clove leaf oil; clove bud oil; neroli oil; olibanum absolute; olibanum oil; opopanax oil; orange flower absolute; orange oil; origanum oil; palmarosa oil; patchouli oil; perilla oil; Peru balsam oil; parsley leaf oil; parsley seed oil; petitgrain oil; peppermint oil; pepper oil; pimento oil; pine oil; pennyroyal oil; rose absolute; rosewood oil; rose oil; rosemary oil; Dalmatian sage oil; Spanish sage oil; sandalwood oil; celery seed oil; spike-lavender oil; star anise oil; storax oil; tagetes oil; fir needle oil; tea tree oil; turpentine oil; thyme oil; Tolu balsam; tonka bean absolute; tuberose absolute; vanilla extract; violet leaf absolute; verbena oil; vetiver oil; juniperberry oil; wine lees oil; wormwood oil; wintergreen oil; ylang-ylang oil; hyssop oil; civet absolute; cinnamon leaf oil; cinnamon bark oil; and fractions thereof or ingredients isolated therefrom; individual fragrance ingredients from the group comprising hydrocarbons, such as for example 3-carene;  $\alpha$ -pinene;  $\beta$ -pinene;  $\alpha$ -terpinene;  $\gamma$ -terpinene; p-cymene; bisabolene; camphene; caryophyllene; cedrene; farnesene; limonene; longifolene; myrcene; ocimene; valencene; (E,Z)-1,3,5-undecatriene; styrene; diphenylmethane; aliphatic alcohols, such as for example hexanol; octanol; 3-octanol; 2,6-dimethyl-heptanol; 2-methyl-2-heptanol, 2-methyl-2-octanol; (E)-2-hexenol; (E)-and (Z)-3-hexenol; 1-octen-3-ol; a mixture of 3,4,5, 6,6-pentamethyl-3/4-hepten-2-ol and 3,5,6,6-tetramethyl-4-methylenheptan-2-ol; (E,Z)-2,6-nonadienol; 3,7-dimethyl-7-methoxyoctan-2-ol; 9-decenol; 10-undecenol; 4-methyl-3-decen-5-ol; aliphatic aldehydes and their acetals such as for example hexanal; heptanal; octanal; nonanal; decanal; undecanal; dodecanal; tridecanal; 2-methyloctanal; 2-methylnonanal; (E)-2-hexenal; (Z)-4-heptenal; 2,6-dimethyl-5-heptenal; 10-undecenal; (E)-4-decenal; 2-dodecenal; 2,6,10-trimethyl-5,9-undecadienal; heptanal-diethylacetal; 1,1-dimethoxy-2,2,5-trimethyl-4-hexene; citronellyl oxyacetaldehyde; aliphatic ketones and oximes thereof, such as for example 2-heptanone; 2-octanone; 3-octanone; 2-nonanone; 5-

methyl-3-heptanone; 5-methyl-3-heptanone oxime; 2,4,4,7-tetramethyl-6-octen-3-one; aliphatic sulfur-containing compounds, such as for example 3-methylthiohexanol; 3-methylthiohexyl acetate; 3-mercaptophexanol; 3-mercaptophexyl acetate; 3-mercaptophexyl butyrate; 3-acetylthiohexyl acetate; 1-menthene-8-thiol; aliphatic nitriles, such as for example 2-nonenenitrile; 2-tridecenenitrile; 2,12-tridecenenitrile; 3,7-dimethyl-2,6-octadienenitrile; 3,7-dimethyl-6-octenenitrile; aliphatic carboxylic acids and esters thereof, such as for example (E)-and (Z)-3-hexenylformate; ethyl acetoacetate; isoamyl acetate; hexyl acetate; 3,5,5-trimethylhexyl acetate; 3-methyl-2-butenyl acetate; (E)-2-hexenyl acetate; (E)-and (Z)-3-hexenyl acetate; octyl acetate; 3-octyl acetate; 1-octen-3-yl acetate; ethyl butyrate; butyl butyrate; isoamyl butyrate; hexylbutyrate; (E)-and (Z)-3-hexenyl isobutyrate; hexyl crotonate; ethylisovalerate; ethyl-2-methyl pentanoate; ethyl hexanoate; allyl hexanoate; ethyl heptanoate; allyl heptanoate; ethyl octanoate; ethyl-(E,Z)-2,4-decadienoate; methyl-2-octinate; methyl-2-noninate; allyl-2-isoamyl oxyacetate; methyl-3,7-dimethyl-2,6-octadienoate; acyclic terpene alcohols, such as, for example, citronellol; geraniol; nerol; linalool; lavandulol; nerolidol; farnesol; tetrahydrolinalool; tetrahydrogeraniol; 2,6-dimethyl-7-octen-2-ol; 2,6-dimethyloctan-2-ol; 2-methyl-6-methylene-7-octen-2-ol; 2,6-dimethyl-5,7-octadien-2-ol; 2,6-dimethyl-3,5-octadien-2-ol; 3,7-dimethyl-4,6-octadien-3-ol; 3,7-dimethyl-1,5,7-octatrien-3-ol 2,6-dimethyl-2,5,7-octatrien-1-ol; as well as formates, acetates, propionates, isobutyrate, butyrates, isovalerates, pentanoates, hexanoates, crotonates, tiglinates and 3-methyl-2-butenates thereof; acyclic terpene aldehydes and ketones, such as, for example, geranial; neral; citronellal; 7-hydroxy-3,7-dimethyloctanal; 7-methoxy-3,7-dimethyloctanal; 2,6,10-trimethyl-9-undecenal;  $\alpha$ -sinensal;  $\beta$ -sinensal; geranylacetone; as well as the dimethyl-and diethylacetals of geranial, neral and 7-hydroxy-3,7-dimethyloctanal; cyclic terpene alcohols, such as, for example, menthol; isopulegol; alpha-terpineol; terpinen-4-ol; menthan-8-ol; menthan-1-ol; menthan-7-ol; borneol; isoborneol; linalool oxide; nopol; cedrol; ambrinol; vetiverol; guaiol; and the formates, acetates, propionates, isobutyrate, butyrates, isovalerates, pentanoates, hexanoates, crotonates, tiglinates and 3-methyl-2-butenates of alpha-terpineol; terpinen-4-ol; methan-8-ol; methan-1-ol; methan-7-ol; borneol; isoborneol; linalool oxide; nopol; cedrol;

ambrinol; vetiverol; guaiol; cyclic terpene aldehydes and ketones, such as, for example, menthone; isomenthone; 8-mercaptomenthan-3-one; carvone; camphor; fenchone; alpha-ionone; beta-ionone; alpha-n-methylionone; beta-n-methylionone; alpha-isomethylionone; beta-isomethylionone; alpha-irone; alpha-damascone; beta-damascone; beta-danascenone; delta-damascone; gamma-damascone; 1-(2,4,4-trimethyl-2-cyclohexen-1-yl)-2-buten-1-one; 1,3,4,6,7, 8a-hexahydro-1,1,5,5-tetramethyl-2H-2,4a-methanonaphthalen-8(5H)-one; nootkatone; dihydronootkatone; acetylated cedarwood oil (cedryl methyl ketone); cyclic alcohols, such as, for example, 4-tert.-butylcyclohexanol; 3,3,5-trimethylcyclohexanol; 3-isocamphylcyclohexanol; 2,6,9-trimethyl-Z2,Z5,E9-cyclododecatrien-1-ol; 2-isobutyl-4-methyltetrahydro-2H-pyran-4-ol; cycloaliphatic alcohols, such as, for example, alpha,3,3-trimethylcyclo-hexyl-methanol; 2-methyl-4-(2,2,3-trimethyl-3-cyclopent-1-yl)butanol; 2-methyl-4-(2,2,3-trimethyl-3-cyclopent-1-yl)-2-buten-1-ol; 2-ethyl-4-(2,2,3-trimethyl-3-cyclopent-1-yl)-2-buten-1-ol; 3-methyl-5-(2,2, 3-trimethyl-3-cyclopent-1-yl)-pentan-2-ol; 3-methyl-5-(2,2,3-trimethyl-3-cyclopent-1-yl)-4-penten-2-ol; 3,3-dimethyl-5-(2,2,3-trimethyl-3-cyclopent-1-yl)-4-penten-2-ol; 1-(2,2,6-trimethylcyclohexyl)pentan-3-ol; 1-(2,2,6-trimethylcyclohexyl)hexan-3-ol; cyclic and cycloaliphatic ethers, such as, for example, cineole; cedryl methyl ether; cyclododecyl methyl ether; (ethoxymethoxy) cyclododecane; alpha-cedrene epoxide; 3a,6,6,9a-tetramethyldodecahydronaphtho[2,1-b]furan; 3a-ethyl-6,6,9a-trimethyldodecahydronaphtho[2,1-b]furan; 1,5,9-trimethyl-13-oxabicyclo[10.1.0]-trideca-4,8-diene; rose oxide; 2-(2,4-dimethyl-3-cyclohexen-1-yl)-5-methyl-5-(1-methyl-propyl)-1,3-dioxan; cyclic ketones, such as, for example, 4-tert.-butylcyclohexanone; 2,2,5-trimethyl-5-pentylcyclopentanone; 2-heptylcyclopentanone; 2-pentylcyclopentanone; 2-hydroxy-3-methyl-2-cyclopenten-1-one; 3-methyl-cis-2-penten-1-yl-2-cyclopenten-1-one; 3-methyl-2-pentyl-2-cyclopenten-1-one; 3-methyl-4-cyclopentadecenone; 3-methyl-5-cyclopentadecenone; 3-methylcyclopentadecanone; 4-(1-ethoxyvinyl)-3,3,5,5-tetramethylcyclo-hexanone; 4-tert.-pentylcyclohexanone; 5-cyclohexadecen-1-one; 6,7-dihydro-1,1,2,3,3-pentamethyl-4(5H)-indanone; 5-cyclohexadecen-1-one; 8-cyclohexadecen-1-one; 9-cycloheptadecen-1-one; cyclopentadeca-none; cycloaliphatic aldehydes, such as, for example, 2,4-dimethyl-3-cyclohexene

carbaldehyde; 2-methyl-4-(2,2,6-trimethyl-cyclohexen-1-yl)-2-butenal; 4-(4-hydroxy-4-methylpentyl)-3-cyclohexene carbaldehyde; 4-(4-methyl-3-penten-1-yl)-3-cyclohexene carbaldehyde; cycloaliphatic ketones, such as, for example, 1-(3,3-dimethylcyclohexyl)-4-penten-1-one; 1-(5,5-dimethyl-1-cyclohexen-1-yl)-4-penten-1-one; 2,3,8,8-tetramethyl-1,2,3,4,5,6,7,8-octahydro-2-naphthalenyl methyl ketone; methyl-2,6,10-trimethyl-2,5,9-cyclododecatrienyl ketone; tert.-butyl-(2,4-dimethyl-3-cyclohexen-1-yl)ketone; esters of cyclic alcohols, such as, for example, 2-tert.-butylcyclohexyl acetate; 4-tert.-butylcyclohexyl acetate; 2-tert.-pentylcyclohexyl acetate; 4-tert.-pentylcyclohexyl acetate; decahydro-2-naphthyl acetate; 3-pentyltetrahydro-2H-pyran-4-yl acetate; decahydro-2,5, 5,8a-tetramethyl-2-naphthyl acetate; 4,7-methano-3a,4,5,6,7,7a-hexa-hydro-5 or 6-indenyl acetate; 4,7-methano-3a,4,5,6,7,7a-hexahydro-5 or 6-indenyl propionate; 4,7-methano-3a,4,5,6,7,7a-hexahydro-5 or 6-indenyl isobutyrate; 4,7-methanooctahydro-5 or 6-indenyl acetate; esters of cycloaliphatic carboxylic acids, such as, for example, allyl 3-cyclohexylpropionate; allyl cyclohexyl oxyacetate; methyl dihydrojasmonate; methyl jasmonate; methyl 2-hexyl-3-oxocyclopentanecarboxylate; ethyl 2-ethyl-6,6-dimethyl-2-cyclohexenecarboxylate; ethyl 2,3,6,6-tetramethyl-2-cyclohexenecarboxylate; ethyl 2-methyl-1,3-dioxolane-2-acetate; araliphatic alcohols, such as, for example, benzyl alcohol; 1-phenylethyl alcohol; 2-phenylethyl alcohol; 3-phenylpropanol; 2-phenylpropanol; 2-phenoxyethanol; 2,2-dimethyl-3-phenylpropanol; 2,2-dimethyl-3-(3-methylphenyl)propanol; 1,1-dimethyl-2-phenylethyl alcohol; 1,1-dimethyl-3-phenylpropanol; 1-ethyl-1-methyl-3-phenylpropanol; 2-methyl-5-phenylpentanol; 3-methyl-5-phenylpentanol; 3-phenyl-2-propen-1-ol; 4-methoxybenzyl alcohol; 1-(4-isopropylphenyl)ethanol; esters of araliphatic alcohols and aliphatic carboxylic acids, such as, for example, benzyl acetate; benzyl propionate; benzyl isobutyrate; benzyl isovalerate; 2-phenylethyl acetate; 2-phenylethyl propionate; 2-phenylethyl isobutyrate; 2-phenylethyl isovalerate; 1-phenylethyl acetate; alpha-trichloromethylbenzyl acetate; alpha,alpha-dimethylphenylethyl acetate; alpha,alpha-dimethylphenylethyl butyrate; cinnamyl acetate; 2-phenoxyethyl isobutyrate; 4-methoxybenzyl acetate; araliphatic ethers, such as for example 2-phenylethyl methyl ether; 2-phenylethyl isoamyl ether; 2-phenylethyl-1-ethoxyethyl ether; phenylace-

taldehyde dimethyl acetal; phenylacetaldehyde diethyl acetal; hydratropaaldehyde dimethyl acetal; phenylacetaldehyde glycerol acetal; 2, 4,6-trimethyl-4-phenyl-1,3-dioxane; 4,4a,5,9b-tetrahydroindeno[1,2-d]-m-dioxin; 4,4a,5,9b-tetrahydro-2,4-dimethylindeno[1,2-d]-m-dioxin; aromatic and araliphatic aldehydes, such as, for example, benzaldehyde; phenylacetaldehyde; 3-phenylpropanal; hydratropaldehyde; 4-methylbenzaldehyde; 4-methyl-phenylacetaldehyde; 3-(4-ethylphenyl)-2,2-dimethylpropanal; 2-methyl-3-(4-isopropylphenyl)propanal; 2-methyl-3-(4-tert.-butylphenyl)propanal; 3-(4-tert.-butyl-phenyl)propanal; cinnamaldehyde; alpha-butylcinnamaldehyde; alpha-amylcinnamaldehyde; alpha-hexylcinnamaldehyde; 3-methyl-5-phenylpentanal; 4-methoxybenzaldehyde; 4-hydroxy-3-methoxybenzaldehyde; 4-hydroxy-3-ethoxybenzaldehyde; 3,4-methylene-dioxybenzaldehyde; 3,4-dimethoxybenzaldehyde; 2-methyl-3-(4-methoxyphenyl)propanal; 2-methyl-3-(4-methylendioxyphenyl)propanal; aromatic and araliphatic ketones, such as, for example, acetophenone; 4-methylacetophenone; 4-methoxyacetophenone; 4-tert.-butyl-2,6-dimethylacetophenone; 4-phenyl-2-butanone; 4-(4-hydroxyphenyl)-2-butanone; 1-(2-naphthalenyl)ethanone; benzophenone; 1,1,2,3,3,6-hexamethyl-5-indanyl methyl ketone; 6-tert.-butyl-1,1-dimethyl-4-indanyl methyl ketone; 1-[2,3-dihydro-1,1,2,6-tetramethyl-3-(1-methyl-ethyl)-1H-5-indenyl]ethanone; 5',6',7',8'-tetrahydro-3',5',5',6',8',8'-hexamethyl-2-acetonaphthone; aromatic and araliphatic carboxylic acids and esters thereof, such as, for example, benzoic acid; phenylacetic acid; methyl benzoate; ethyl benzoate; hexyl benzoate; benzyl benzoate; methyl phenylacetate; ethyl phenylacetate; geranyl phenylacetate; phenylethyl phenylacetate; methyl cinnamate; ethyl cinnamate; benzyl cinnamate; phenylethyl cinnamate; cinnamyl cinnamate; allyl phenoxyacetate; methyl salicylate; isoamyl salicylate; hexyl salicylate; cyclohexyl salicylate; cis-3-hexenyl salicylate; benzyl salicylate; phenylethyl salicylate; methyl 2,4-dihydroxy-3,6-dimethylbenzoate; ethyl 3-phenylglycidate; ethyl 3-methyl-3-phenylglycidate; nitrogen-containing aromatic compounds, such as, for example, 2,4,6-trinitro-1,3-dimethyl-5-tert-butylbenzene; 3,5-dinitro-2,6-dimethyl-4-tert.-butylacetophenone; cinnamionitrile; 5-phenyl-3-methyl-2-pentenitrile; 5-phenyl-3-methylpentanonitrile; methyl anthranilate; methy-N-methylantranilate; Schiff's bases of methyl anthranilate with 7-hydroxy-

3,7-dimethyloctanal, 2-methyl-3-(4-tert.-butylphenyl)-propanal or 2,4-dimethyl-3-cyclohexene carbaldehyde; 6-isopropylquinoline; 6-isobutylquinoline; 6-sec.-butylquinoline; indole; skatole; 2-methoxy-3-isopropyl-pyrazine; 2-isobutyl-3-methoxypyrazine; phenols, phenyl ethers and phenyl esters, such as, for example, estragole; anethole; eugenol; eugenyl methyl ether; isoeugenol; isoeugenol methyl ether; thymol; carvacrol; diphenyl ether; beta-naphthyl methyl ether; beta-naphthyl ethyl ether; beta-naphthyl isobutyl ether; 1, 4-dimethoxybenzene; eugenyl acetate; 2-methoxy-4-methylphenol; 2-ethoxy-5-(1-propenyl)phenol; p-cresyl phenylacetate; heterocyclic compounds, such as, for example, 2,5-dimethyl-4-hydroxy-2H-furan-3-one; 2-ethyl-4-hydroxy-5-methyl-2H-furan-3-one; 3-hydroxy-2-methyl-4H-pyran-4-one; 2-ethyl-3-hydroxy-4H-pyran-4-one; lactones, such as, for example, 1,4-octanolide; 3-methyl-1, 4-octanolide; 1,4-nonanolide; 1,4-decanolide; 8-decen-1,4-olide; 1,4-undecanolide; 1,4-dodecanolide; 1,5-decanolide; 1,5-dodecanolide; 1,15-pentadecanolide; cis-and trans-11-pentadecen-1,15-olide; cis-and trans-12-pentadecen-1,15-olide; 1,16-hexadecanolide; 9-hexadecen-1,16-olide; 10-oxa-1,16-hexadecanolide; 11-oxa-1,16-hexadecanolide; 12-oxa-1,16-hexadecanolide; ethylene-1,12-dodecanedioate; ethylene-1,13-tridecanedioate; coumarin; 2,3-dihydrocoumarin; octahydrocoumarin.

**[0094]** Especially suitable lemon fragrances are limonenal (3-(4-methyl-3-cyclohexenyl)butanal), limonene (4-isopropenyl-1-methylcyclohexene), lemon oil, and lemonal (3,7-dimethyl-2,6-octadienal).

**[0095]** Malodors are usually caused by particularly odorous substances which are, however, frequently only present in trace amounts. Such substances include, for example, nitrogen-containing compounds such as ammonia and amines, heterocyclic compounds such as pyridines, pyrazines, indoles, etc. and sulfur-containing compounds such as hydrogen sulfide, mercaptans, sulfides, acidic compounds such as acetic acid, butyric acid and fatty acids, and aldehyde compounds such as acetaldehyde and formaldehyde. The masking of malodors is a problem, which is difficult to handle and solve with perfume compositions. The specific unique quality of a malodor greatly restricts the use of perfumes having the various types of

commonly known fragrances. Usually, it is only possible to mask malodors by means of a specially developed perfume oil having a very specific type of fragrance. Active ingredients are, therefore, particularly advantageous when they are capable of reducing the intensity of malodors without themselves possessing any significantly intense odor or fragrance. Such active ingredients do not mask malodors but neutralize them. This has the advantage that when using such active ingredients for perfuming objects or products with malodors, perfume oils of any desired type of fragrance can be used. The consumer can, therefore, be offered a considerably broader range of fragrance types for combating malodors. In addition, active ingredients, which neutralize malodors, provide the possibility of reducing the quantity of perfume oil previously required for masking odors. It is also possible to use less intensely odorous perfumes for combating malodors than those so far employed, which sometimes have an overpowering effect due to their high intensity.

**[0096]** Suitable malodor control compounds are the general classification of musk compounds. These include Galaxolide™ (1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethylcyclopenta-2-benzopyran), Traseolide™ (6-acetyl-1-isopropyl-2,3,3,5-tetramethylindane), Ambrettolide (cyclohexadecen-7-olide), Celestolide (4-Acetyl-6-tert-butyl-1,1-dimethylindane), Dihydroambrettolide (cyclohexadecanolide), Ethylene brassylate (cyclo-1,13-ethylenedioxy-tridecan-1,13-dione), Exaltolide (cyclopentadecanolide), Exaltone (cyclopentadecanone), Moskene (1,1,3,3,5-Pentamethyl-4,6-dinitroindane), Musk ambrette (2,4-dinitro-3-methyl-6-tert-butylanisole), Musk Ketone (4-tert-butyl-3,5-dinitro-2,6-dimethylacetophenone), Musk MC4 (ethylene 1,12-dodecanedioate), Musk R1 (11-Oxahexadecanolide), Musk tibetine (2-tert-butyl-1,3-dinitro-4,5,6-trinitrobenzene), Musk xylol (1-tert-butyl-3,5-dimethyl-2,4,6-trinitrobenzene), Phentolide (5-Acetyl-1,1,2,3,3,6-hexamethylindane), Tonalid (1,1,2,4,4,7-hexamethyl-6-acetyl-1,2,3,4-tetrahydronaphthalene), versalide (1,1,4,4-tetramethyl-6-acetyl-7-ethyl-1,2,3,4-tetrahydronaphthalene).

**[0097]** Additional suitable malodor control agents are found in WO2009/131748 to Conover, describing a multiple component compound containing a molecular encapsulator, Ordenone, and an aromatic complex, such as citronellal and

hydroxycitronella. Additional useful compounds are aldehydes and their complexes, such as aldehydes and complexes of decanal; undecanal; dodecanal; undecene-10-al; 2-methyl-undecanal; 2,3,5,5-tetramethylhexanal; 1-formyl-2,4-dimethyl-2-cyclohexene; 1-formyl-3,5-dimethyl-4-cyclohexene; 1-formyl-2,3,5-trimethyl-4-cyclohexene; 1-formyl-2,4,6-trimethyl-3-cyclohexene; ([5.2.1.0]-tricyclo-8-decylidene)-4-butanal; 2,6,10-trimethyl-9-undecenal; (4-methyl-3-pentenyl)-cyclohexene-3-yl carboxaldehyde; 7-formyl-5-isopropyl-2-methyl-[2.2.2]-bicyclo-2-octene; 2-formyl-8-dimethyl-1,2,3,4,5,6,7,8-octahydronaphthalene; citronellal; campholenic aldehyde;  $\alpha$ -methyl-3,4-methylenedioxyhydrocinnamic aldehyde; cyclamen aldehyde; lilial; canthoxal; phenylacetic aldehyde; 3-phenylpropionic aldehyde; hydratropic aldehyde;  $\alpha$ -methyl-3,4-methylenedioxyhydrocinnamic aldehyde; 3-phenylpropionic aldehyde; hydratropic aldehyde; alkoxyacetaldehydes;  $\omega$ -hydroxyaldehydes; myrtenal; perilla aldehyde; substituted 2-furyl carboxaldehydes; cinnamic aldehyde; amylcinnamic aldehyde; hexylcinnamic aldehyde; benzaldehyde; anisic aldehyde; heliotropine; veratric aldehyde; vanillin; isovanillin; and ethylvanillin. Suitable nitriles are described in U.S. Pat. 6,180,814 to Giersch and WO2008/026140 to Tranzeat such as 3-phenyl-2-propenenitrile, citronitrile, geranyl nitrile, citronellyl nitrile, 2-propyl-1-heptanenitrile, dodecanenitrile, 3-(2,3-dimethyl-2(3)-cyclopenten-1-yl)butanenitrile and 3-(2-methyl-3-methylene-1-cyclopentyl)butanenitrile. Additional suitable malodor control agents are found in U.S. Pat. 6,432,891 to O'Connor and include cyclohexyl and phenoxy substituted esters, such as 1-cyclohexyl-ethyl-butyrate, 1-cyclohexyl-ethyl-acetate, 1-cyclohexyl-ethanol, 4-isopropyl-cyclohexyl-propionate, phenoxyacetic acid 2-hydroxy-ethyl ester.

**[0098]** The film may include a fragrance release inhibitor in the same layer as the fragrance and malodor control agents. A typical fragrance release inhibitor is titanium dioxide. Additional fragrance release inhibitors include starch, clays and nanoclays, talc, and microcapsules.

**[0099]** All references, including publications, patent applications, and patents, cited herein are hereby incorporated by reference to the same extent as if each

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

**[00100]** 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 can 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.

**[00101]** Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations of those preferred embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors 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.

## WE CLAIM

1. A thermoplastic bag comprising:
  - a first sidewall of pliable thermoplastic material;
  - a second sidewall of pliable thermoplastic material overlaying and joined to the first sidewall along a first side edge, an opposite second side edge, and a bottom edge extending between the first and second side edges to provide an interior volume, the interior volume accessible by an opening provided by first and second top edges of the respective first and second sidewalls;
    - wherein the length of the first and second top edges in the relaxed state are less than the length of the bottom edge;
    - a draw tape in a first hem formed proximate the first top edge, the draw tape attached to the bag at the first and second side edges, a second draw tape in a second hem formed proximate the second top edge, the second draw tape attached to the bag at the first and second side edges;
    - wherein the first and second hems enclose a hem area and the hem area comprises a fragrance.
2. The thermoplastic bag of claim 1, wherein the hem area additionally comprises a malodor control agent.
3. The thermoplastic bag of claim 1, wherein the hem area additionally comprises a fragrance release inhibitor.
4. The thermoplastic bag of claim 1, wherein the fragrance is concentrated in the hem area.
5. The thermoplastic bag of claim 1, wherein the fragrance comprises greater than 20 percent fragrance ingredients with ClogP of greater than 4.
6. A thermoplastic bag comprising:
  - a first sidewall of pliable thermoplastic material;
  - a second sidewall of pliable thermoplastic material overlaying and joined to the first sidewall along a first side edge, an opposite second side edge, and a bottom edge extending between the first and second side edges to provide an interior volume,

the interior volume accessible by an opening provided by first and second top edges of the respective first and second sidewalls;

wherein the bag includes a first hem and a draw tape in the first hem, wherein the hem is substantially enclosed from the interior volume;

wherein the length of the hem in the relaxed state is less than the length of the bottom edge; and

wherein the hem comprises a fragrance, a malodor control agent, and a fragrance release inhibitor

7. The thermoplastic bag of claim 6, wherein the hem has three or more layers of pliable thermoplastic material wherein the layers include an exterior layer, a central layer, and an interior layer wherein the central layer of the hem area comprises a fragrance, a malodor control agent, and a fragrance release inhibitor.

8. The thermoplastic bag of claim 6, wherein the fragrance comprises a compound selected from the group consisting of 1,1-Dimethoxy-2,2,5-trimethylhex-4-ene, N-methyl-N-phenyl-2-methylbutanamide, 1-p-methene-8-thiol, thiobenzoic acids, 2,4,6-trimethyl-4-phenyl-1,3-dioxane, 2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone, 2,4,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone, 2,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-3-enone, 2,6-Dimethyl-2-(3-methyl-but-2-enyl)-cyclohexanone, 1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 6-methoxy-1,5,6-trimethyl-5-(3-methyl-but-2-enyl)-cyclohexene, 1,2,4,6-Tetramethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-1-vinyl-cyclohex-2-enol, 2,6-Dimethyl-1-ethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohexa-2,4-dienol, and 2-(2,3-Dimethyl-but-2-enyl)-2,6-dimethyl-cyclohexanone and mixtures thereof.

9. The thermoplastic bag of claim 8, wherein the fragrance release inhibitor comprises titanium dioxide.

10. The thermoplastic bag of claim 6, wherein the fragrance comprises a compound selected from the group consisting of acetanisole, anisyl acetate, anisyl alcohol, anisyl propionate, benzoin, cinnamaldehyde, ethyl vanillin, 2-methoxy-4-methylphenol, 1-

(p-methoxyphenyl)-2-propanone, propenyl guaethol, veratraldehyde, vanillylacetone, vanillin isobutyrate, veratrole, acetovanillone and mixtures thereof.

11. The thermoplastic bag of claim 10, wherein the fragrance release inhibitor comprises titanium dioxide.

12. The thermoplastic bag of claim 6, wherein the malodor control agent comprises a musk compound.

13. The thermoplastic bag of claim 12, wherein the musk compound comprises a compound selected from the group consisting of 1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethylcyclopenta-2-benzopyran, 6-acetyl-1-isopropyl-2, 3,3,5-tetramethylindane, Ambrettolide (cyclohexadecen-7-olide), Celestolide (4-Acetyl-6-tert-butyl-1,1-dimethylindane), Dihydroambrettolide (cyclohexadecanolide), Ethylene brassylate (cyclo-1,13-ethylenedioxy-tridecan-1,13-dione), Exaltolide (cyclopentadecanolide), Exaltone (cyclopentadecanone), Moskene (1,1,3,3,5-Pentamethyl-4,6-dinitroindane), Musk ambrette (2,4-dinitro-3-methyl-6-tert-butylanisole), Musk Ketone (4-tert-butyl-3,5-dinitro-2,6-dimethylacetophenone), Musk MC4 (ethylene 1,12-dodecanedioate), Musk R1 (11-Oxahexadecanolide), Musk tibetine (2-tert-butyl-1,3-dinitro-4,5,6-trinitrobenzene), Musk xylol (1-tert-butyl-3,5-dimethyl-2,4,6-trinitrobenzene), Phentolide (5-Acetyl-1,1,2,3,3,6-hexamethylindane), Tonalid (1,1,2,4,4,7-hexamethyl-6-acetyl-1,2,3,4-tetrahydronaphthalene), versalide (1,1,4,4-tetramethyl-6-acetyl-7-ethyl-1,2,3,4-tetrahydronaphthalene), and combinations thereof.

14. A thermoplastic bag comprising:
- a first sidewall of pliable thermoplastic material;
  - a second sidewall of pliable thermoplastic material overlaying and joined to the first sidewall along a first side edge, an opposite second side edge, and a bottom edge extending between the first and second side edges to provide an interior volume, the interior volume accessible by an opening provided by first and second top edges of the respective first and second sidewalls;
  - a draw tape in a first hem formed proximate the first top edge, the draw tape attached to the bag at the first and second side edges, a second draw tape in a second hem formed proximate the second top edge, the second draw tape attached to the bag

at the first and second side edges, wherein one of the draw tapes comprises a fragrance.

15. The thermoplastic bag of claim 14, wherein the fragrance comprises a compound selected from the group consisting of 1,1-Dimethoxy-2,2,5-trimethylhex-4-ene, N-methyl-N-phenyl-2-methylbutanamide, 1-p-methene-8-thiol, thiobenzoic acids, 2,4,6-trimethyl-4-phenyl-1,3-dioxane, 2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclo-hex-2-enone, 2,4,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone, 2,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-3-enone, 2,6-Dimethyl-2-(3-methyl-but-2-enyl)-cyclohexanone, 1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 6-methoxy-1,5,6-trimethyl-5-(3-methyl-but-2-enyl)-cyclohexene, 1,2,4,6-Tetramethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-1-vinyl-cyclohex-2-enol, 2,6-Dimethyl-1-ethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol, 2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclo-hex-2-enol, 1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohexa-2,4-dienol, and 2-(2,3-Dimethyl-but-2-enyl)-2,6-dimethyl-cyclohexanone and mixtures thereof.

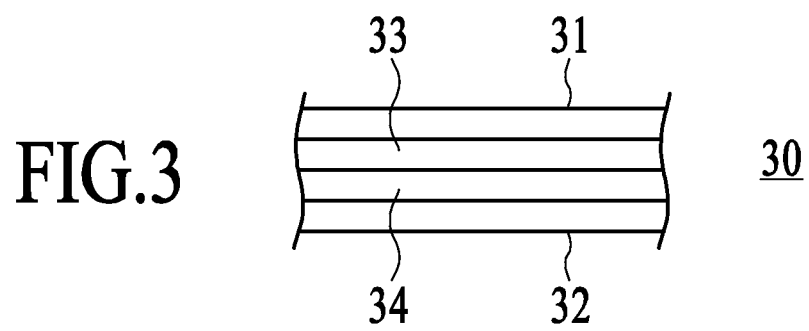
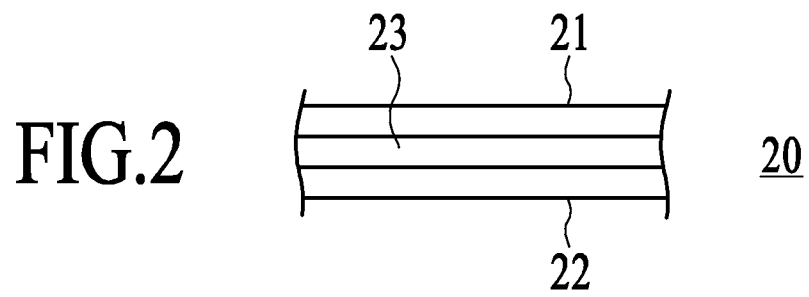
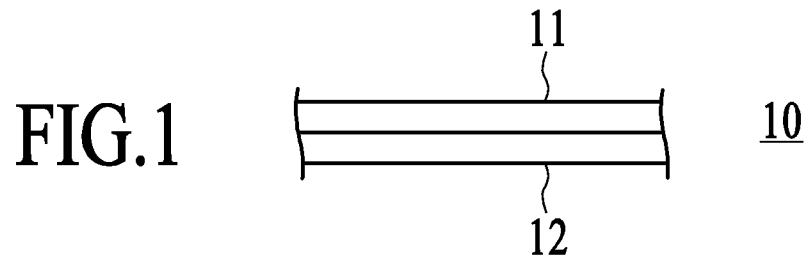
16. The thermoplastic bag of claim 14, wherein the fragrance comprises a compound selected from the group consisting of acetanisole, anisyl acetate, anisyl alcohol, anisyl propionate, benzoin, cinnamaldehyde, ethyl vanillin, 2-methoxy-4-methylphenol, 1-(p-methoxyphenyl)-2-propanone, propenyl guaethol, veratraldehyde, vanillylacetone, vanillin isobutyrate, veratrole, acetovanillone and mixtures thereof.

17. The thermoplastic bag of claim 14, wherein the draw tape additionally comprises a fragrance release inhibitor.

18. The thermoplastic bag of claim 17, wherein the fragrance release inhibitor comprises titanium dioxide.

19. The thermoplastic bag of claim 14, wherein the draw tape additionally comprises a malodor control agent.

20. The thermoplastic bag of claim 19, wherein the malodor control agent comprises a musk compound.



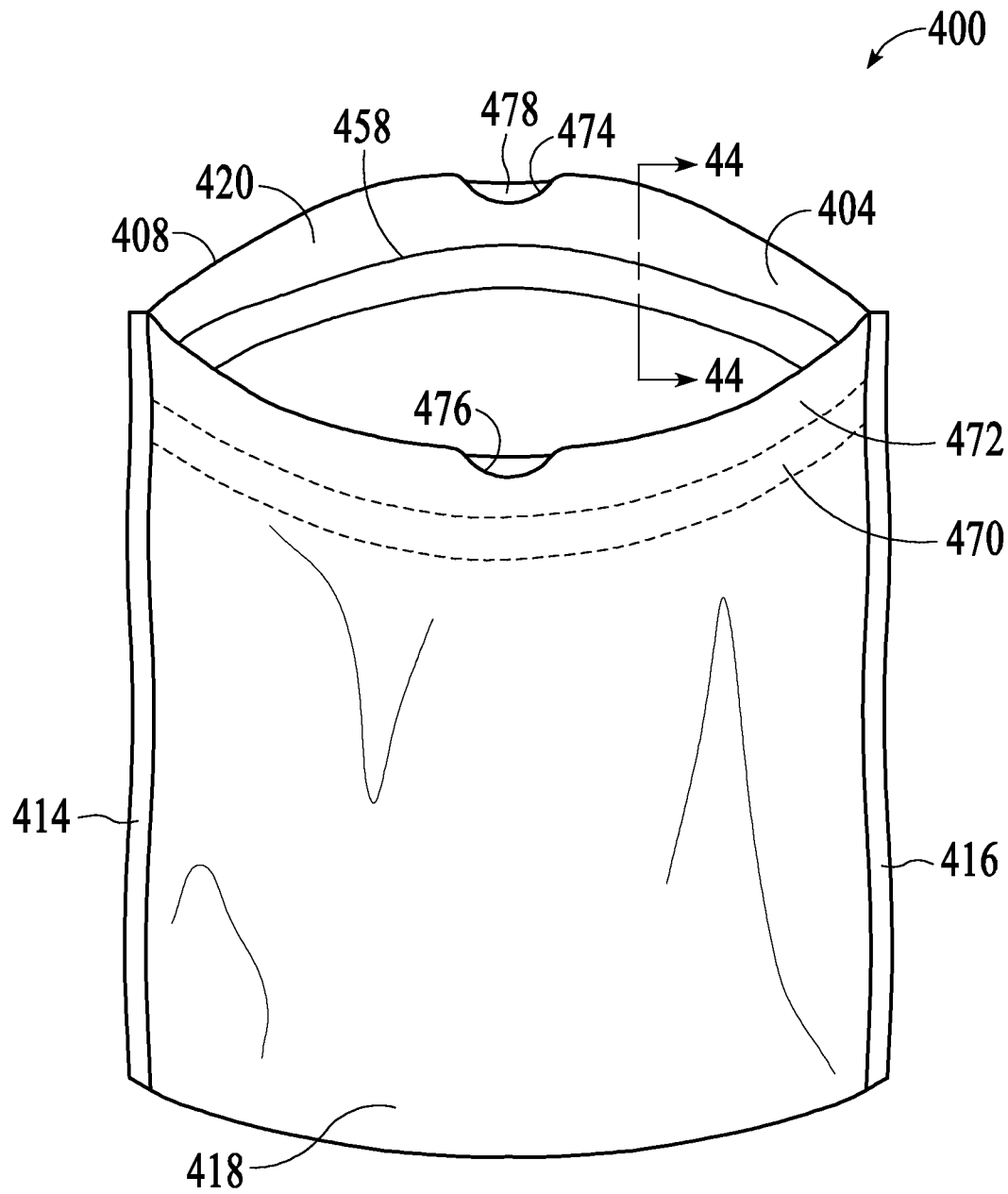
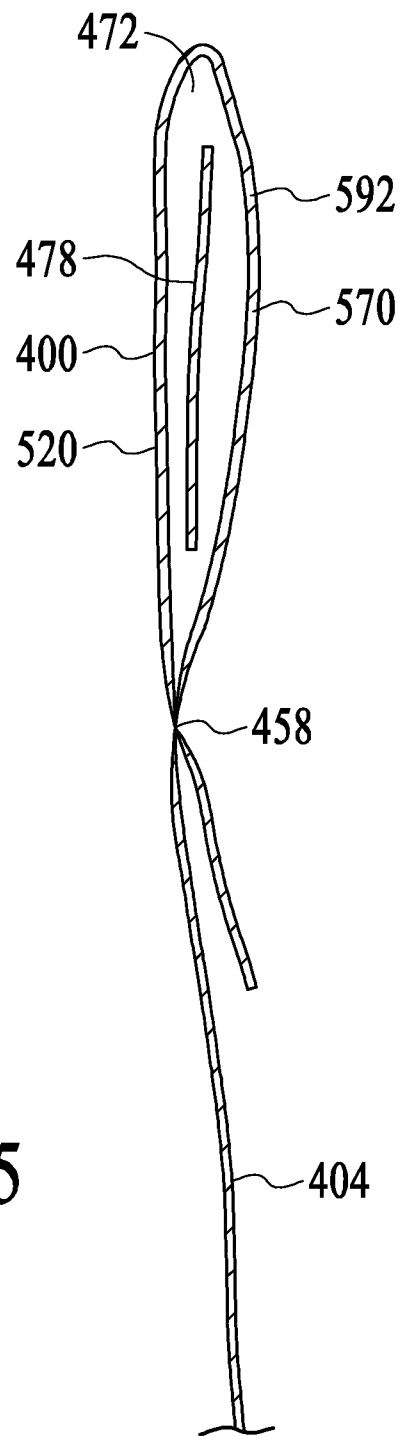


FIG.4



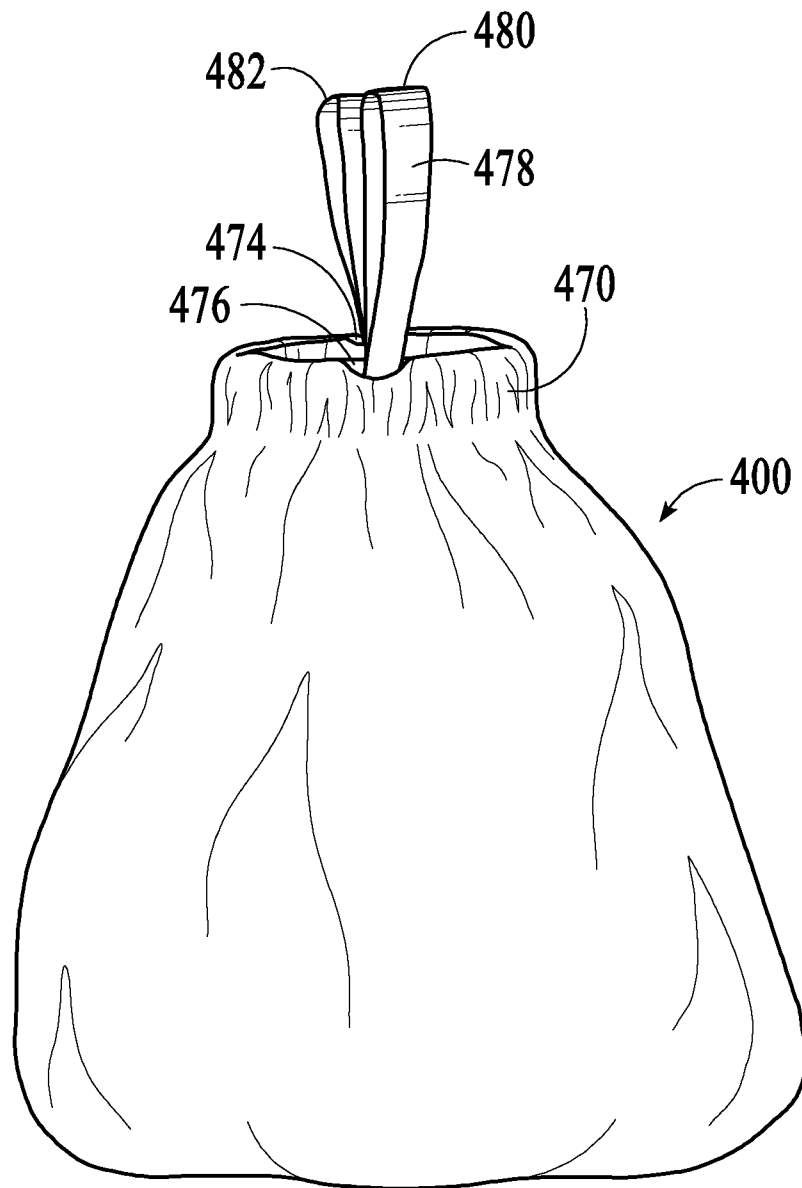


FIG. 6

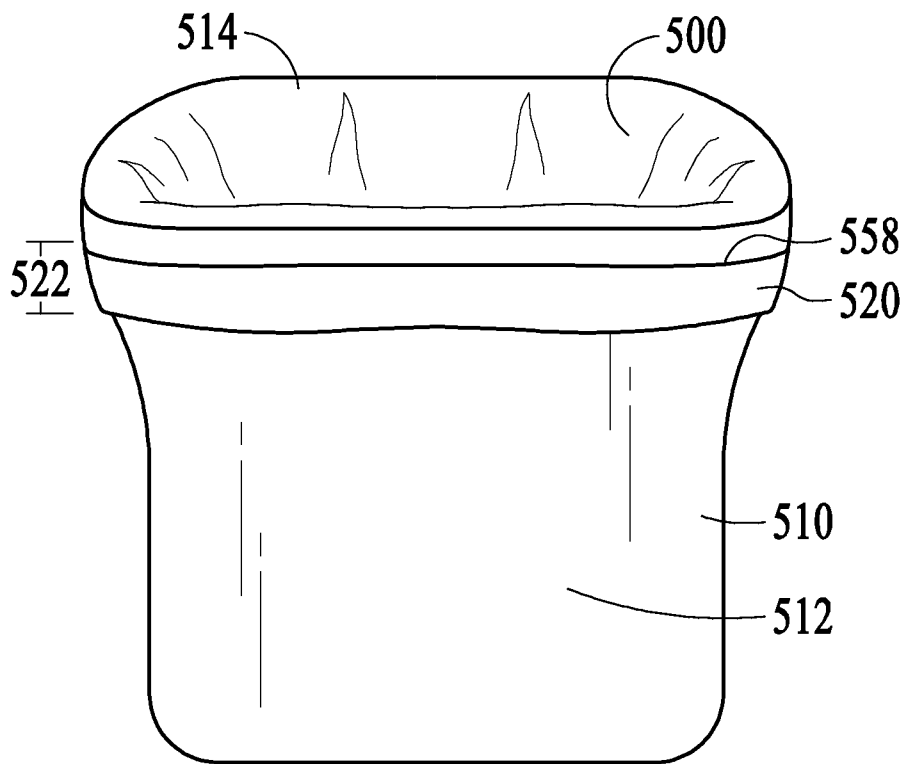


FIG. 7

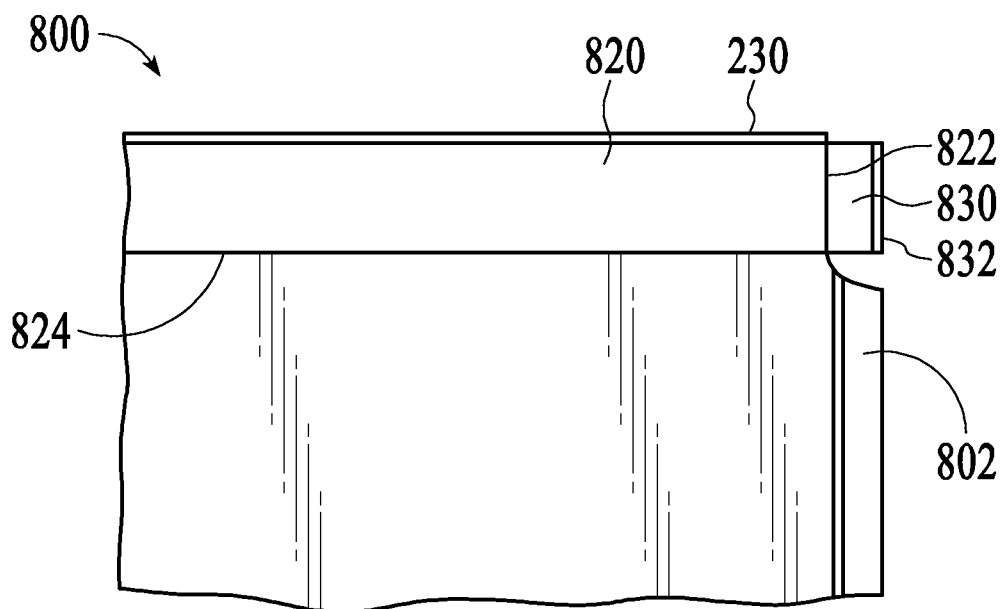


FIG. 8

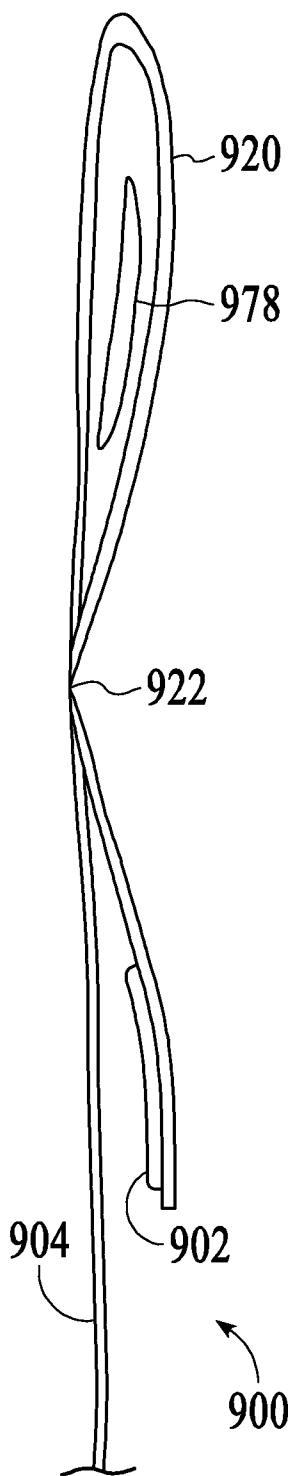


FIG. 9A

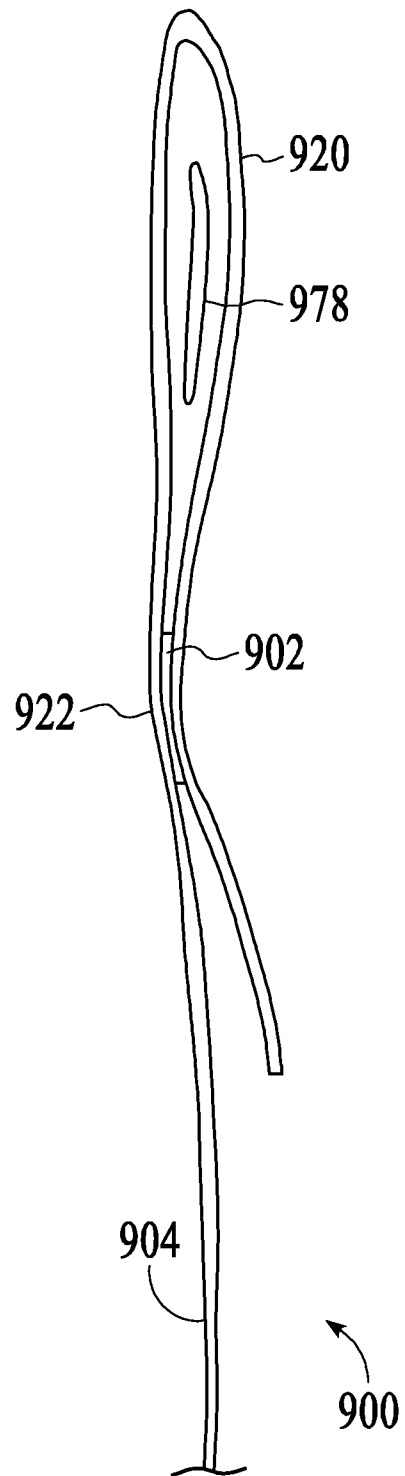


FIG. 9B

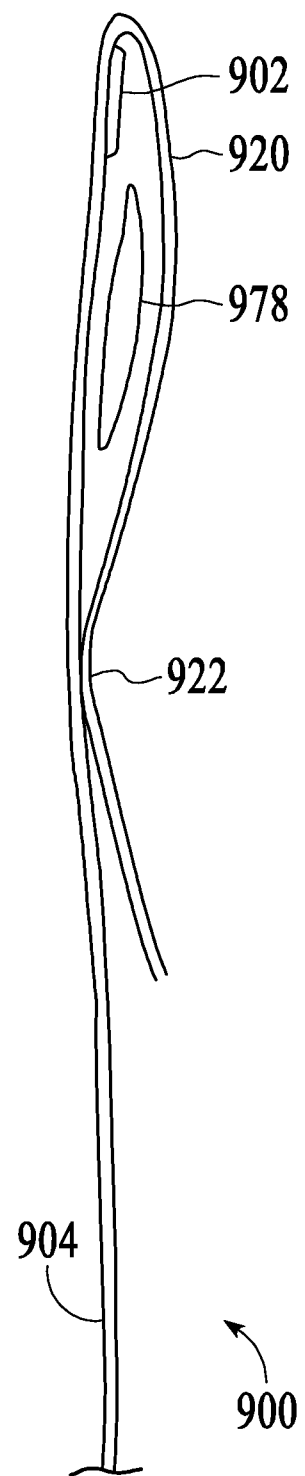


FIG. 9C

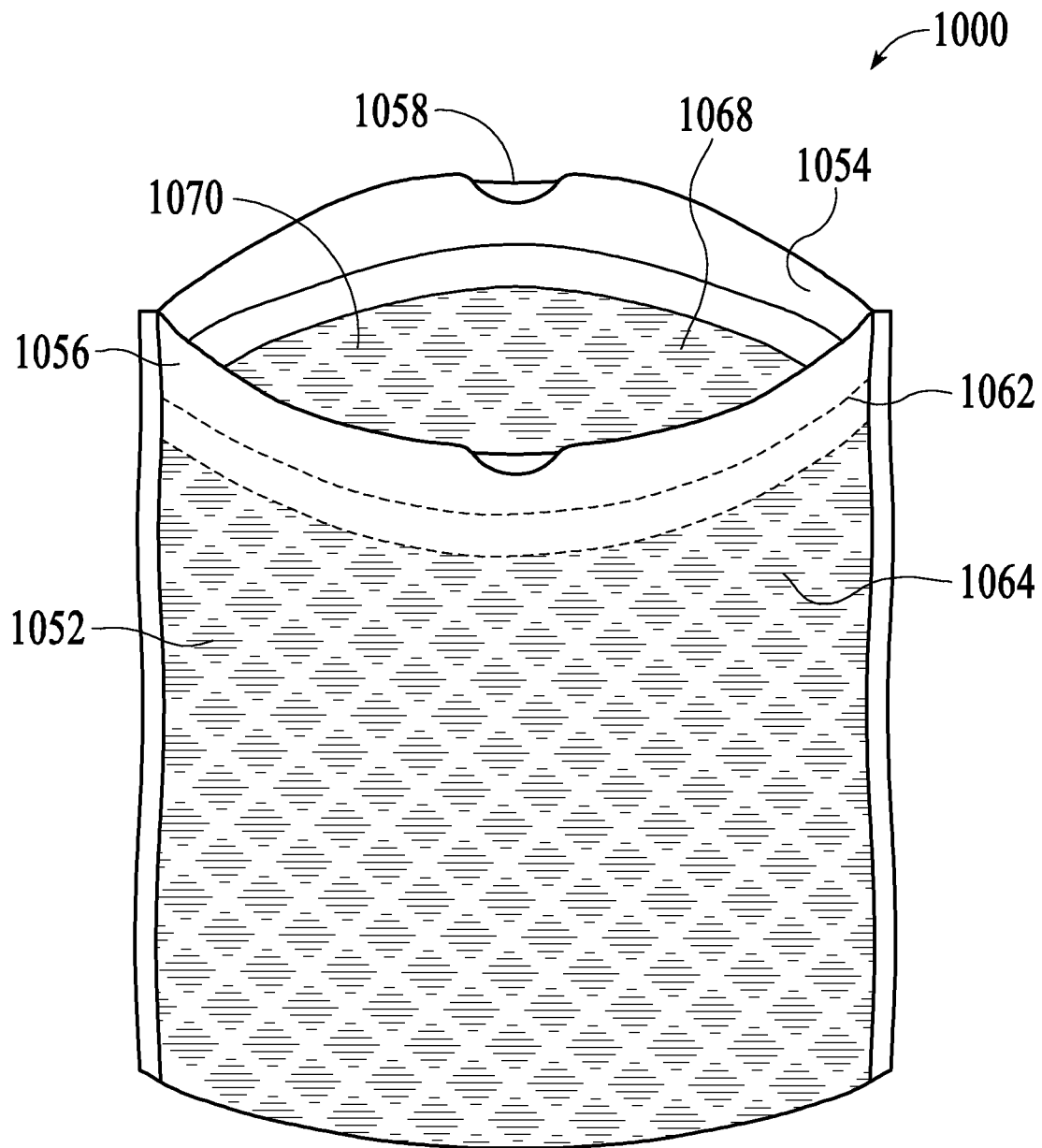


FIG.10

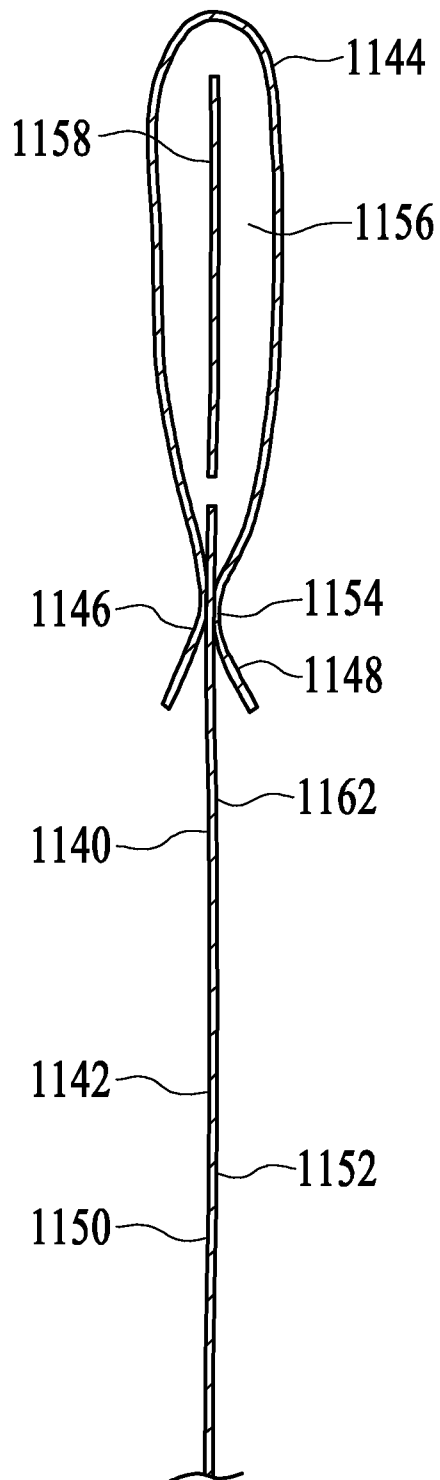


FIG. 11A

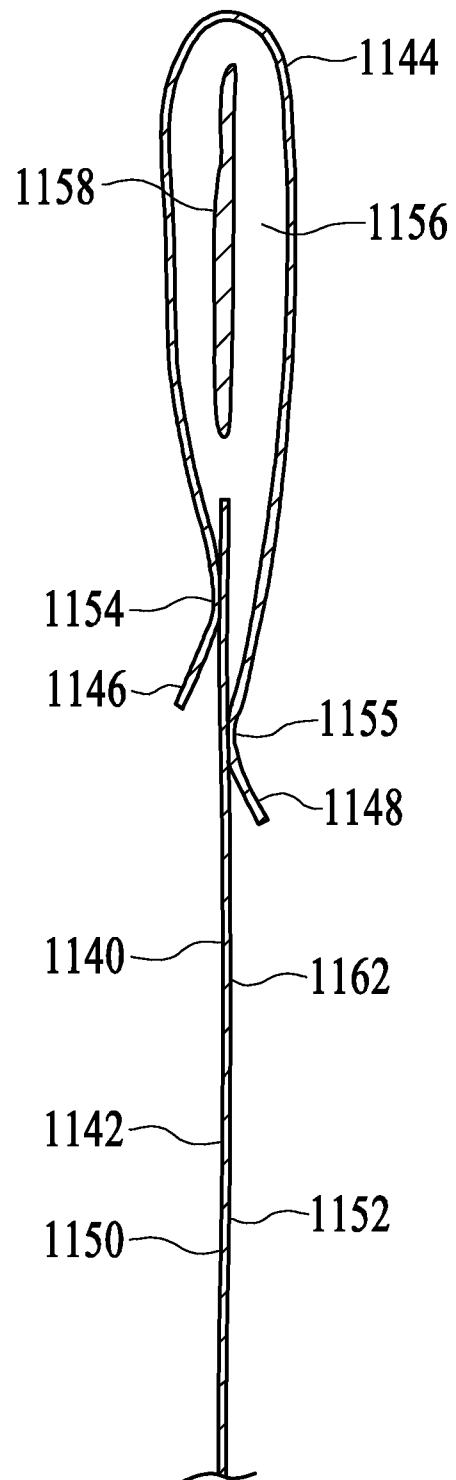


FIG. 11B

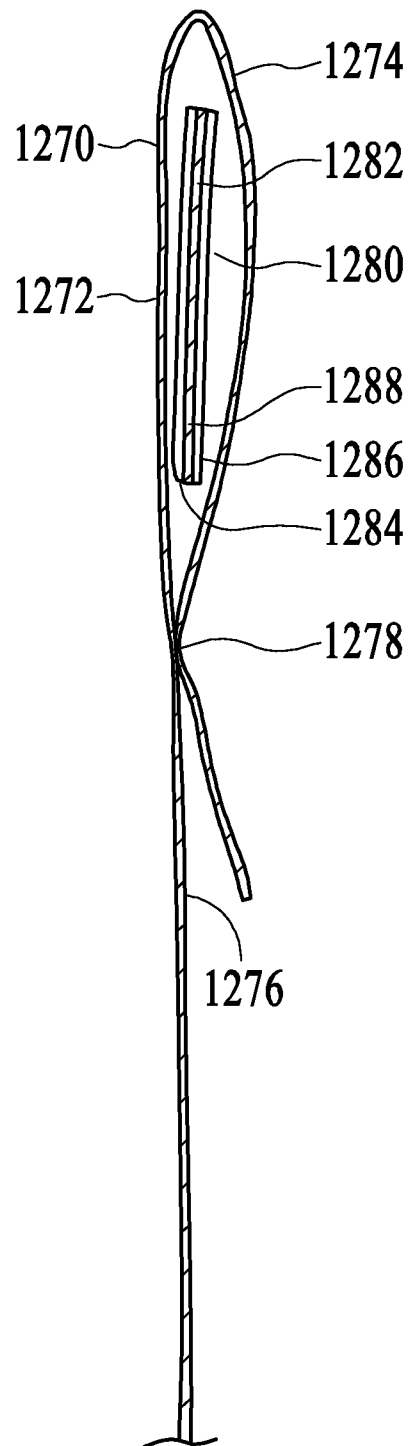


FIG.12

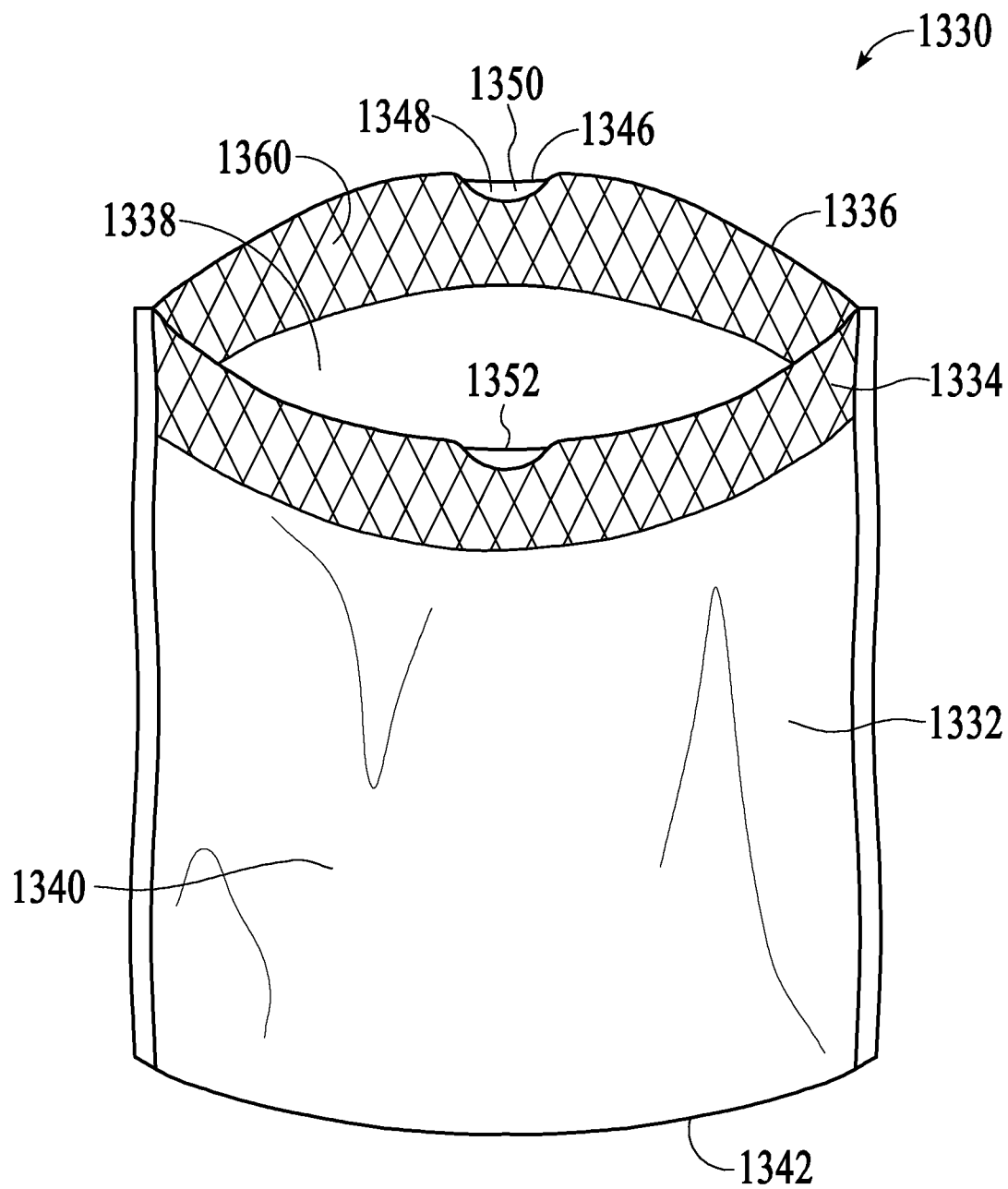


FIG.13

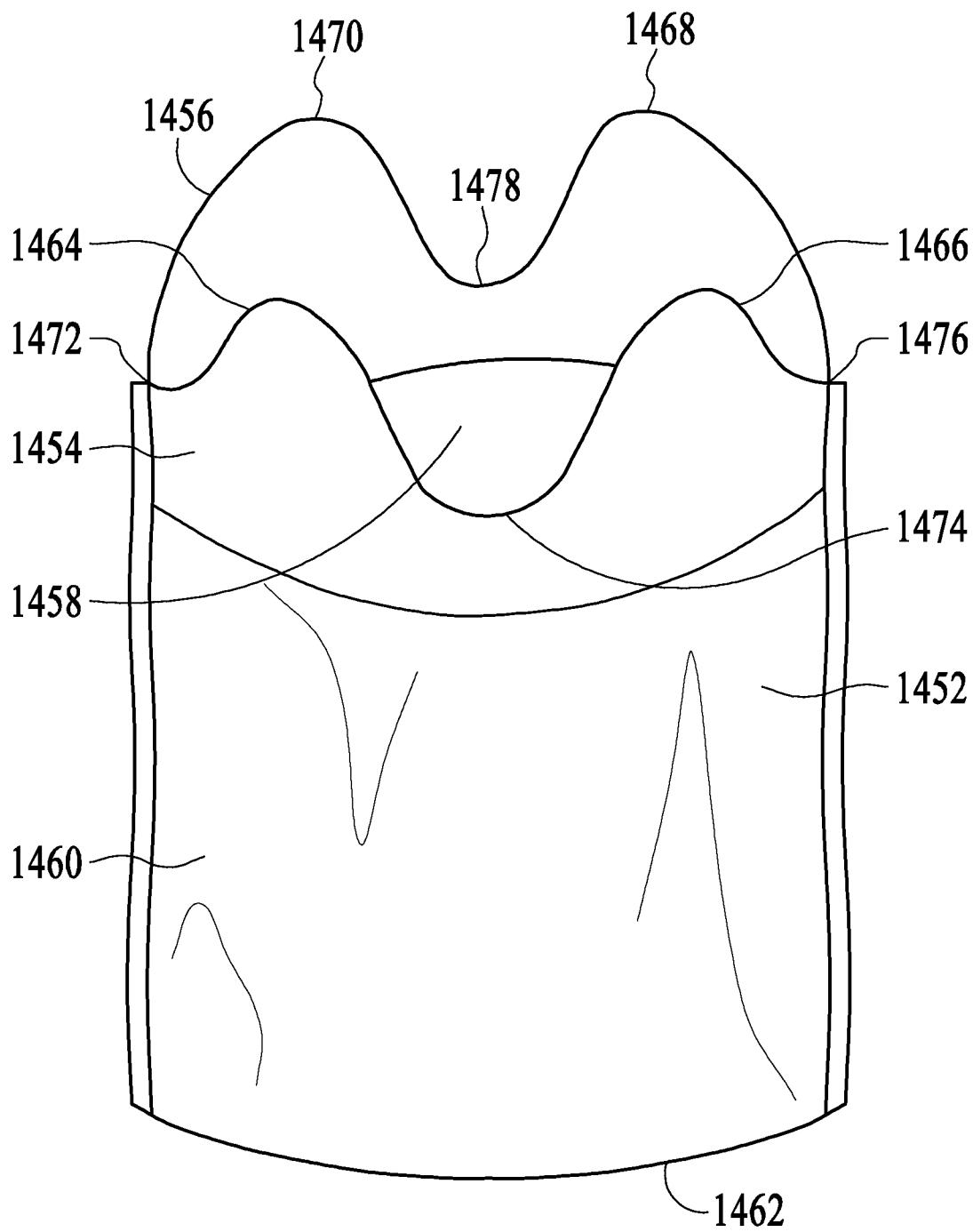


FIG.14

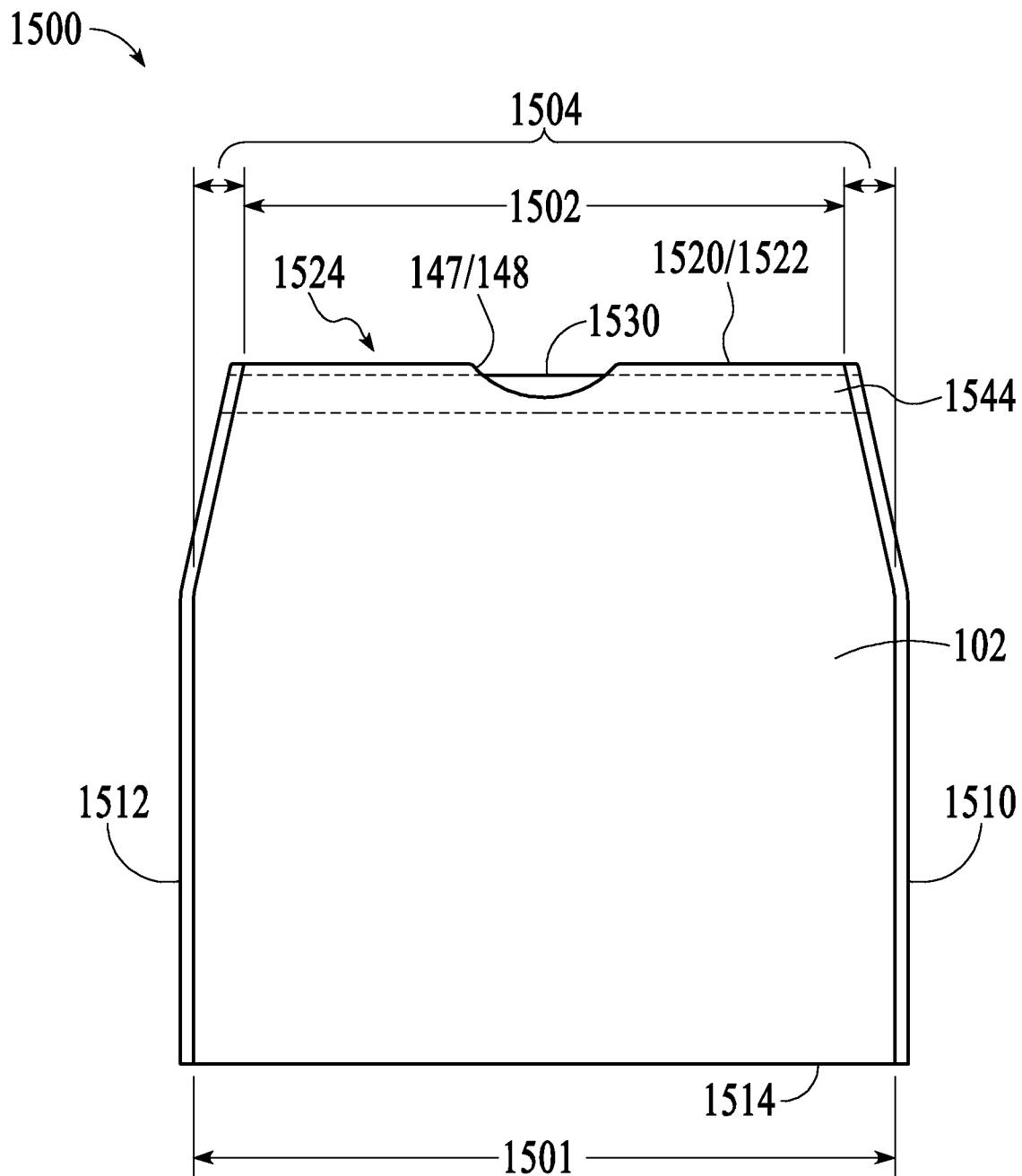


FIG.15

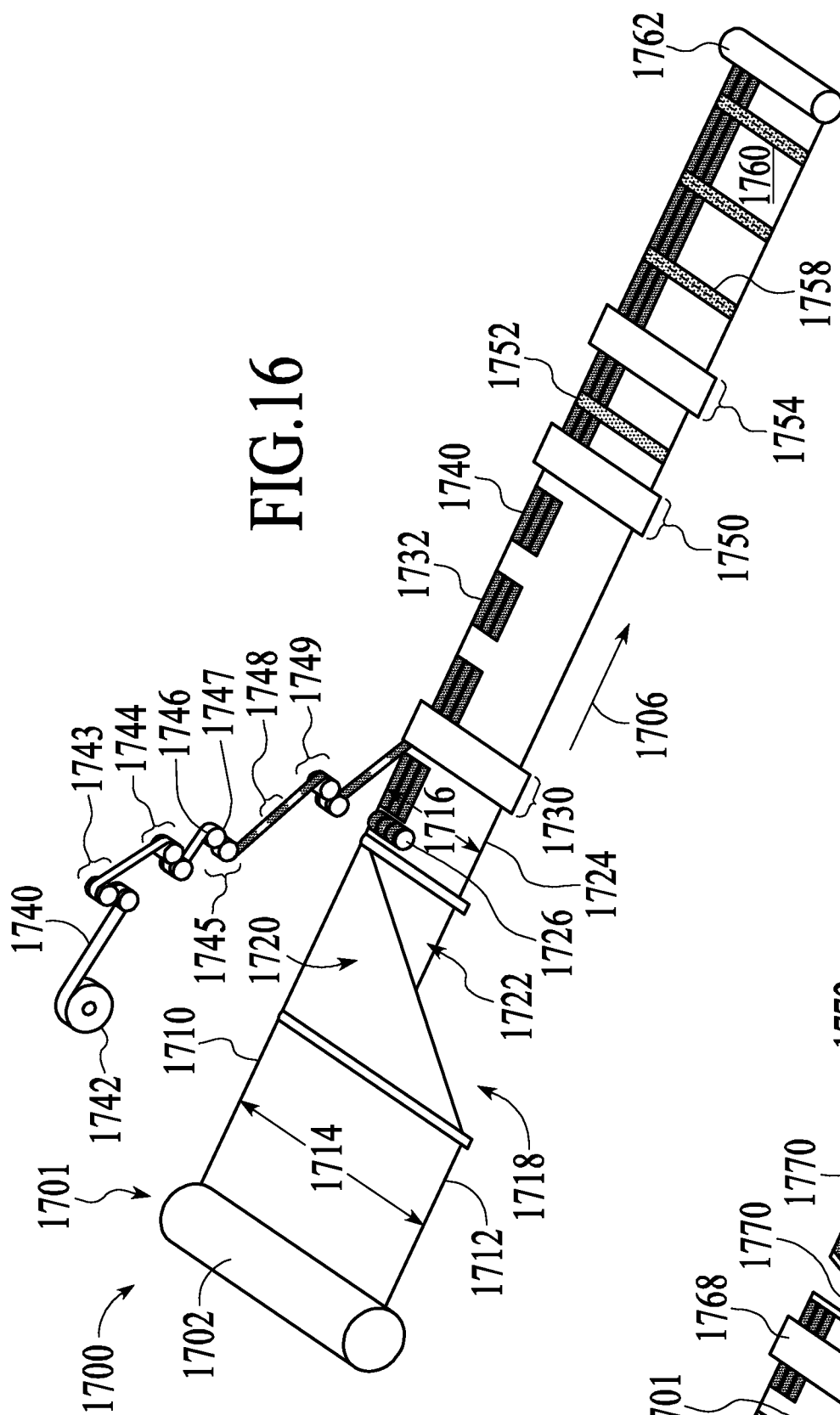


FIG. 16

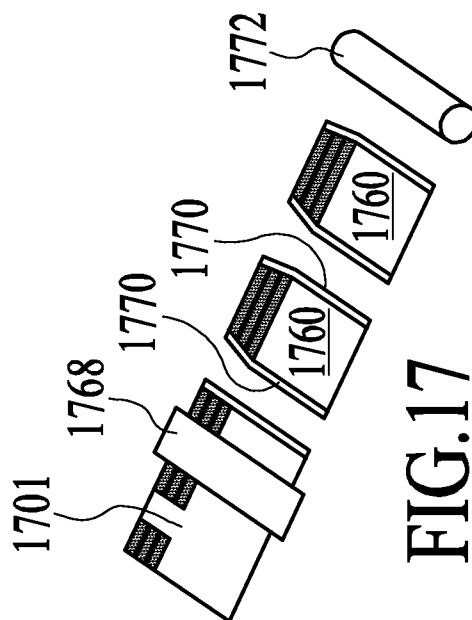
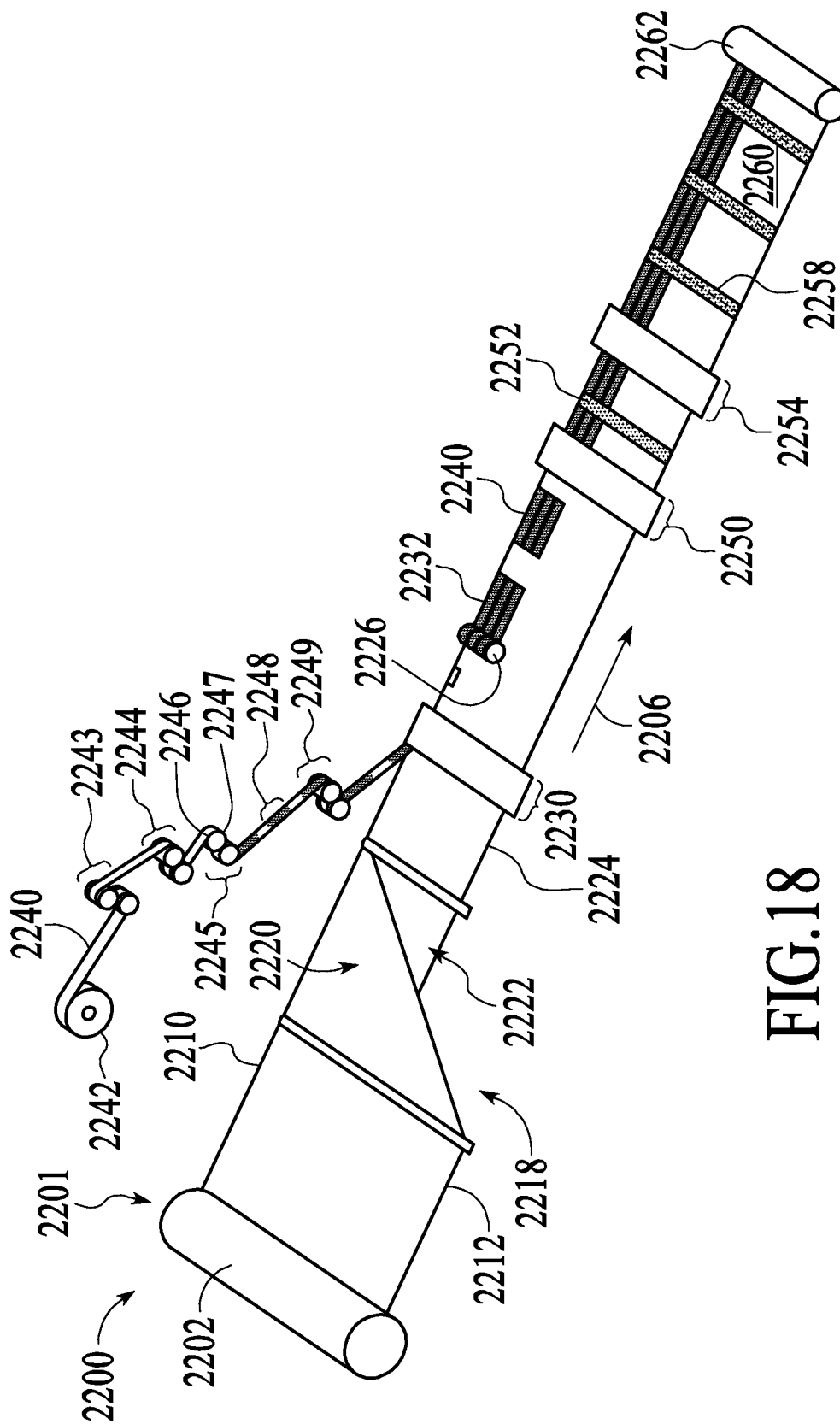


FIG. 17



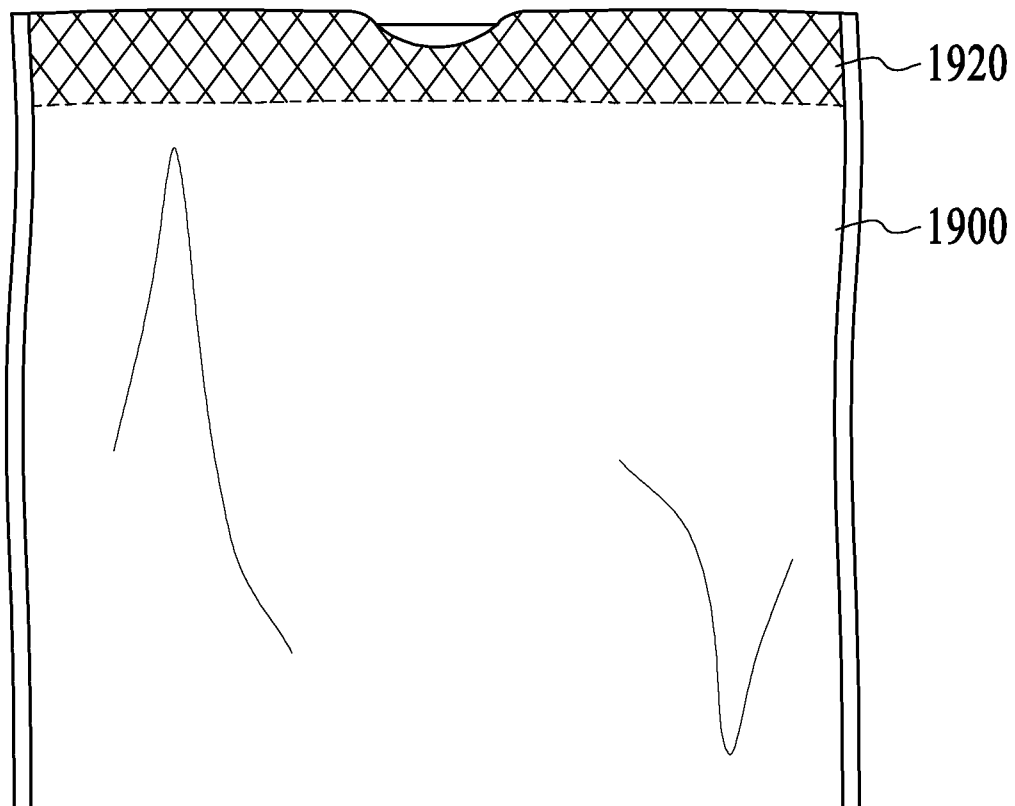


FIG.19

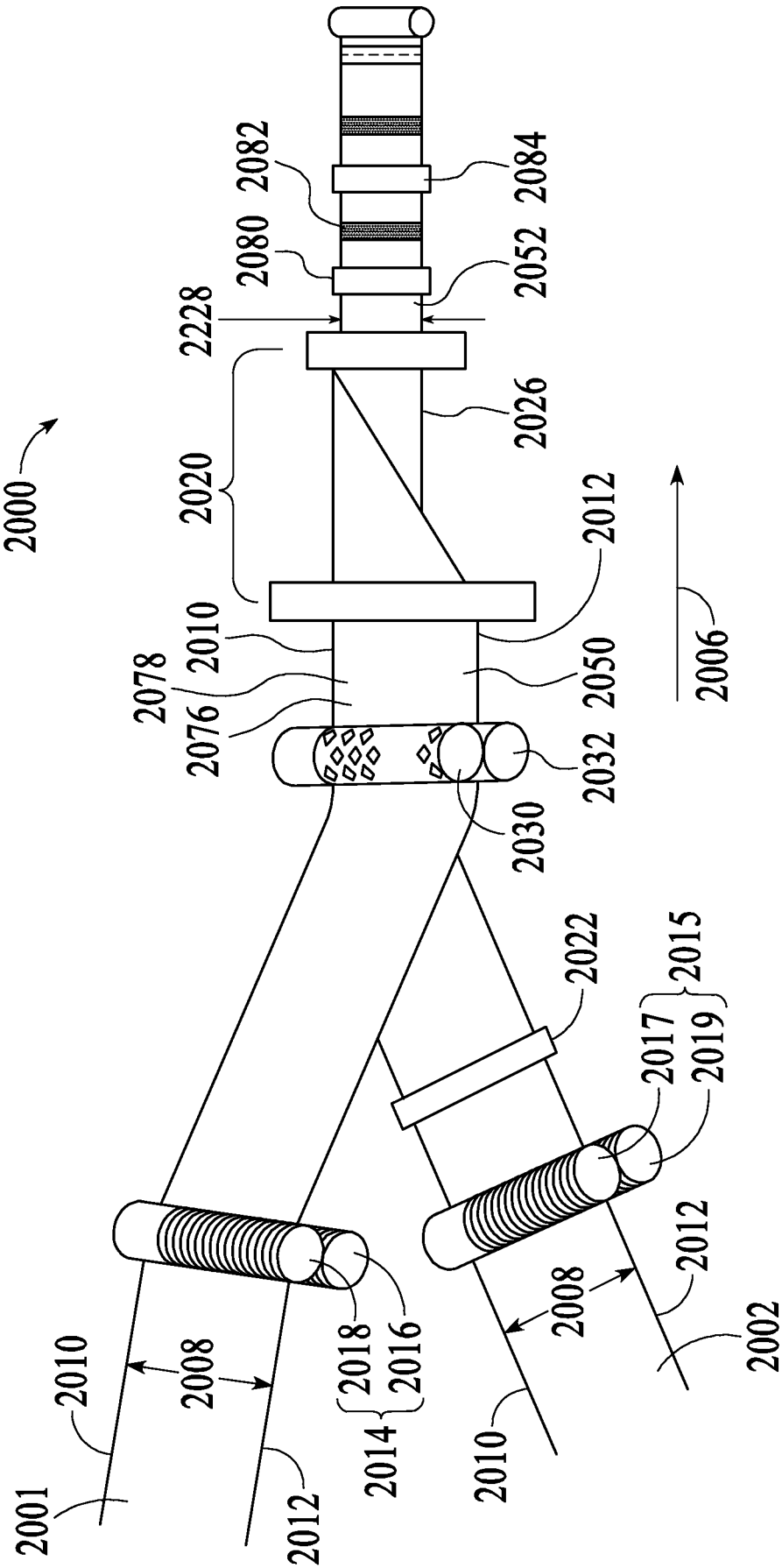


FIG. 20

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>IPC(8) - B65D 33/16 (2011.01)<br>USPC - 383/75<br>According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                   |                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>IPC (8) - B65D 33/16 (2011.01)<br>USPC - 383/75<br>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br>USPC - 383/61.4, 71, 72, 109<br>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br>PUBWEST (PGPB,USPT,USOC,EPAB,JPAB) Terms - odor malodor scent perfume fragrance titanium dioxide drawstring draw string<br>tape hem thermoplastic bag pouch trash resuse disposable<br>Google - bag with (odor OR malodor) control hem musk fragrance-release-inhibitor; fragrance-release-inhibitor titanium-dioxide                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                   |                                                                                            |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                   |                                                                                            |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document, with indication, where appropriate, of the relevant passages                | Relevant to claim No.                                                                      |
| X<br>---<br>Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 2009/0232422 A1 (BROERING, ET AL.) 17 September 2009 (17.09.2009), para [0063], [0071], FIG. 4 | 1-2, 4-5<br>-----<br>3, 6-20                                                               |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US 4,349,104 A (HAYES) 14 September 1982 (14.09.1982), entire document                            | 14-20                                                                                      |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US 2003/0078552 A1 (TEPPER, ET AL.) 24 April 2003 (24.04.2003), para [0054]                       | 3, 6-13, 17-18                                                                             |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US 2009/0067760 A1 (SHELLEY, ET AL.) 12 March 2009 (12.03.2009), entire document                  | 1-20                                                                                       |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                   |                                                                                            |
| * Special categories of cited documents:<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier application or patent but published on or after the international filing date<br>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed<br>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<br>"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<br>"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<br>"&" document member of the same patent family |                                                                                                   |                                                                                            |
| Date of the actual completion of the international search<br>05 February 2011 (05.02.2011)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                   | Date of mailing of the international search report<br><b>23 FEB 2011</b>                   |
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                   | Authorized officer:<br>Lee W. Young<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |