

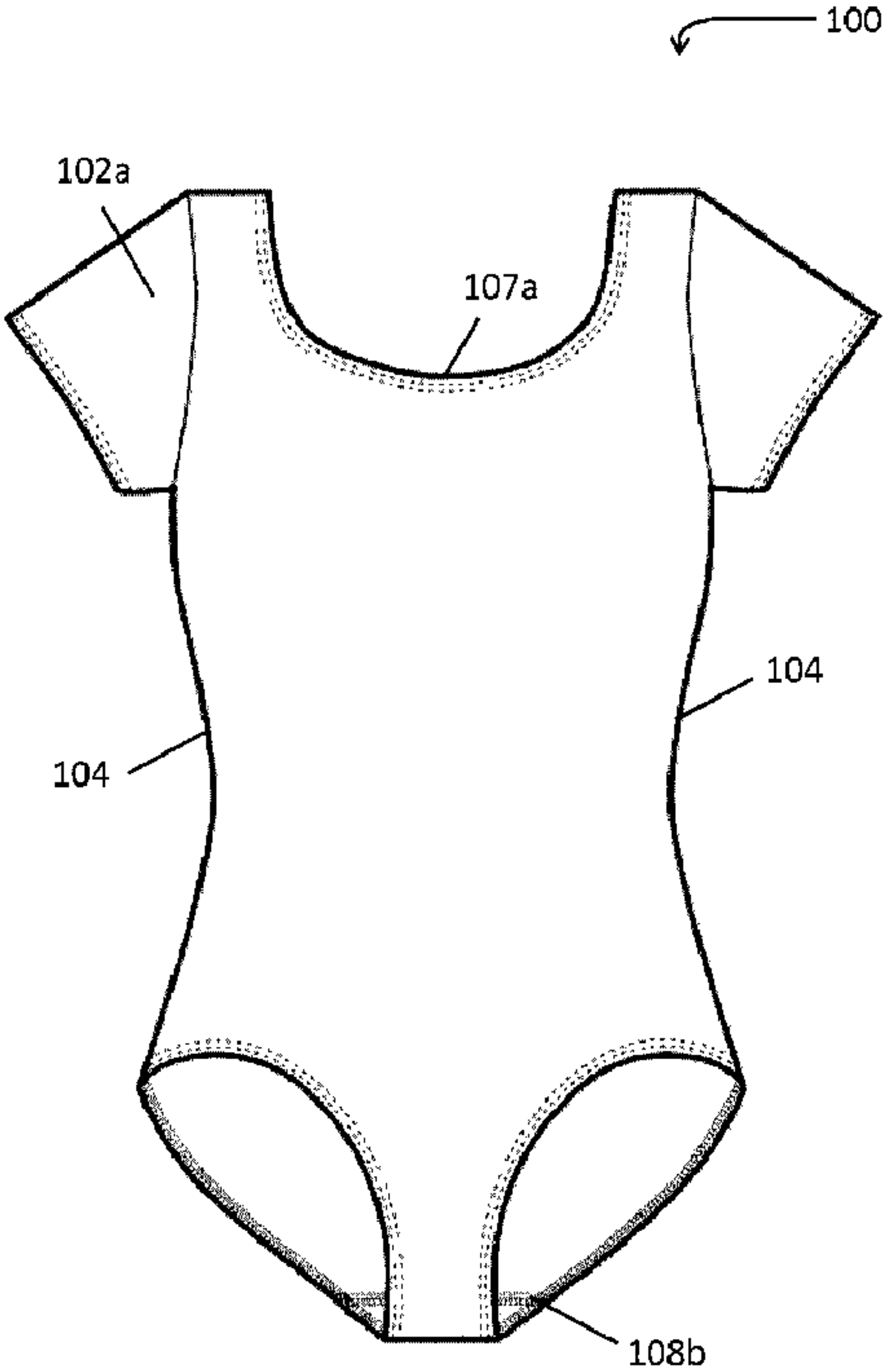


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(54) Titre : COMBINAISON A STRUCTURE DE DOUBLURE INTERIEURE INTEGREE ET METHODE DE FABRICATION
(54) Title: BODYSUIT WITH INTEGRATED LINING STRUCTURE AND METHOD OF MANUFACTURE



(57) **Abrégé/Abstract:**
In some embodiments, a bodysuit includes an outer shell with front and rear panel and a first inner lining with front and rear panels. Each of the front and rear panels of the first inner lining extends from above a waistline of the bodysuit to a seam at a respective

(57) **Abrégé(suite)/Abstract(continued):**

side of a crotch region. The bodysuit may include a second inner lining attached to the front and rear panels of the first inner lining at first and second seams, the first and second seams located at first and second sides of the crotch region. The bodysuit also may include a third inner lining positioned on top of and attached to the second inner lining. Attachment of the first inner lining to the second inner lining and the second inner lining to the third inner lining may be accomplished via inner seams not visible on an exterior of the bodysuit.

ABSTRACT

In some embodiments, a bodysuit includes an outer shell with front and rear panel and a first inner lining with front and rear panels. Each of the front and rear panels of the first inner lining extends from above a waistline of the bodysuit to a seam at a respective side of a crotch region. The bodysuit may include a second inner lining attached to the front and rear panels of the first inner lining at first and second seams, the first and second seams located at first and second sides of the crotch region. The bodysuit also may include a third inner lining positioned on top of and attached to the second inner lining. Attachment of the first inner lining to the second inner lining and the second inner lining to the third inner lining may be accomplished via inner seams not visible on an exterior of the bodysuit.

BODYSUIT WITH INTEGRATED LINING STRUCTURE AND METHOD OF MANUFACTURE

FIELD

The disclosed embodiments are generally directed to bodysuits, and more particularly to bodysuits with integrated lining structures and methods of manufacture.

BACKGROUND

Bodysuits are articles of clothing that are worn by female and males, such as dancers, swimmers, cyclists, yogis and gymnasts. Typically, the bodysuit covers at least the torso, portions of the back, the buttocks and the crotch of the wearer, with openings for the neck, arms, and legs. In some instances, the bodysuit may include sleeves and/or legs.

SUMMARY

In one embodiment, a bodysuit includes an outer shell having a front panel and a rear panel, a first inner lining attached to the outer shell, the first inner lining having a front panel and a rear panel, the front panel of the first inner lining extending from above a waistline of the outer shell front panel to a first seam and the rear panel of the first inner lining extending from above a waistline of the outer shell rear panel to a second seam, wherein the first seam is located at a first side of a crotch region of the bodysuit and the second seam is located at a second, opposite side of the crotch region of the bodysuit, and a second inner lining attached to the first inner lining at the first and second seams.

In another embodiment, a method of constructing a bodysuit having an outer shell with front and rear panels is disclosed. The method includes attaching a front panel of a first inner lining to a front panel of an outer shell of the bodysuit and attaching a rear panel of the first inner lining to a rear panel of the outer shell, wherein the front panel of the first inner lining extends from a portion above a waistline of the outer shell to a first seam and the rear panel of the first inner lining extends from a portion above the waistline of the outer shell to a second seam, the first seam defining a first edge of a crotch region of the bodysuit and the second seam defining a

second edge of the crotch region, and attaching a second inner lining to the front and rear panels of the first inner lining at the first and second seams.

It should be appreciated that the foregoing concepts, and additional concepts discussed below, may be arranged in any suitable combination, as the present disclosure is not limited in this respect.

The foregoing and other aspects, embodiments, and features of the present teachings can be more fully understood from the following description in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

The accompanying drawings are not intended to be drawn to scale. In the drawings, each identical or nearly identical component that is illustrated in various figures is represented by a like numeral. For purposes of clarity, not every component may be labeled in every drawing. In the drawings:

FIG. 1 is a front view of a bodysuit according to one embodiment;

FIG. 2 is a rear view of the bodysuit of FIG. 1;

FIG. 3 is a front view of a bodysuit according to another embodiment;

FIG. 4 is an interior view of a bodysuit prior to final assembly, with front and rear panels attached only in a crotch region of the bodysuit;

FIG. 5 is a front view of an interior of a bodysuit according to one embodiment;

FIG. 6 is a rear view of the bodysuit of FIG. 5;

FIG. 7 illustrates an outer shell front panel and a first inner lining front panel of a bodysuit according to some embodiments;

FIG. 8 illustrates an outer shell rear panel and a first inner lining rear panel of the bodysuit of FIG. 7;

FIG. 9 is a side view of the bodysuit of FIG. 5;

FIG. 10 is an top view of the interior of the bodysuit of FIG. 1;

FIG. 11 is top view of a second inner lining of a bodysuit according to some embodiments;

FIG. 12 shows a third inner lining of a bodysuit according to some embodiments;

FIGS. 13-15 illustrate attachment of first, second and third inner linings of a bodysuit;

FIGS. 16A and 16B illustrate front and rear fragmentary views of a bodysuit according to one embodiment;

FIGS. 17A and 17B illustrate construction of a leg opening bend back according to one embodiment;

FIGS. 18A and 18B illustrate attachment of second and third inner linings to the leg opening bend back of FIGS. 17A and 17B;

FIGS. 19A and 19B are enlarged cross sectional views of second and third inner linings attached to a leg opening bend back according to some embodiments;

FIG. 20 is a cross sectional side view of a crotch region of a bodysuit; and

FIG. 21 is a table listing types of fabrics and fabric treatments.

DETAILED DESCRIPTION

Bodysuits are articles of clothing that may be worn to be form fitting and highlight a wearer's muscle definition and skeletal alignment, and to allow for unencumbered movement and comfort. For purposes herein, a bodysuit may include a leotard, a unitard, a swimsuit, a biketard, or similar garments. Bodysuits may be used in various athletic activities, such as for dance, yoga, pilates, running, swimming, and gymnastics. Bodysuits are typically worn without any additional garments over or underneath the bodysuit. In some embodiments, the bodysuit can cover the body like a second skin and provide modesty. Typically, a bodysuit covers at least the torso, a portion of the back, the buttocks and the crotch of the wearer, and has openings for the neck, arms and legs. Bodysuits also may include one or more sleeves of varying lengths and/or one or more pant legs of varying lengths.

Typically, a bodysuit includes an outer layer made of any one of a variety of synthetic and non-synthetic materials (e.g., nylon, polyester and cotton) with fibers (e.g., spandex, lycra, rubber or elastane) that allow the outer layer to stretch to varying degrees. The outer layer is typically constructed of front and back panels that are secured to one another on each side via a seam that may be stitched, welded or bonded. The front and back panels also may be secured to one another via a single seam that is stitched, welded or bonded in or adjacent to the crotch region. In some embodiments, the crotch region of the outer shell may be formed via at least a portion of the front panel and/or at least a portion of the rear panel. For example, a portion of the front panel may extend from the front of the garment, through the crotch region, and be attached

to the rear panel via a seam at a rear of the crotch region. In some embodiments, the leg, arm and neck openings may be finished with decorative stitching, binding or elastics, and/or straps.

For purposes herein, the crotch region may include a portion of the bodysuit, such as a portion of the outer shell or one of the inner linings, that extends between the leg openings and is adjacent to a crotch of the wearer when the bodysuit is being worn. For example, for female wearers, the crotch region may be a portion of the bodysuit that is positionable over the wearer's vulva, pudendal cleft and mons pubis. In some embodiments, the crotch region is located between the leg holes of the bodysuit and extends upwardly toward the front of the bodysuit and rearwardly toward the rear of the bodysuit. In some embodiments, the crotch region may be substantially hourglass in shape.

A bodysuit also may include an inner lining that covers, supports and/or protects the whole torso or portions thereof. An inner lining typically includes a single layer that is attached to the uppermost edges of the front of the outer shell, such as from the neckline, and laterally connected to the side seam(s). The inner lining also may be connected to the leg openings and reward under the crotch and towards the buttocks, where the inner lining is stitched to the seam at the rear end of the crotch region. The lining may be made of a material with a similar stretch to that of the outer shell. Typically, bodysuits do not have a lining attached to the rear of the bodysuit, unless there is a flaw in the outer layer.

The female body from time to time excretes or can excrete bodily fluids, like vaginal discharge, menstrual flow and/or urine. While wearing a traditional bodysuit, the wearer may experience a variety of anxieties and embarrassments from visible undergarments, sanitary napkins, tampon strings and/or incontinence diapers. For example, because bodysuits are typically form fitting, they are not discrete and may highlight the additional undergarment and/or other sanitary product worn under the bodysuit. The additional undergarment and/or sanitary product also may add bulk and not be the same shape as the bodysuit or the wearer, thus signaling to the public that the wearer is protecting against the possibility of excreting fluids.

Additionally, because excretions may occur at any unforeseen time, the wearer of the bodysuit may not be prepared and therefore may have an accident. Wetness and/or blood may become visible on the outer layer(s) of the traditional bodysuit. The wearer also may wet or bleed through the bodysuit and any undergarment and/or sanitary product used to control

excretions. Such visible excretions may cause embarrassment and/or undue distress to the wearer.

The inventors have recognized that advantages may be realized by providing a bodysuit with one or more inner linings that are capable of absorbing and/or blocking the permeation of excretions without the use of an undergarment, overgarment or other sanitary product. For example, in some embodiments, the inner layers may reduce or even eliminate the need for the wearer to use an undergarment or other sanitary product to protect against menstruation, incontinence, or other female excretion. The inventors have further recognized that advantages may be realized if such bodysuits are not distinguishable from typical bodysuits such that the wearer may not be identified as someone protecting against incontinence, menstrual flow or other menstrual discharge. For example, in some embodiments, the bodysuit does not include visible seams in a crotch region of the outer shell where the one or more protective inner linings may be present and attached to one another. As will be appreciated, the inner seams of the inner linings also may be located at other portions of the bodysuit, such as near the waist of the bodysuit, the inner seams not being visible near the waist of the outer shell.

To that end, embodiments disclosed herein include a bodysuit with an outer shell and one or more inner linings arranged to absorb and/or block the permeation of excretions, the one or more inner linings not being visible from the exterior of the bodysuit. In some embodiments, the bodysuit includes an outer shell with front and rear panels. The bodysuit also may include a first inner lining that has front and rear panels, each of the panels of the first inner lining extending from above a waistline of the outer shell to a seam that may be at a first or second end of the crotch region. For example, the front panel of the first inner lining may extend all the way from the neckline of the bodysuit to a seam defining the front end of the crotch region. In such embodiments, the first inner lining may be attached to the outer shell only at the neckline and at one or more seams on a side of the bodysuit.

The bodysuit also may include a second inner lining that extends from the seam at the front of the crotch region to the seam at the rear of the crotch region. The second inner lining may be formed in the shape of the crotch region, such as having a substantially hourglass shape. For example, the second inner lining may be wider at the top and bottom than in a central region. In some embodiments, the second inner lining is attached to the first inner lining at the seams at the front and rear edges of the crotch region. The bodysuit also may include a third inner lining

that is placed on top of and is attachable to the second inner lining. In some embodiments, the third inner lining may have the same shape as the second inner lining, and crotch region, but be smaller than the second inner lining. In some embodiments, by having a third lining that is smaller than the second lining, fluids absorbed by the third lining may not be transferred to the outer shell (e.g., via the second lining). In these embodiments, attachment between the second and first inner linings and between the second and third inner linings may be accomplished via inner seams that are not attached to the outer shell. In some embodiments, the third inner lining may include one or more layers.

In these embodiments, each of the first, second and third inner linings may have a body contacting surface. In some embodiments, one or more of the inner linings may be arranged to absorb and/or wick fluids. In some embodiments, at least one of the inner linings acts as a barrier layer that may minimize or prevent excretions from passing through to the outer shell. In some embodiments, the barrier layer may be stain releasing so that the bodysuit is not permanently damaged during an accident. In some embodiments, the layers may be formed of a stretchable material.

Turning now to the figures, FIGS. 1 and 2 show a bodysuit 100 according to embodiments of the present disclosure. As shown in these views, the bodysuit may have an outer shell with a front panel 102a and a rear panel 102b. In some embodiments, the front and rear panels 102a, 102b are secured to one another via seams 104 located at opposite sides of the bodysuit 100, and via a rear outer seam 105 located adjacent to the crotch region of the bodysuit. As will be appreciated in view of the above, at least a portion of the front panel 102a may form the crotch region of the outer shell of the bodysuit. The front and rear panels 102a, 102b also may be secured to one another along the top edge of the neckline 107a, 107b. In some embodiments, the rear outer seam 105 is not visible in the inside of the bodysuit. As will be appreciated, such a seam 105 may be obstructed by the one or more inner linings inside the bodysuit 100. As shown in FIGS. 1 and 2, other than the rear outer seam 105, neither the front or rear panels 102a, 102b of the outer shell include seams visible on the outside of the garment, such as in the crotch region, where one or more inner linings are attached to one another.

As will be appreciated, the outer shell of the bodysuit may have any suitable configuration. For example, as shown in FIGS. 1 and 2, the bodysuit may have sleeves. In other embodiments, as shown in FIG. 3, the bodysuit also may be sleeveless. In some embodiments,

the bodysuit may cover the legs, or at least a portion of the legs. As will be appreciated, in such embodiments, the one or more inner linings may be adjusted in size to accommodate the size and shape of the outer shell.

As shown in FIGS. 4-6, in some embodiments, the bodysuit may include two or more inner linings. As will be described, the inner linings may be attached to one another and to the outer shell. In some embodiments, the inner linings may have different protective characteristics, such as for absorbing, wicking, and/or blocking transmission of fluids.

In some embodiments, as shown in FIGS. 4-10 and 13, the bodysuit includes a first inner lining having a front panel 106a and a rear panel 106b. In some embodiments, the first inner lining may extend from above a waistline of the respective panel of the outer shell to a edge of the crotch region 111. In this regard, the first inner lining may be arranged to not extend into the crotch region of the bodysuit.

As shown in FIGS. 4-6, in some embodiments, the crotch region may be defined by a front seam 108a at a front edge of the crotch region and a rear seam 108b at a rear edge of the crotch region. As will be described, the first and second inner linings 106a, 106b, 110 may be joined to one another via the front and rear seams 108a, 108b. As will be appreciated from the above, the front and rear seams 108a, 108b may be visible from the interior of the bodysuit but not visible on the exterior of the bodysuit.

As shown in FIG. 7, a length *L1* of the front panel 102a of the outer shell may be longer than a length *L2* of the front panel 106a of the first inner lining of the bodysuit. In such embodiments, the front panel of the first inner lining may end at or above a crotch region of the bodysuit. As shown in FIG. 8, and similar to the front panels, a length *L3* of the rear panel 102b of the outer shell may be longer than a length *L4* of the rear panel 106b of the first inner lining in some embodiments.

As shown in FIGS. 7 and 8, the first inner lining may be formed in a shape similar to that of the outer shell. For example, the front and rear panels of the first inner lining have similarly shaped neck openings and silhouettes. As shown in these views, the front and rear panels 106a, 106b of the first inner lining need not include each of the features of the front and rear panels 102a, 102b of the outer shell. For example, as shown in these views, the front and rear panels 106a, 106b of the first inner lining do not have sleeve portions.

As will be appreciated, the length *L1* of the front panel 102a of the outer shell need not be the same as the length *L3* of the rear panel of the outer shell. In a similar fashion, the length *L2* of the front panel 106a of the first inner lining may be different than the length *L4* of the rear panel 106b of the first inner lining. As will be further appreciated, the front and rear panels 106a, 106b of the first inner lining may be formed of the same material or may be formed of different materials. For example, the front panel of the inner lining may be formed of a material that is arranged to wick fluids, while the rear panel of the inner lining may be formed of a stretchable material with no protective features.

In some embodiments, as shown in FIG. 9, the front and rear panels 106a, 106b of the first inner lining are secured to the front and rear panels 102a, 102b of the outer shell at seams 104 located on opposite sides of the bodysuit. As shown in FIGS. 4-6, The first inner lining 102a, 102b also may be secured at a neckline 107a of a front of the bodysuit and a neckline 107b of the rear of the bodysuit.

As shown in FIGS. 4-6, 9-10 and 14, the bodysuit 100 also includes a second inner lining 110 positioned in the crotch region of the bodysuit. In some embodiments, as shown in these views, the second inner lining 110 is attached to the front panel 106a of the first inner lining at the front seam 108a and to the rear panel 106b of the first inner lining at the rear seam 108b. In such embodiments, the second inner may extend along the crotch region 111 of the bodysuit.

As shown in FIGS. 4 and 10-11, the second inner lining 110 may have a substantially hourglass shape, with front and rear portions of the second inner lining 110 being wider than a central portion. For purposes herein, the front portion of the second inner lining is the portion of the second inner lining that is positioned towards the front of the bodysuit when the bodysuit is worn by the user, and the rear portion is the portion positioned towards the rear of the bodysuit. As shown in these views, the front portion of the second inner lining 110 need not be the same size (e.g., the same width) as the rear portion of the second inner lining 110. For example, as shown in FIG. 11, a rear portion of the second inner lining 110 may be wider than the front portion. In some embodiments, the second inner lining may be the same size as the crotch region of the outer shell. In other embodiments, the second inner lining may be larger than the crotch region. As will be appreciated, the shape and size of the second inner lining may vary based on the shape and size of the crotch region of the outer shell.

As also shown in FIGS. 4-6 and 9-10, the bodysuit also may include a third inner lining 112. As with the second inner lining, the third inner lining 112 is also arranged to be positioned in the crotch region of the bodysuit. As shown in FIG. 10, the third inner lining 112 is attached to the second inner lining via front 114a and rear 114b seams. In some embodiments, the second inner lining is flatlocked on top of the first inner lining at the front and rear seams 108a, 108b. As with other embodiments, the front and rear seams 114a, 114b are positioned toward a front and rear of the garment, respectively, when the garment is worn by the wearer. In some embodiments, the second and third inner linings 110, 112 may be attached (see stitching 115 in FIG. 10) on top of a leg opening 116 bend back.

In some embodiments, as shown in FIGS. 4-6, and 9-10, the third inner lining is smaller than the second inner lining. In some embodiments, by having the third inner lining be smaller than the second inner lining, fluids absorbed by the third inner lining may not be transferred to the outer shell. In such embodiments, the front seam 108a attaching the second inner lining 110 to the first inner lining 106a is spaced from the front seam 114a attaching the third inner lining 112 to the second inner lining 110. In a similar fashion, the rear seam 108b attaching the second inner lining 110 to the first inner lining 106a may be spaced from the rear seam 114b attaching the third inner lining 112 to the second inner lining 110. As will be appreciated, the respective front seams 108a, 114a and rear seams 108b, 114b may be longitudinally spaced from one another.

As shown in FIG. 15, the front seams 108a, 114a may be spaced a distance ***D1*** of at least about 0.25 inches from one another. For example, the seams 108a, 114a may be spaced a distance ***D1*** of between about 0.25 inches and about 1 inch. In a similar fashion, the rear seams 108b, 114b may be spaced a distance ***D2*** of at least about 0.25 inches from one another. For example, the seams 108b, 114b may be spaced a distance ***D2*** of between about 0.25 inches and about 1 inch. As will be appreciated, the distance ***D1*** between the first seams 108a, 114a and the distance ***D2*** between the rear seams 108b, 114b may be the same in some embodiments. For example, the distances ***D1***, ***D2*** may be about 0.375 inches. In other embodiments, the distances ***D1***, ***D2*** may be different from one another.

As also shown in FIG. 15, a side of the third inner lining 112 may be spaced from a side of the second inner lining 110. For example, in some embodiments, the side of the third inner lining may be spaced a distance ***D3*** of at least about 0.125 inches. For example, the side of the

third lining may be spaced a distance **D3** of between about 0.125 inches and 0.375 inches. For example, in some embodiments, the distance **D3** between the second and third inner linings 110, 112 may be about 0.25 inches.

In some embodiments, the third inner lining has a substantially hourglass shape, with the front and rear portions of the third inner lining 112 being wider than a width of a central portion of the third inner lining. As with the above, the front portion of the third inner lining may be narrower than the rear portion. As will be appreciated, the shape and size of the third inner lining may vary based on the shape and size of the crotch region of the outer shell.

As also shown in FIGS. 4-6 and 9-10, the third inner lining 112 may have a similar shape as the second inner lining 110. As will be appreciated, the third inner lining need not have the same shape as the second inner lining. For example, the third inner lining may have a substantially rectangular shape while the second inner lining has a substantially hourglass shape.

In some embodiments, the third inner lining 112 may include one or more layers of material. For example, as shown in FIG. 12, in some embodiments, the third inner lining 112 may include first and second layers 118a, 118b. In some embodiments, the first and second layers may be stitched to one another around a periphery of each layer. As will be appreciated, although the third inner lining 112 is shown as having two layers in this embodiment, the third inner lining also may have more than two layers in other embodiments.

In some embodiments, a single inner lining may have a weight of between about 3.7 oz./yd² to about 7.2 oz./yd². In some embodiments, a single inner lining may have a weight of between about 7 oz./yd² to about 14.6 oz./yd². In some embodiments, the combined weight of the inner linings (e.g., of the first, second and third inner linings) may be between about 9.5 oz./yd² to about 24.9oz/yd².

In embodiments in which an inner lining includes more than one layers, such as the third inner lining 112 having first and second layers 118a, 118b (see FIG. 12), the combined weight of the layers may be the same as the weight of a single layer. For example, the weight of the third inner lining with only a single layer, or the combined weight of a third inner lining having first and second layers, may be between about 3.7 oz./yd² to about 7.2 oz./yd² or between about 7 oz./yd² to about 14.6 oz./yd². In embodiments having more than one layers, the weight of each layer may be the same. For example, each of the first and second layers may weigh about 2 oz./yd², with a combined weight of about 4 oz./yd². The weight of the individual layers also may

be different. For example, a first layer may have a weight of about 1.5 oz./yd² and a second layer may have a weight of about 2.5 oz./yd², with a combined weight of about 4 oz./yd².

FIGS. 13-19 illustrate the construction of a bodysuit according to embodiments of the present disclosure. As shown in FIG. 13, front and rear panels 106a, 106b of the first inner lining may be cut shorter than the front and rear panels 102, 102b of the outer shell. As with other embodiments, the front and rear panels 106a, 106b of the first inner lining may be cut so that the front and rear panels 106a 106b do not extend to the crotch region 111 of the bodysuit. As shown in FIG. 13, the crotch region 111 of the bodysuit may include a region that is substantially hourglass in shape and that extends between the legs of a wearer, adjacent a wearer's crotch.

As shown in FIG. 14, a second inner lining 110 may be cut in the general shape of the crotch region of the outer shell so that it may be stitched to the first inner lining and ultimately to the outer shell. As shown in FIG. 14, the second inner lining 110 may be attached to the front and rear panels 106a, 106b of the first inner lining at front and rear seams 108a, 108b. As will be appreciated, the first inner lining may be stitched, bonded, welded or otherwise attached to the second inner lining at the front and rear seams 108a, 108b. In some embodiments, the second inner lining 110 may be flatlocked to the first inner lining 106a, 106b at the front and rear seams 108a, 108b.

Next, as shown in FIG. 15, a third inner lining 112 may be cut for attachment to the second inner lining. In some embodiments, the third inner lining 112 may include a single layer. In other embodiments, two or more layers may be cut and stitched together at the peripheral edges to form the third inner lining 112. In some embodiments, the third inner lining is placed on top of and attached to the second inner lining 110. In some embodiments, the third inner lining 112 may be stitched to the second inner lining 110 at a front seam 114a and rear seam 114b. For example, the third inner lining 112 may be coverstitched to the second inner lining at flatlock seam 114a and at flatlock seam 114b. As shown in these views, each of the flatlock seams extends generally horizontally across the third inner lining. In some embodiments, the third inner lining is not yet attached to the second inner lining at one or more side portions.

Although the seams 114a, 114b are described as being flatlocked, it will be appreciated that the third inner lining 112 may be attached to the second inner lining 110 via other suitable

methods. For example, the third inner lining may be welded, or otherwise bonded to the second inner lining. Other suitable methods also may be used to join the second and third inner linings.

FIGS. 16A and 16B show front and rear interior views of the bodysuit with the first, second and third inner linings attached to one another. As also shown in this view, the front and rear panels 106a, 106b of the first inner lining have been stitched to the outer shell via side seams 104.

FIGS. 17A and 17B illustrate construction of the leg opening bend back. As shown in these views, the leg opening bend back may be stitched together via seam 120. During such construction, the second and third inner linings 110, 112 may be moved aside and out of the way.

Next, as shown in FIGS. 18A, and 18B, the second and third inner linings 110, 112 may be stitched on top of the bend back at seam 122. As will be appreciated in view of FIGS. 18A and 18B, the second and third inner linings 110, 112 may be attached to the bend back at respective side portions of each inner lining.

In embodiments in which the third inner lining has more than one layer, the second inner lining may be secured in between the sub-layers of the third lining, along the outer edge. The second inner lining may then be secured to the primary lining and to the outer shell

FIGS. 19A and 19B illustrate the attachment of the second and third inner linings 110, 112 to the leg opening bend back. As shown in these views, the second inner lining 110 is stitched on top of the bend back (see 126). The third inner lining 112 is stitched on top of the second inner lining 110 and the bend back (see 128) to complete the three layers of stitching in the leg opening of the crotch region.

FIG. 20 illustrates a side view of the linings in the crotch region of the bodysuit. As shown in this view, the crotch region 111 includes the outer shell 102a of the leg opening bend back. As will be appreciated, the bend back stitching may come into contact with the skin. In this regard, the bend back stitching may be covered by the second inner lining to prevent staining and wetness to the outer shell. In some embodiments, the second inner lining 110 comes into contact with the outer shell, as the second inner lining is placed in between the outer shell and the third inner lining. The crotch region also may include the third inner lining, which has a body-contacting side and is visible to the wearer.

Although embodiments have been shown and described in which the first inner lining extends to a crotch region, with the second inner lining being attached to the first inner lining and

extending in the crotch region, the bodysuit may have other arrangements in other embodiments. For example, the front panel of the first inner lining may extend from a first position above a waist of the bodysuit to a second position above the crotch region and below the waist. In a similar fashion, the rear panel of the first inner lining may extend from a third position above a waist of the bodysuit to a fourth position above the crotch region and below the waist. In such embodiments, the second inner lining may be attached to the front and rear panels at the second and fourth positions above the crotch region. In this regard, the second inner lining may be connected to the first inner lining and extend from the second position above the front crotch region, through the crotch region, and to the rear of the bodysuit to the fourth position above the rear crotch region. In such embodiments, the second inner lining may be larger than the crotch region.

As will be appreciated, the inner linings may have any suitable properties and be formed of any suitable materials. In some embodiments, the second inner lining may be formed of a stretchable material, such as like nylon, cotton, thermoplastic urethane, spandex, polyester, lycra, elastane or a combination thereof. The second inner lining also may be formed of other similar stretchable materials. As will be described, the second inner lining may have unique properties that prevent moisture from leaking to the outer shell, is stain releasing, antibacterial and/or breathable. In some embodiments, the third inner lining may be formed of a stretchable materials like nylon, spandex, cotton, polyester, lycra, elastane, thermoplastic urethane, or combinations thereof. The third layer also may be formed of other similar stretchable materials. As will be described, the third lining may have unique properties that are absorbent, breathable, wicking, or combinations thereof. Although each of the first, second and third inner linings are described as having certain properties, it will be appreciated that these linings may have other possible properties in other embodiments.

In some embodiments, the first, second and third inner linings may be connected to one another via stitching, bonding, or welding, and using a variety of appropriate materials. In some embodiments, such a constructions does not compromise the stretch properties of the bodysuit. Such a construction also may not negate the desired property or properties of the inner linings. For example, one or more of the inner linings may be wicking, absorbing, blocking, and/or releasing.

In some embodiments, suitable materials for one or more linings, such as a body-contacting lining, includes, but are not limited to: polyolefin, polyamide, polyester and combination thereof. In such embodiments, the materials may have inherently stain-resisting fibers. For purposes herein, “stain releasing,” means both stain-resistant materials and stain-releasing materials, including those that have been treated to be stain resistant or stain releasing. The linings also may include any suitable fabric that has been treated with a stain releasing finish (such as the Darlington finishes listed in Table A (see FIG. 21). Such linings also may include an inherently stain-releasing material such as microfiber or a microfiber blend including different materials that can be treated to have even greater stain-releasing capabilities.

In some embodiments, one or more linings (e.g., the second or third inner linings) may be formed of a relatively dark material color that can assist in masking stains.

In some embodiments, one or more linings, such as the third inner lining, may include a material capable of absorbing fluids, and of releasing the absorbed fluids under certain conditions, such as during a laundry cycle. The moisture-absorbent lining may include an absorbency of greater than about 300 grams/square meter (gm/m^2), more particularly greater than about 800 gm/m^2 , and more particularly greater than about 1054 gm/m^2 . For example, in some embodiments, the third inner lining may be capable of absorbing up to about 50 mL of fluid. Suitable materials for a moisture absorbent lining include, but are not limited to, woven or non-woven microfiber or polymer knits, fabrics formed using hydrophilic fibers, absorbent or superabsorbent foams, fibers or powders. In some embodiments, any knit, absorbent knit, woven, nonwoven or polymeric material that has reservoir properties due to air gaps or voids can be used as the moisture absorbing liner. Examples of such materials include, but are not limited to, needlebar knit fabrics, foams, nonwovens, and the like.

In some embodiments, the moisture-absorbent lining can include a knitted fabric that has been treated to have hydrophilic properties. In some embodiments, the yarn from which the fabric is made can be treated prior to knitting to be hydrophilic. In some embodiments, the yarn and knitted fabric can both be treated to be hydrophilic.

In some embodiments, a barrier lining, such as the second inner lining, includes any material or combination of materials that prevent or minimize transmission of fluid through the barrier layer. In some embodiments, such a material or combination of materials does not adversely affect the feel and/or hand of the garment. In some embodiments, the barrier lining

may include a woven or non-woven fabric having elongation test results comparable to the Darlington fabrics listed in Table A (see FIG. 21).

In some embodiments, the barrier lining may be formed of a material including, but not limited to, a fabric laminated to a polymer film. The polymer film may comprise a thickness of less than or equal to about 15 microns, more particularly less than or equal to about 10 microns, and more particularly less than or equal to about 5 microns. Suitable materials for the polymer film may include, but not be limited to, copolyether-esters, thermoplastic elastomers (TPEs) such as HYTREL®, nylons and polyolefins. Other soft elastic TPEs may be used if they have sufficient softness and pliability to be used in a bodysuit. The poly film may be laminated in a 2-ply or 3-ply configuration, or be free-hanging and sewn between other layers, such as between an absorbent lining and an outer layer. Other suitable polymer materials may include a highly moisture transmitting monolithic polyurethane film sold by Omniflex Inc., Greenfield, MA under the name TX1540.

Other suitable materials for the barrier lining may include, but are not limited to, a 2-ply laminate polymer film protected by another layer that is not bonded to the film, as this arrangement allows for a softer feel in the finished garment. The film/composite material may optionally be subjected to a hydrophobic (water-repellent) treatment to enhance the barrier properties without negatively impacting the hand of the material. In still another embodiment, the barrier film or composite may be stretched or pressed with heat and/or pressure into the surrounding layers to enhance feel. These stretch or heat and pressure treatments also have the advantage of creating small fissures that enhance breathability.

Other suitable materials for barrier lining may include a hydrophobic fabric that may be inherently hydrophobic, or which may be treated to make it hydrophobic. Suitable fabrics for treating with such hydrophobic coatings include, but are not limited to, relatively tight knitted, nonwoven or woven fabrics. Suitable hydrophobic materials for treating the fabric include, but are not limited to, polymers such as silicone, polyurethane and combinations thereof. In many embodiments, it is desirable to use elastic polymers for this purpose, such as LYCRA® and blends thereof. In some embodiments, the hydrophobic treated knitted, nonwoven or woven material may contain microfibers, as this creates a more tortuous path for any fluid to penetrate.

In some embodiments, if the material used to form the barrier layer is nonwoven, the use of a meltblown nonwoven material may be used, since it also provides a tortuous path for fluids.

Multiple nonwoven, knitted or woven materials may also be combined in any number of layers. Several or all layers may be treated with hydrophobic treatment or made of inherently hydrophobic material(s). Embodiments using such treated (non-film) materials may provide greater breathability than may be achieved with a film barrier. One exemplary barrier layer is an elastic meltblown nonwoven material made from a copolyether-ester polymer similar to the product previously sold by Kimberly-Clark under the brand name DEMIQUE®.

In some embodiments, the barrier lining may include a microporous polymer film. Suitable microporous polymer films may include, but are not limited to, urethane films, polytetrafluoroethylene (PTFE) films, polyolefin films, and combinations thereof. One such microporous urethane film is sold by Porvair PLC, Norfolk, UK. Other microporous PIPE films are available under the product name GORE-TEX® (W. L. Gore & Associates, Inc., Newark, Del.). Such microporous films can be used in any combination of layers, either laminated or unlaminated, and can be treated with a hydrophobic water repellent treatment, or filled with a substance such as oil, to keep the pores from becoming contaminated. In some embodiments, the polymer film may be stretchable.

In some embodiments, a lining may include a single layer of fabric that has a first surface that is stain resistant (inherently, or as a result of being treated with a stain resistant treatment, as described above) and moisture-absorbent, and a second surface that is hydrophobic. The first surface can be capable of absorbing an amount of fluid between about 0.1 milliliters ("ml") and about 50 ml of fluid within as little as 95 cm² up to the entire surface area of the undergarment, and more particularly between about 3 ml and about 15 ml fluid. The second, opposite surface of the layer can be treated to be hydrophobic (as described above) and to prevent or minimize the transmission of the absorbed fluids. The second surface may be treated with a conventional durable water-repellent (DWR) treatment (such as ZEPEL® or other treatments) and/or it may be saturated or impregnated with a hydrophobic polymer (such as silicone or urethane). The hydrophobic polymer fills the gaps in the fabric, and may be applied by dip and squeeze, knife over roll, spray, gravure, or other methods. The fabric used may be, for example, a knit and with the stretch characteristics described above. The fabric may also include the use of microfiber.

In some embodiments, bonding of the seams may be done without stitching using tape or adhesive seams, or using sealants over the stitched seams. Suitable materials may include elastic

polymer sealants and adhesives. Seams can also be sealed with seam tape such as Worthen Industries (Nashua, NH) Tape 375-4, using a Pfaff seam sealing machine.

In some embodiments, stitching of the seams may be done with thread that is non-wicking. In some embodiments, the non-wicking thread may be used to minimize fluid from wicking along the thread in stitched seams. In some embodiments, the thread may be stretchable. The thread also may have other properties. For example, the thread may be hydrophilic or treated to be hydrophilic. The thread also may be hydrophobic or treated to be hydrophobic.

Although embodiments have been shown and described for a bodysuit, it will be appreciated that the same inner lining construction may be used in other garments. For example, the inner linings may be used in an undergarment. In such an example, the undergarment may include an outer shell, a first inner lining that extends from the upper portion of the undergarment (e.g., a waist area of the undergarment) to a crotch seam. As with other embodiments, a second inner lining may extend from a front crotch seam to a rear crotch seam and be formed in the shape of the crotch region. A third inner lining may be attached to a top of the second inner lining. The third inner lining may have the same shape as the second inner lining but be smaller in size. The inner lining construction may be used in other garments in other embodiments. For example, the inner linings may be incorporated into a pair of pants (e.g., leggings).

While the present teachings have been described in conjunction with various embodiments and examples, it is not intended that the present teachings be limited to such embodiments or examples. On the contrary, the present teachings encompass various alternatives, modifications, and equivalents, as will be appreciated by those of skill in the art. Accordingly, the foregoing description and drawings are by way of example only.

Various aspects of the present invention may be used alone, in combination, or in a variety of arrangements not specifically discussed in the embodiments described in the foregoing and is therefore not limited in its application to the details and arrangement of components set forth in the foregoing description or illustrated in the drawings. For example, aspects described in one embodiment may be combined in any manner with aspects described in other embodiments.

Also, the invention may be embodied as a method, of which an example has been provided. The acts performed as part of the method may be ordered in any suitable way. Accordingly, embodiments may be constructed in which acts are performed in an order different than illustrated, which may include performing some acts simultaneously, even though shown as sequential acts in illustrative embodiments.

Use of ordinal terms such as “first,” “second,” “third,” etc., in the claims to modify a claim element does not by itself connote any priority, precedence, or order of one claim element over another or the temporal order in which acts of a method are performed, but are used merely as labels to distinguish one claim element having a certain name from another element having a same name (but for use of the ordinal term) to distinguish the claim elements.

Also, the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of “including,” “comprising,” or “having,” “containing,” “involving,” and variations thereof herein, is meant to encompass the items listed thereafter and equivalents thereof as well as additional items.

What is claimed is:

CLAIMS

1. A bodysuit comprising:
 - an outer shell having a front panel and a rear panel;
 - a first inner lining attached to the outer shell, the first inner lining having a front panel and a rear panel, the front panel of the first inner lining extending from above a waistline of the outer shell front panel to a first seam and the rear panel of the first inner lining extending from above a waistline of the outer shell rear panel to a second seam, wherein the first seam is located at a first side of a crotch region of the bodysuit and the second seam is located at a second, opposite side of the crotch region of the bodysuit; and
 - a second inner lining attached to the first inner lining at the first and second seams.
2. The bodysuit of claim 1, wherein the first and second seams are not joined to either of the front and rear panels of the outer shell.
3. The bodysuit of claim 1, wherein the first seam is located on a front side of the crotch region and the second seam is located on a rear side of the crotch region.
4. The bodysuit of claim 3, wherein the second inner lining extends rearwardly through the crotch region from the first seam to the second seam.
5. The bodysuit of claim 1, further comprising a third lining positioned on an inner side of and attached to the second inner lining;
6. The bodysuit of claim 1, wherein:
 - the front panel of the first inner lining extends from a neckline of the front panel of the outer shell to the first seam; and
 - the rear panel of the first inner lining extends from a neckline of the rear panel of the outer shell to the second seam.

7. The bodysuit of claim 1, wherein a length of the front panel of the first inner lining is different than a length of the rear panel of the first inner lining.
8. The bodysuit of claim 1, wherein the second inner lining has a substantially hourglass shape.
9. The bodysuit of claim 5, wherein the third inner lining has a substantially hourglass shape.
10. The bodysuit of claim 5, wherein the third inner lining is smaller than the second inner lining.
11. The bodysuit of claim 10, wherein:
 - a front side of the third inner lining is attached to a front side of the second inner lining at a third seam; and
 - a rear side of the third inner lining is attached to a rear side of the second inner lining at a fourth seam.
12. The bodysuit of claim 11, wherein the third seam is adjacent to the first seam and the fourth seam is adjacent to the second seam.
13. The bodysuit of claim 11, wherein the third seam is longitudinally spaced from the first seam by a distance of at least about 0.25 inches.
14. The bodysuit of claim 13, wherein the second seam is longitudinally spaced from the fourth seam by a distance of at least about 0.25 inches.
15. The bodysuit of claim 10, wherein a first side of the third inner lining is spaced from a first side of the second inner lining by a distance of at least about 0.125 inches.

16. The bodysuit of claim 1, wherein the front panel of the first inner lining is formed of the same material as the rear panel of the first inner lining.
17. The bodysuit of claim 1, wherein the front panel of the first inner lining is formed of a different material than the rear panel of the first inner lining.
18. The bodysuit of claim 1, wherein the second inner lining is a barrier layer.
19. The bodysuit of claim 18, wherein the second inner lining is formed of a material that is hydrophobic or treated to be hydrophobic.
20. The bodysuit of claim 5, wherein the third inner lining is formed of an absorbent material.
21. The bodysuit of claim 20, wherein the third inner lining is arranged to absorb up to about 50mL of fluid.
22. The bodysuit of claim 20, wherein the third inner lining is formed of a material that is hydrophilic or treated to be hydrophilic.
23. The bodysuit of claim 1, wherein the front panel of the first inner lining is attached to the outer shell at a fifth seam located on a first side of the bodysuit and at a sixth seam located on a second, opposite side of the bodysuit.
24. A method of constructing a bodysuit having an outer shell with front and rear panels;
attaching a front panel of a first inner lining to a front panel of an outer shell of the bodysuit and attaching a rear panel of the first inner lining to a rear panel of the outer shell, wherein the front panel of the first inner lining extends from a portion above a waistline of the outer shell to a first seam and the rear panel of the first inner lining extends from a portion above the waistline of the outer shell to a second seam, the first seam defining a first edge of a crotch region of the bodysuit and the second seam defining a second edge of the crotch region; and

attaching a second inner lining to the front and rear panels of the first inner lining at the first and second seams.

25. The method of claim 24, wherein attaching the second inner lining includes attaching the second inner lining such that the second inner lining extends across the crotch region of the bodysuit.

26. The method of claim 24, further comprising attaching a third inner lining to the second inner lining, the third inner lining being positioned on an inner side of the second inner lining.

27. The method of claim 26, wherein attaching the third inner lining includes attaching the third inner lining to the second inner lining at third and fourth seams, the third seam being adjacent to the first seam and the fourth seam being adjacent to the first seam.

28. The method of claim 27, wherein the first seam is longitudinally spaced from the third seam by a distance at least about 0.25 inches.

29. The method of claim 28, wherein the second seam is longitudinally spaced from the third seam by a distance of at least about 0.25 inches.

30. The method of claim 24, wherein the front and rear panels of the outer shell are attached to the front and rear panels of the first inner lining at first and second sides of the bodysuit, the second side being opposite to the first side.

31. The method of claim 24, wherein:

a length of the front panel of the outer shell is longer than a length of a front panel of the first inner lining; and

a length of the rear panel of the outer shell is longer than a length of the rear panel of the first inner lining.

32. The method of claim 24, wherein:

attaching the front panel of the first inner lining to the front panel of the outer shell of the bodysuit includes attaching the front panel via a seam at a front neckline of the bodysuit and via one or more seams on a side of the bodysuit; and

attaching the rear panel of the first inner lining to the rear panel of the outer shell of the bodysuit includes attaching the rear panel of the first inner lining to the rear panel of the outer shell via a seam at a rear neckline of the bodysuit and via the one or more seams on a side of the bodysuit.

33. The method of claim 24, further comprising attaching the front panel of the outer shell to the rear panel of the outer shell.

34. The method of claim 33, wherein attaching the front panel of the outer shell to the rear panel of the outer shell includes attaching the front and rear panels via a seam in or near the crotch region and via one or more seams at a side of the bodysuit.

35. The method of claim 24, further comprising stitching together a leg opening bend back via a fifth seam.

36. The method of claim 35, further comprising moving the second and third inner linings aside while the leg opening bend back is stitched together via the fifth seam.

37. The method of claim 36, further comprising stitching the second inner lining to the leg opening bend back via a sixth seam.

38. The method of claim 37, further comprising stitching the third inner lining to the second inner lining and to the leg opening bend back via a seventh seam.



FIG. 1

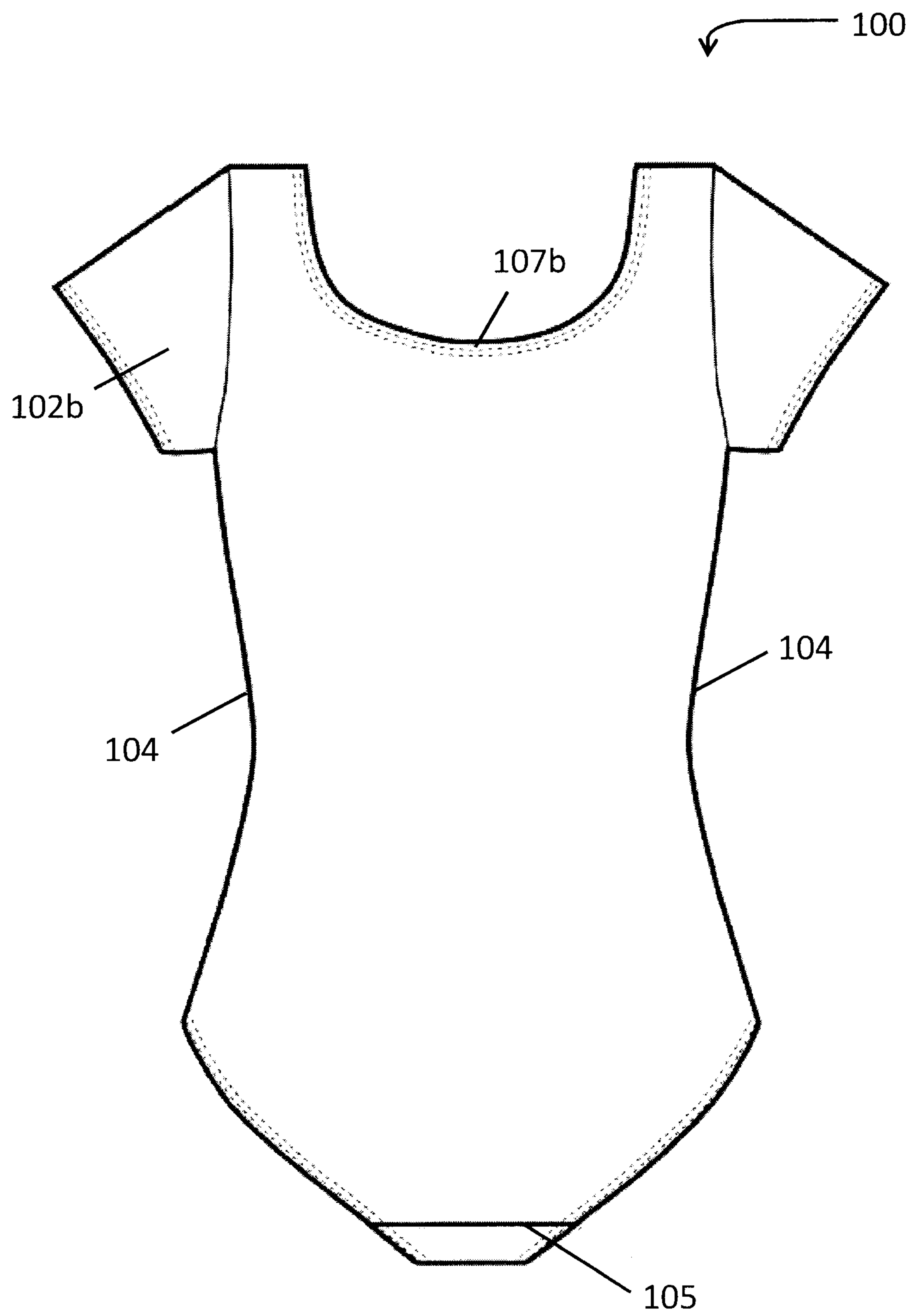


FIG. 2

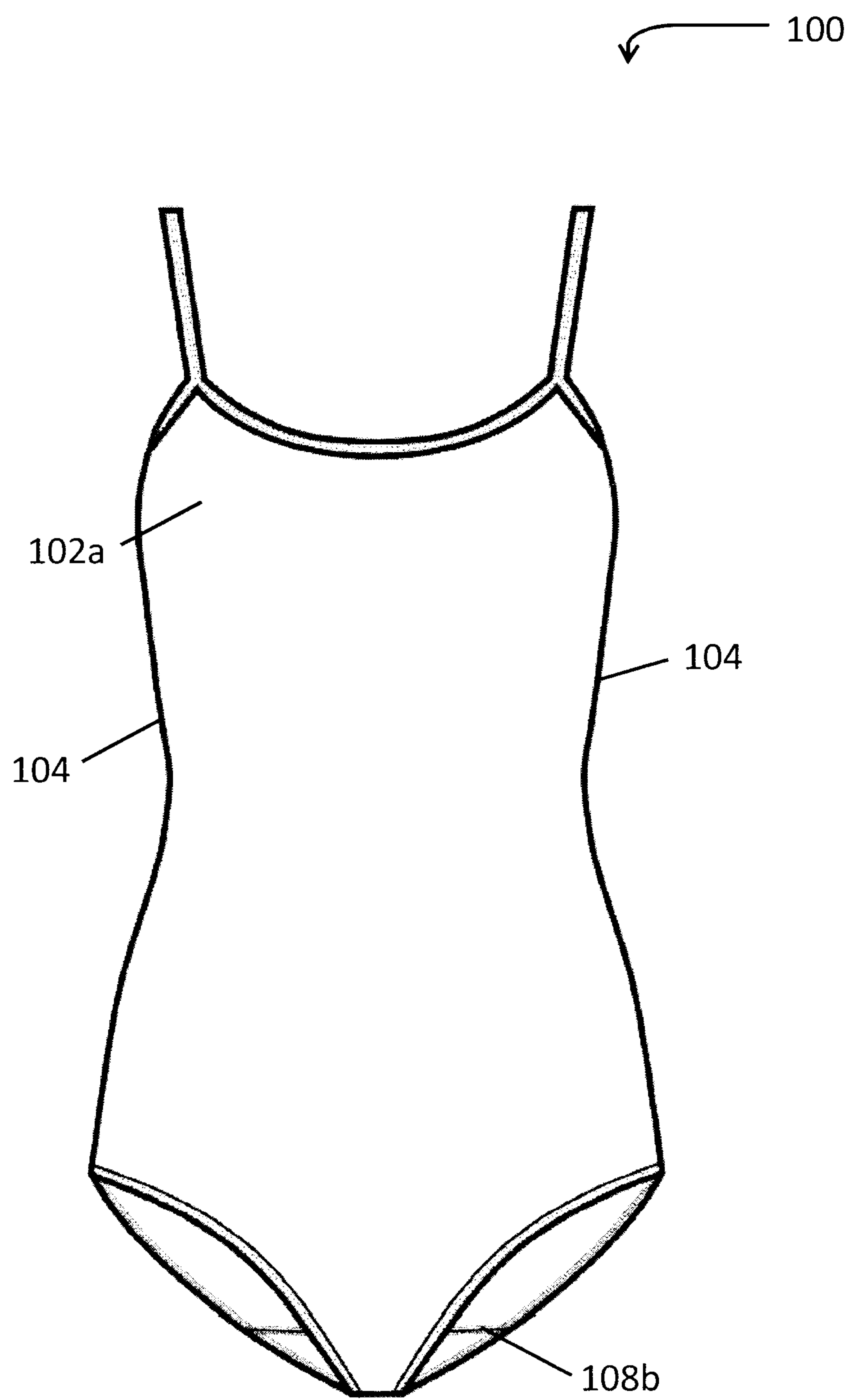


FIG. 3

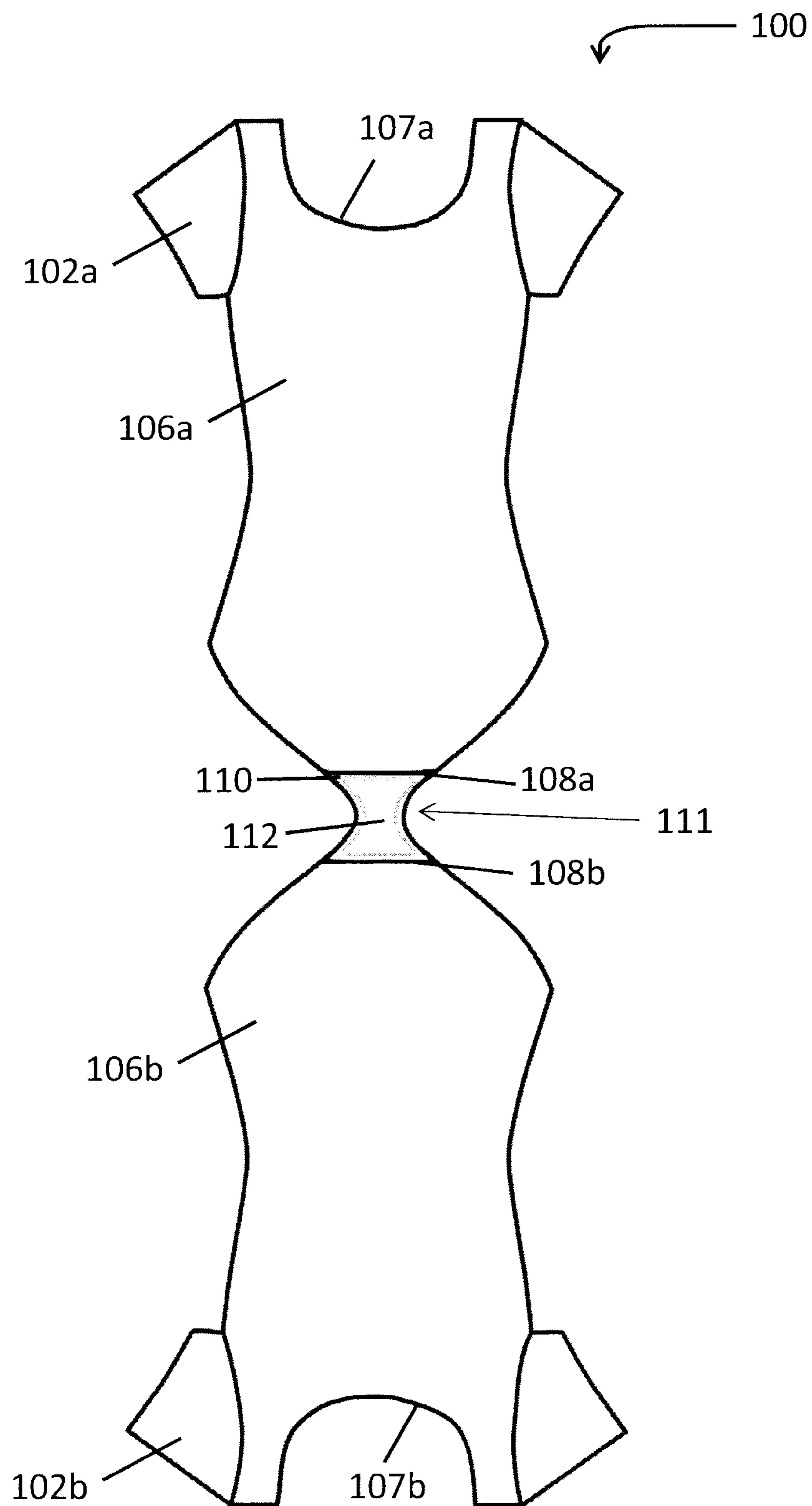


FIG. 4



FIG. 5

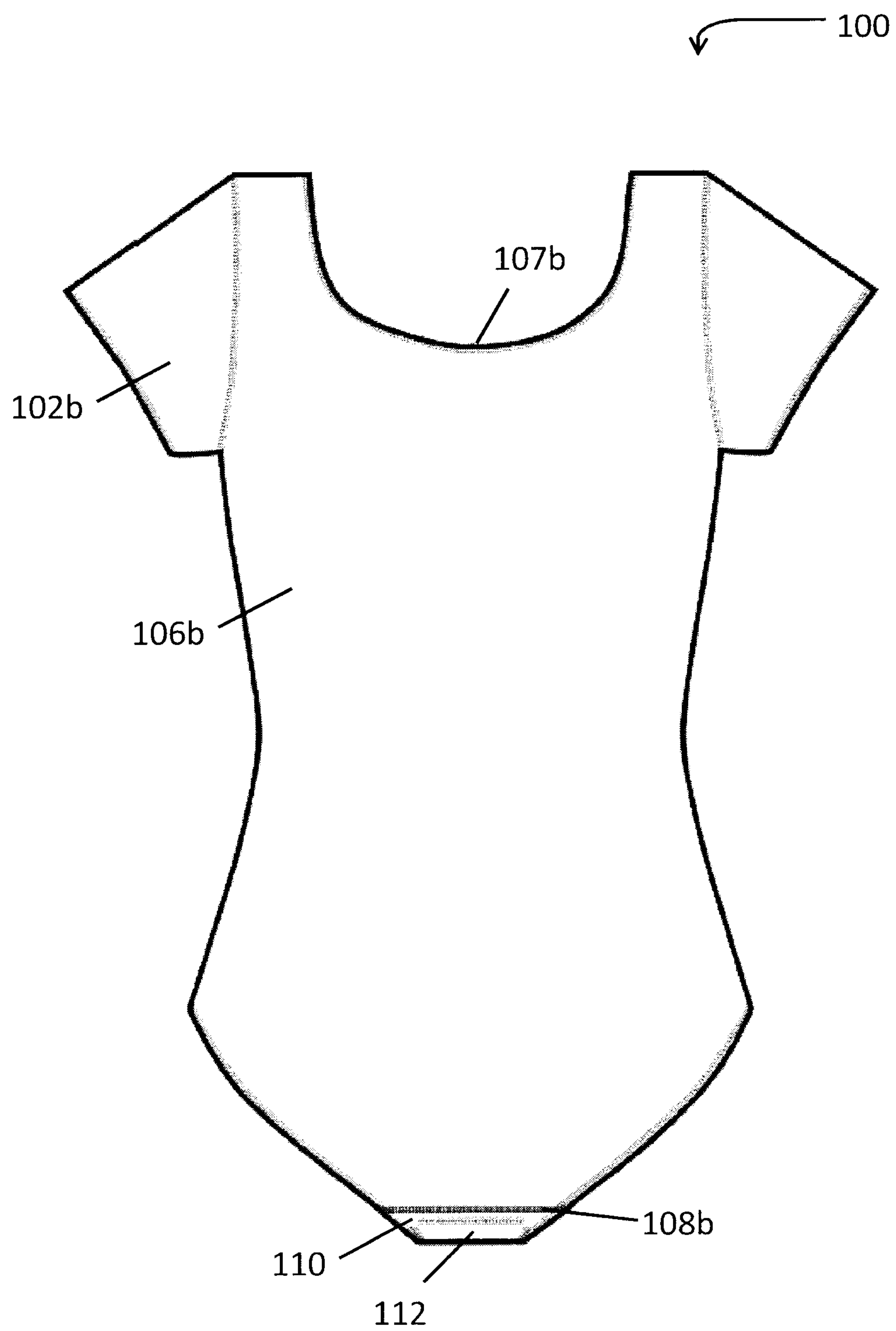


FIG. 6

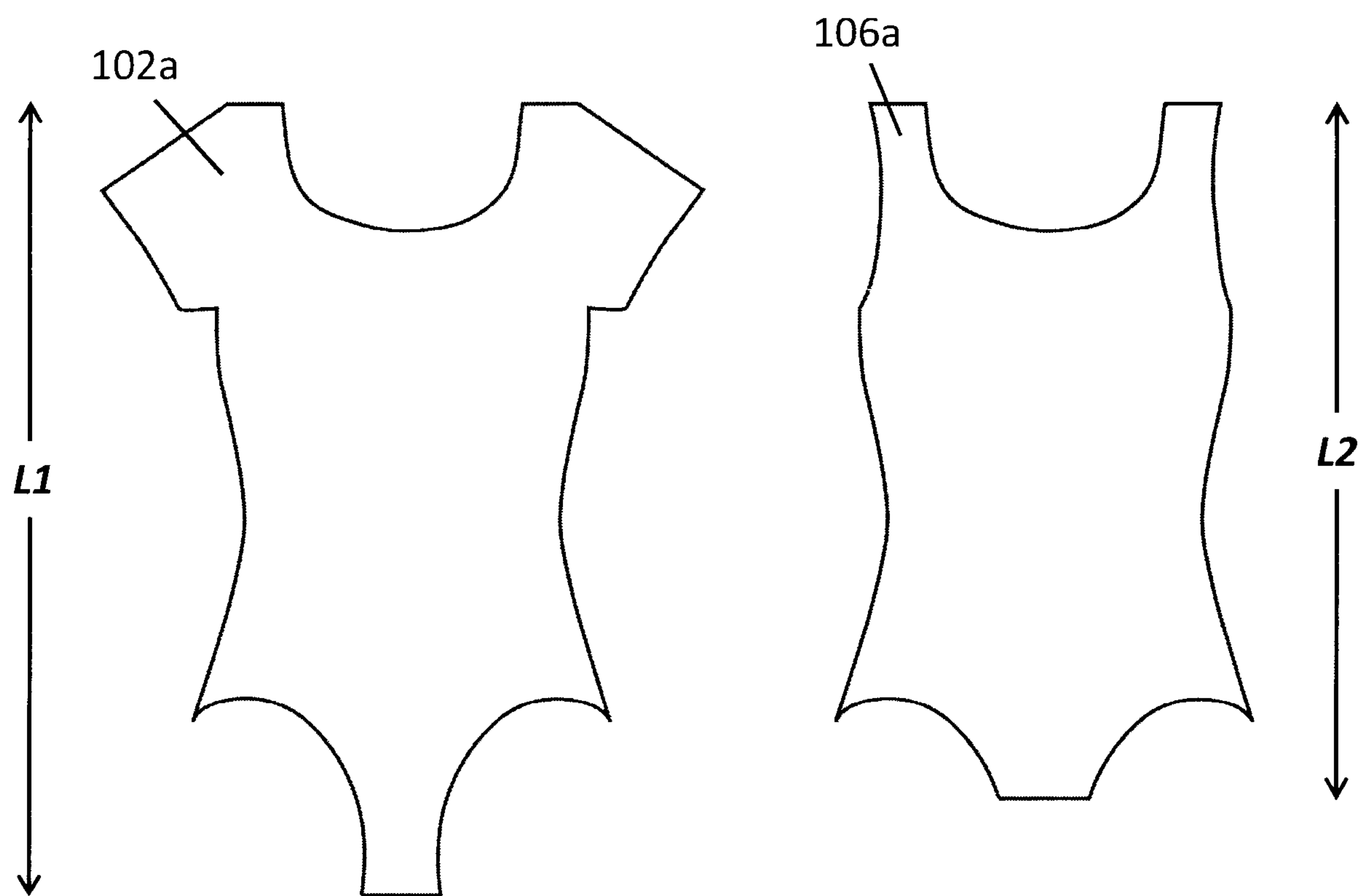


FIG. 7

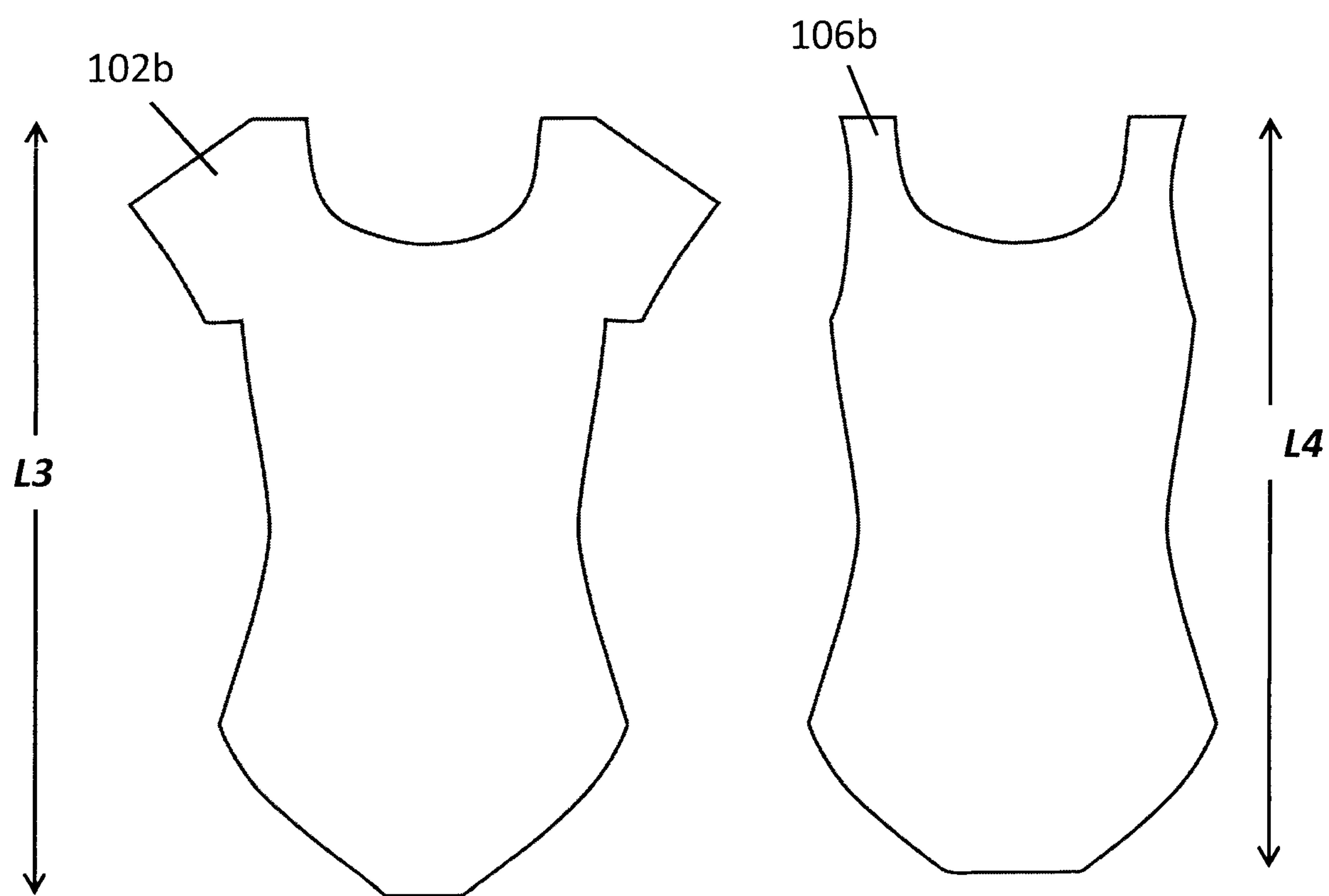


FIG. 8

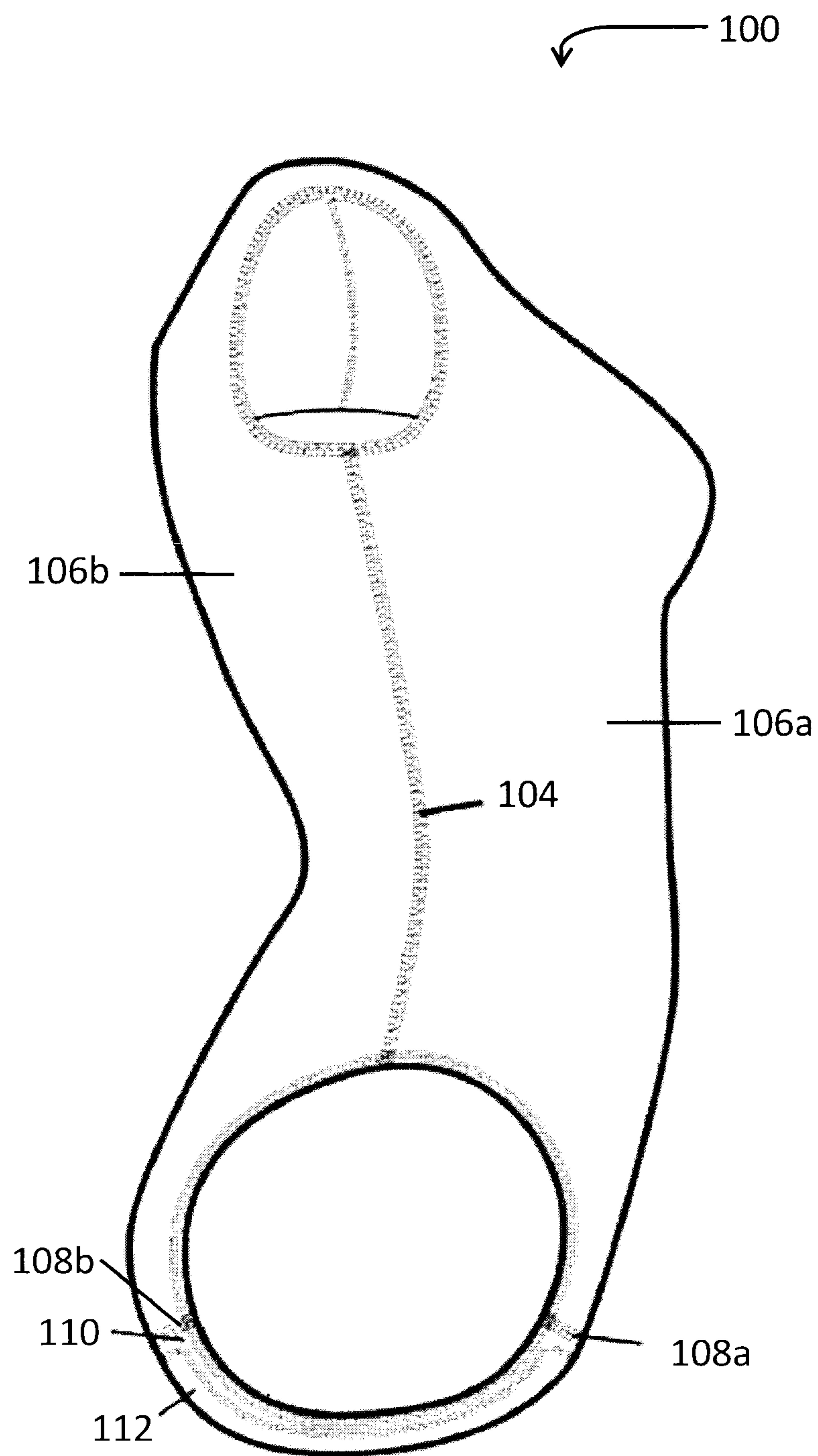


FIG. 9

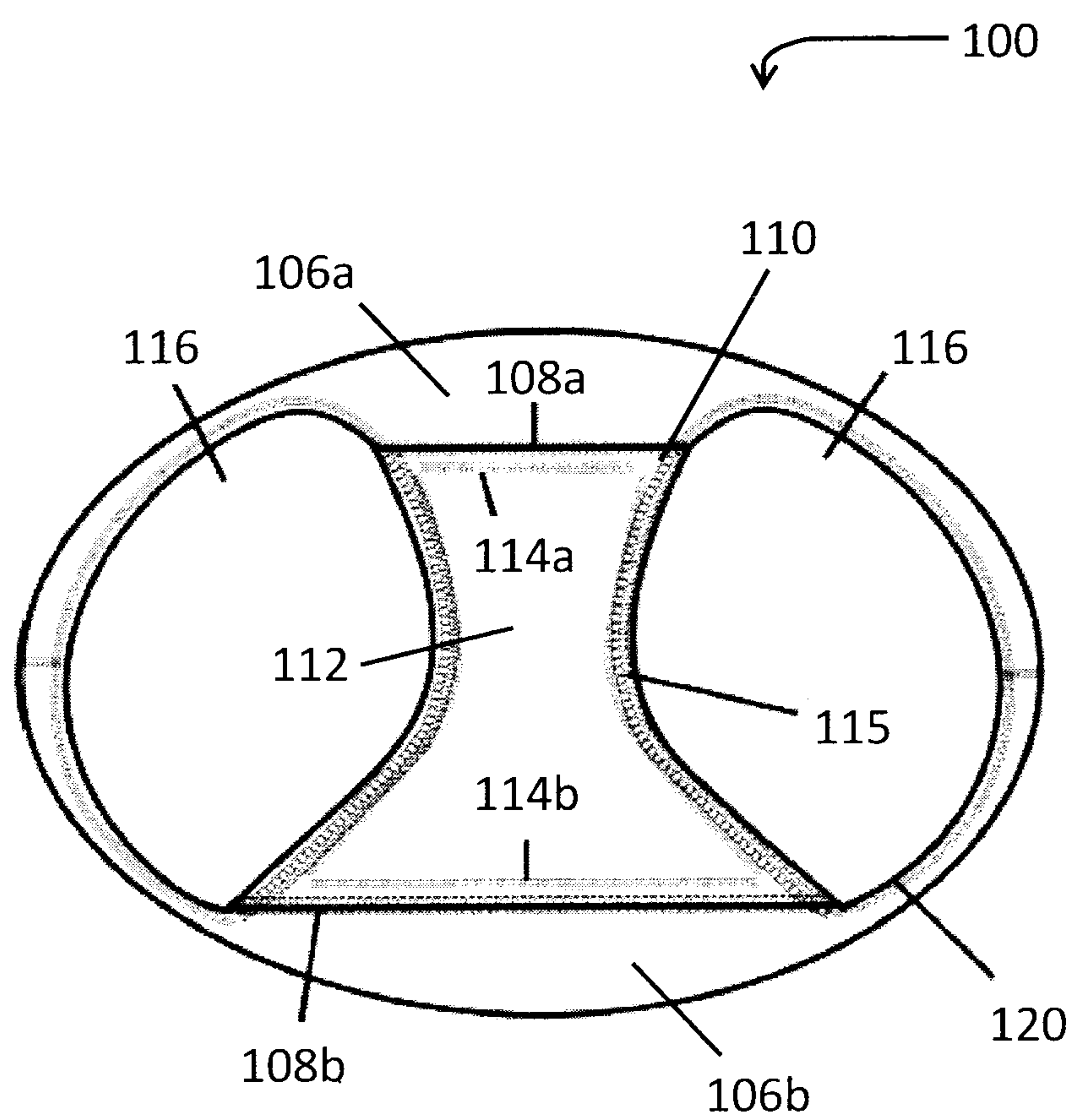


FIG. 10

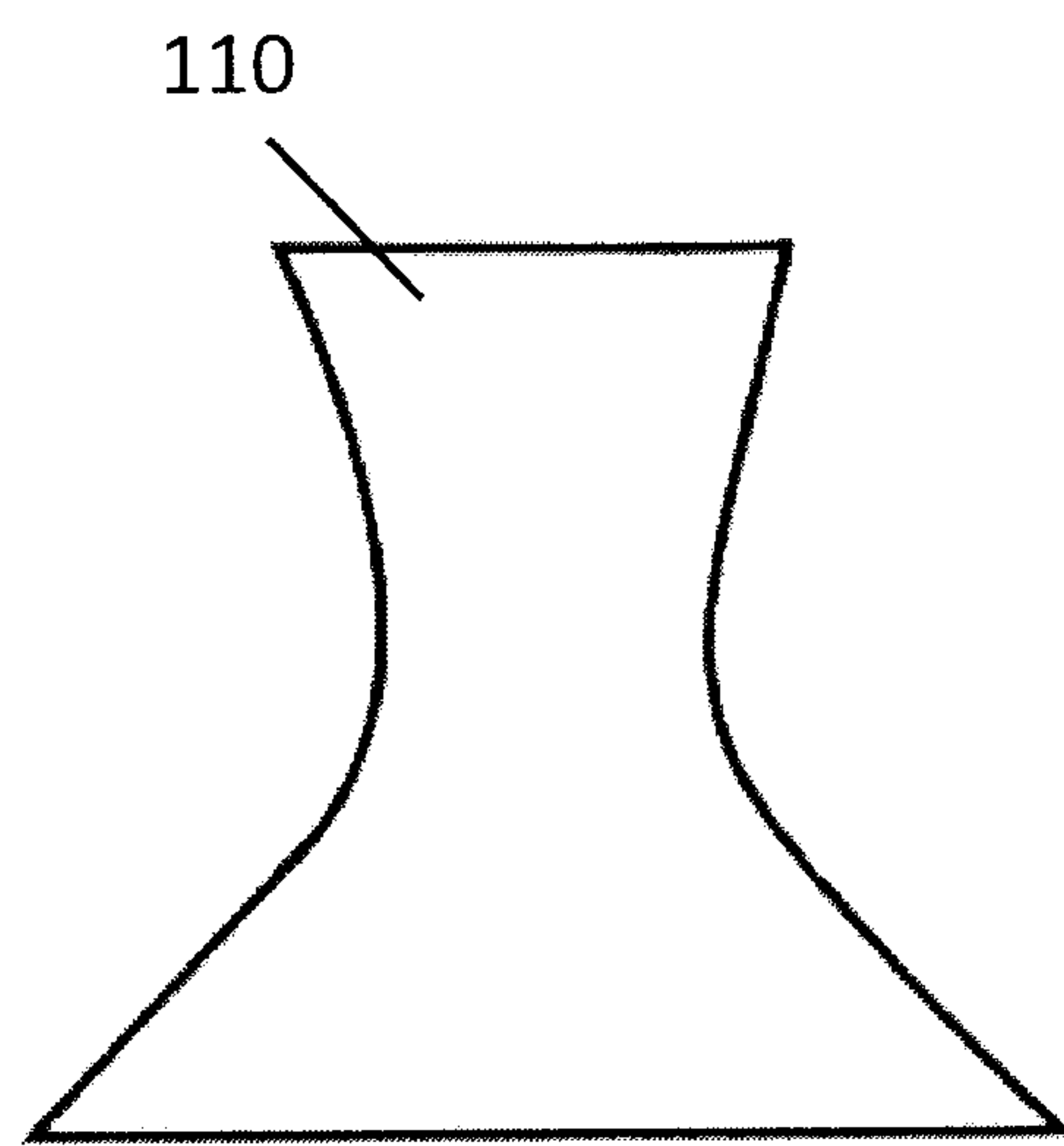


FIG. 11

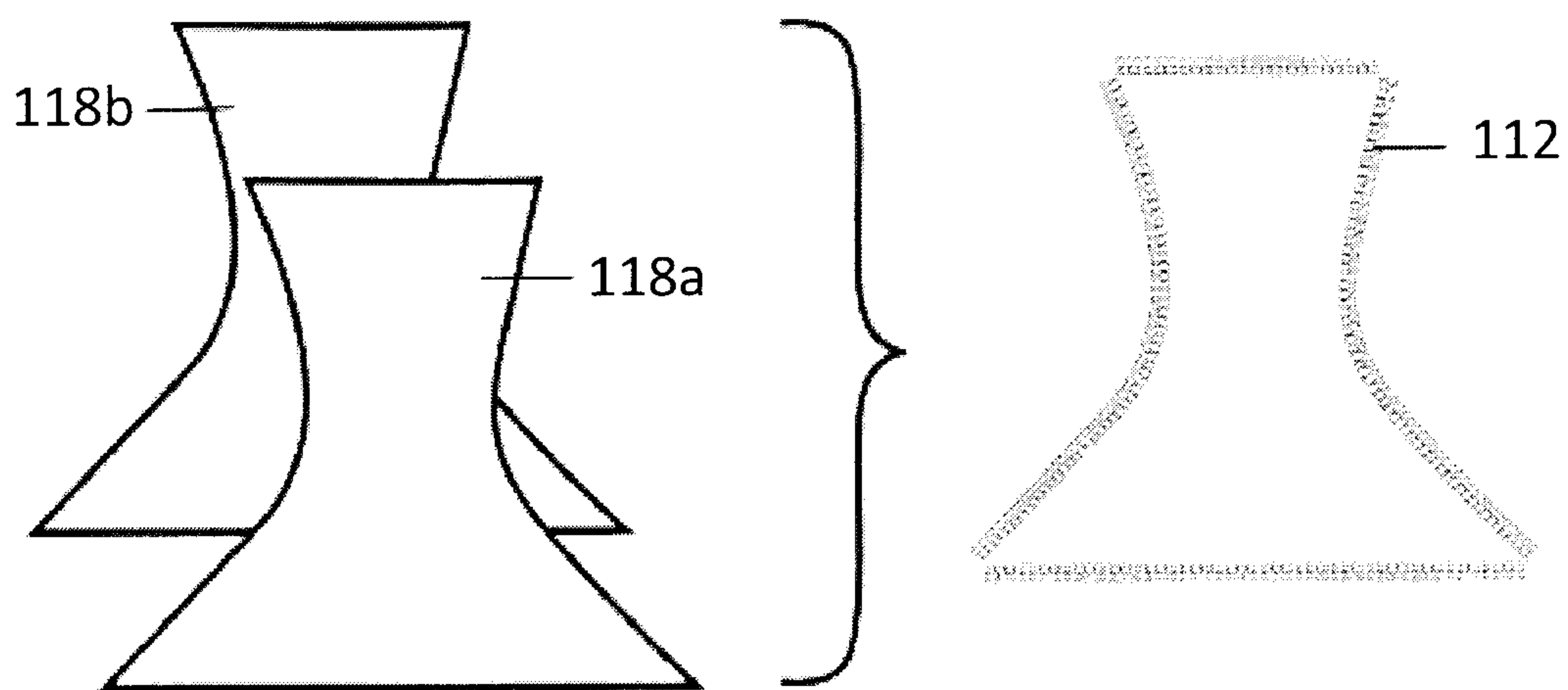


FIG. 12

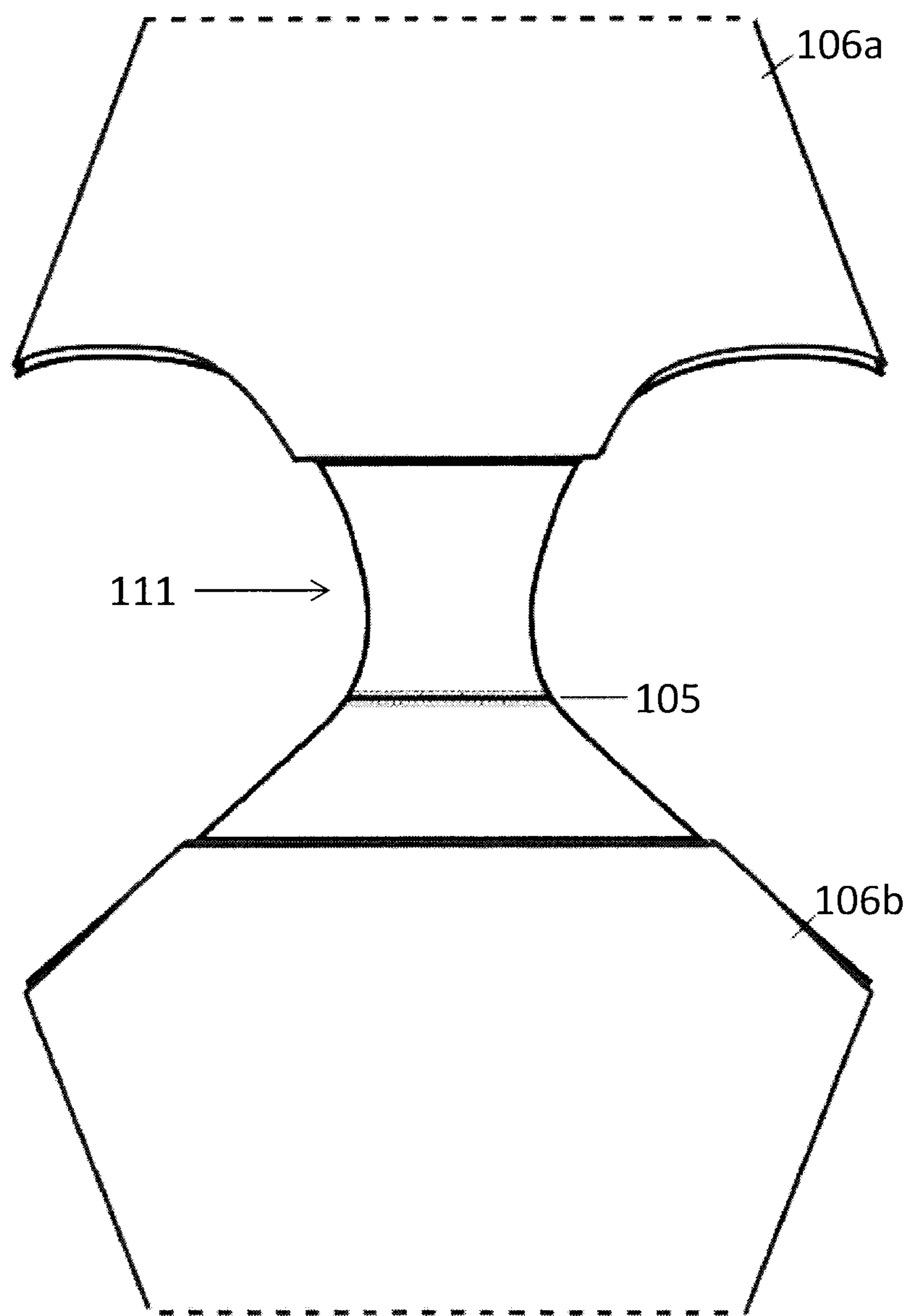


FIG. 13

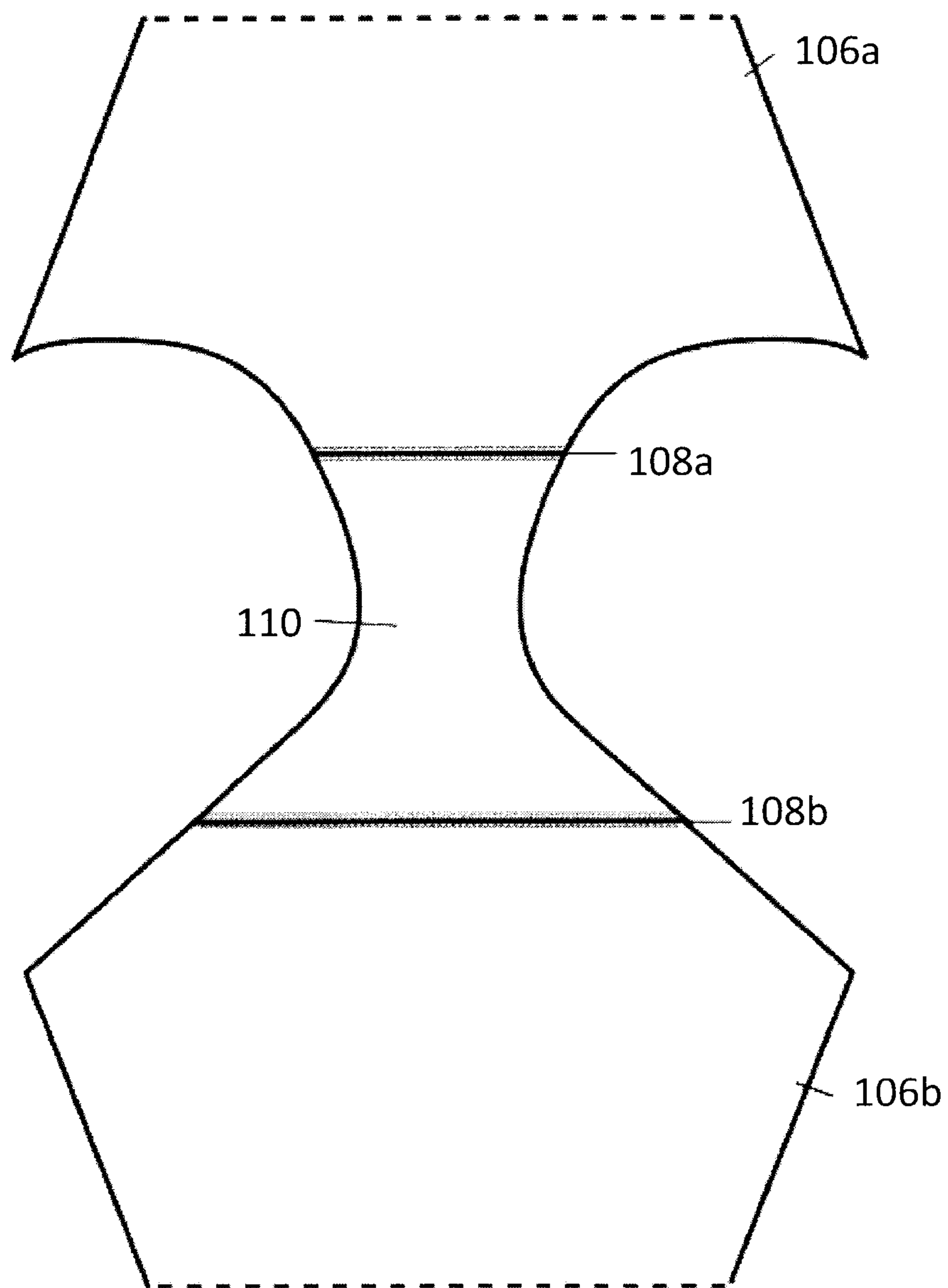


FIG. 14

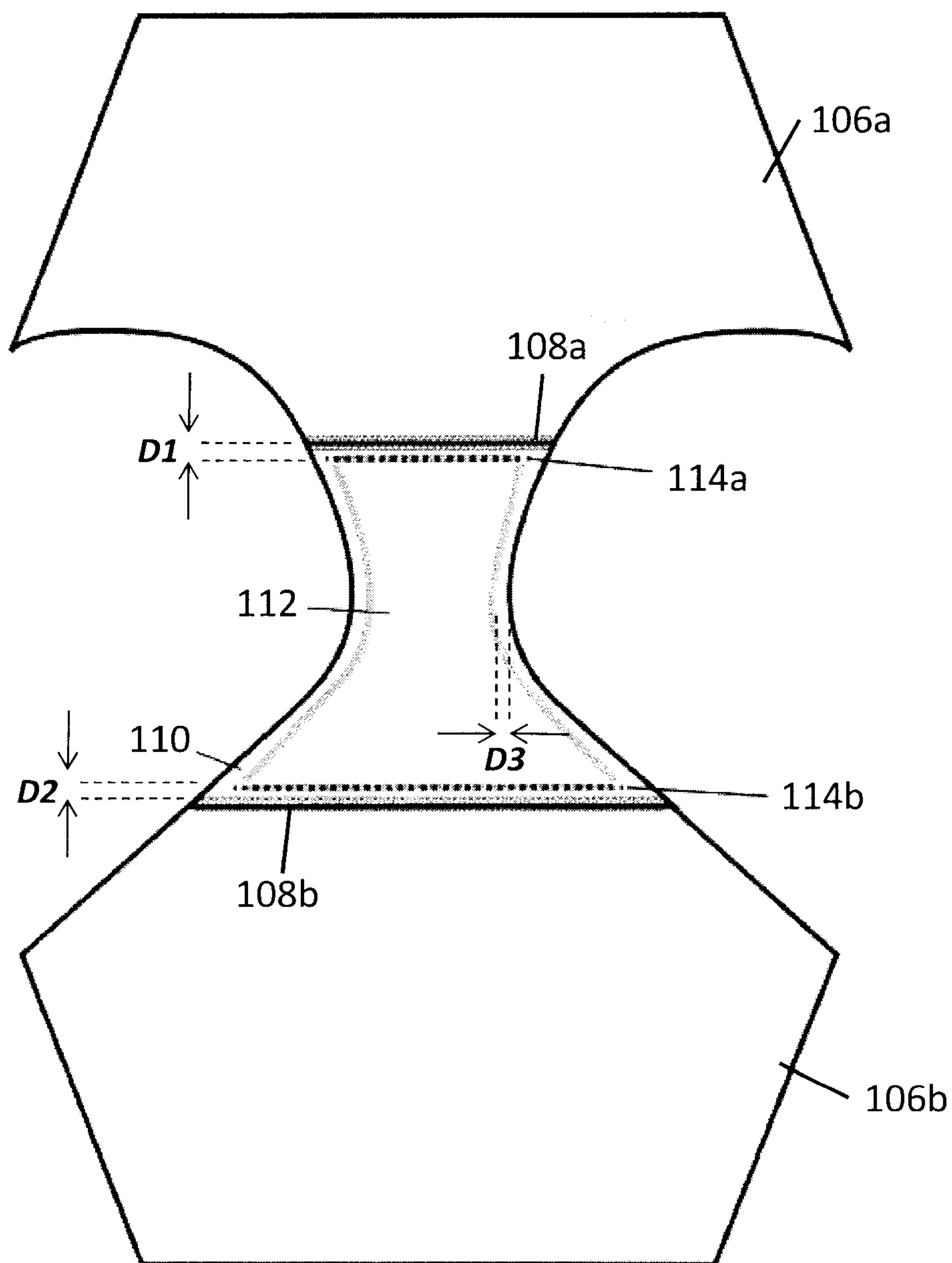


FIG. 15

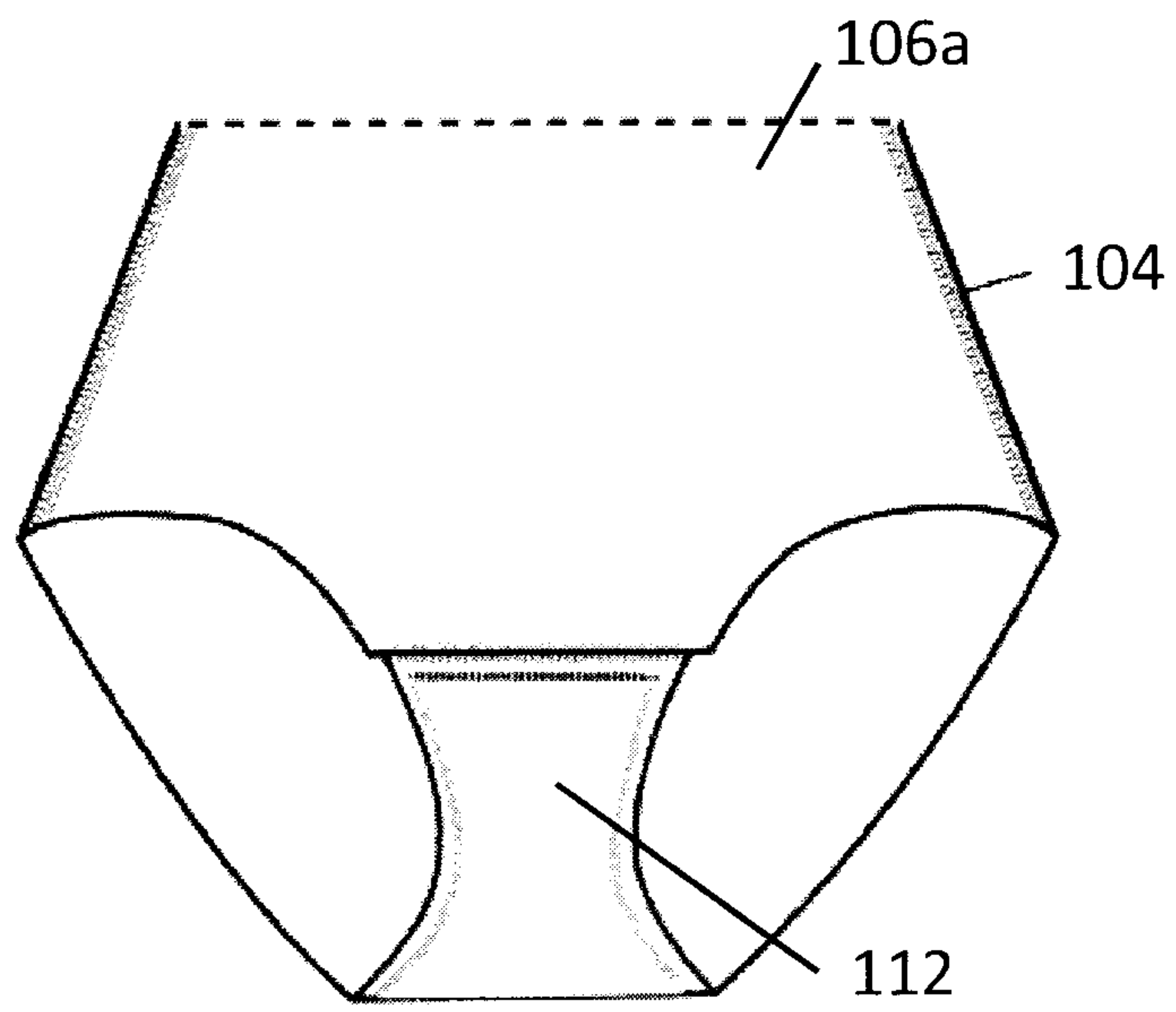


FIG. 16A

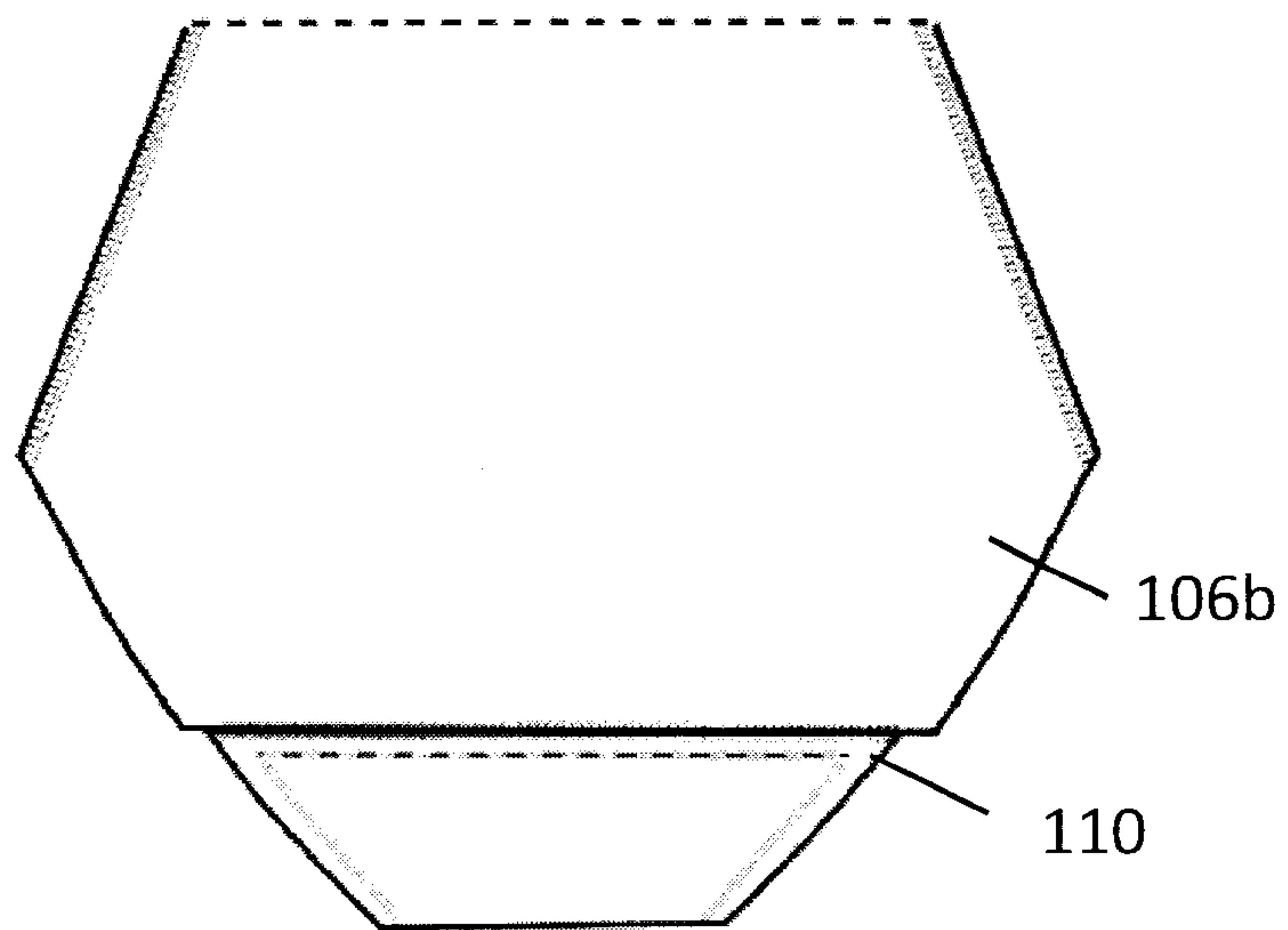


FIG. 16B

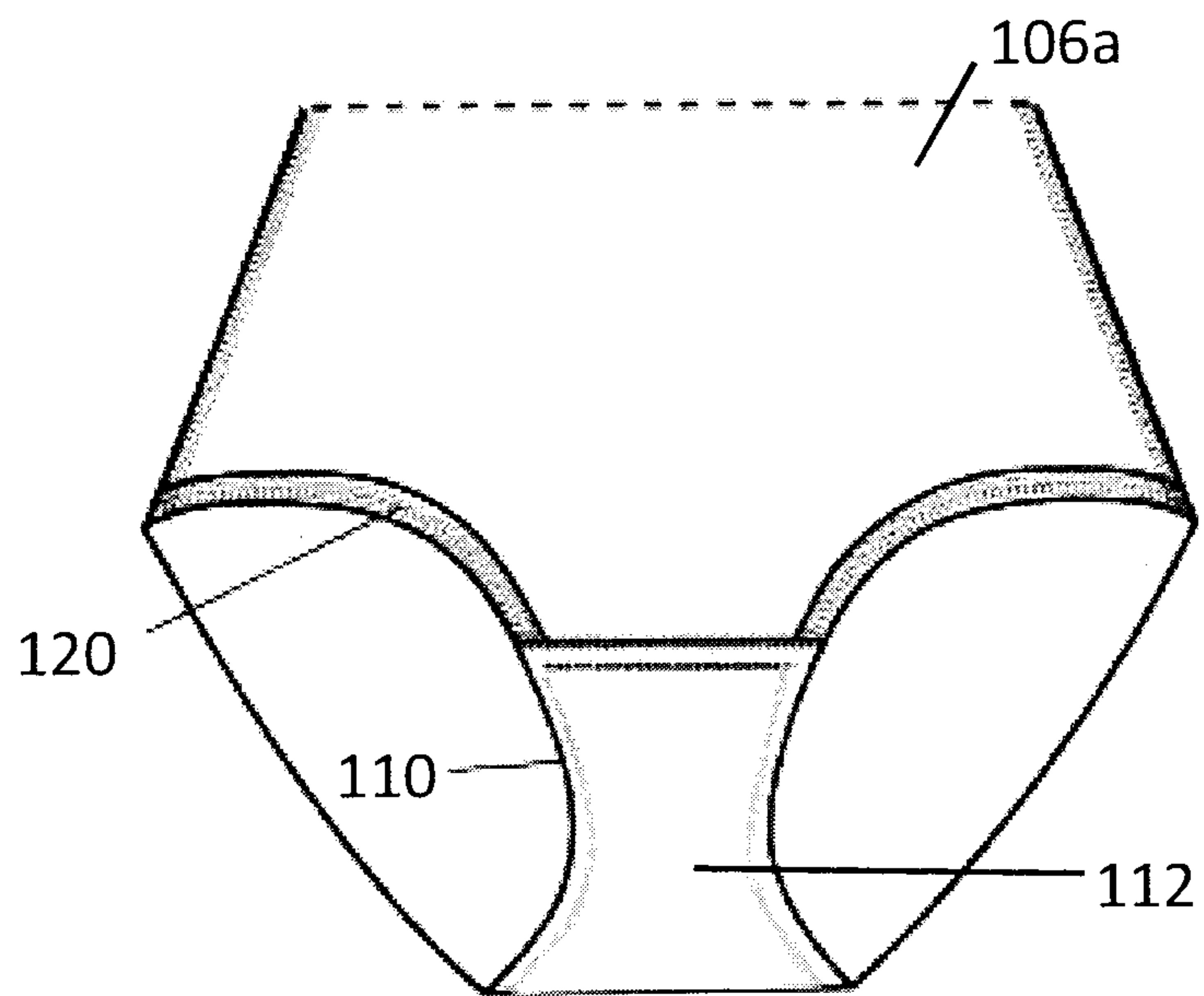


FIG. 17A

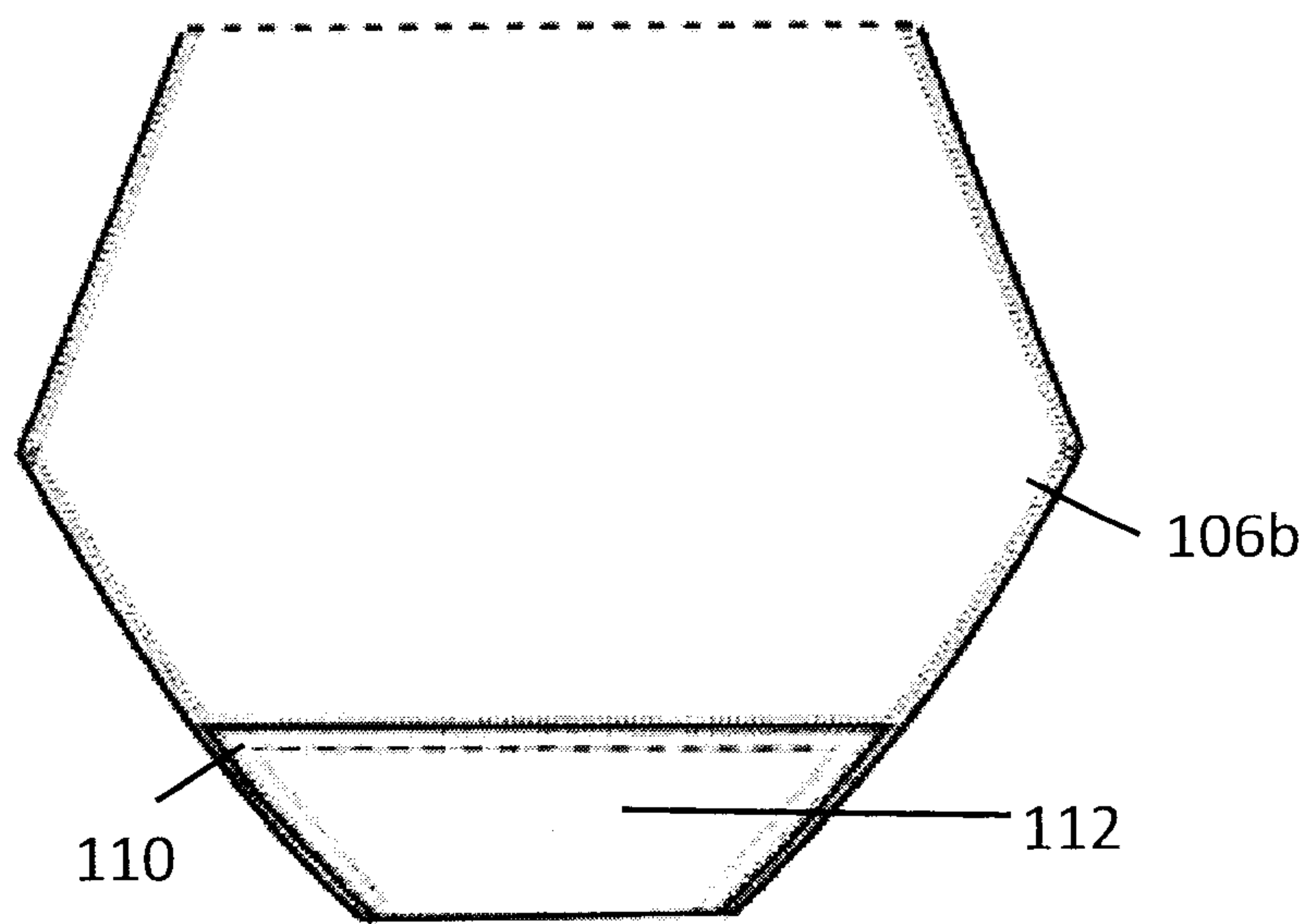


FIG. 17B

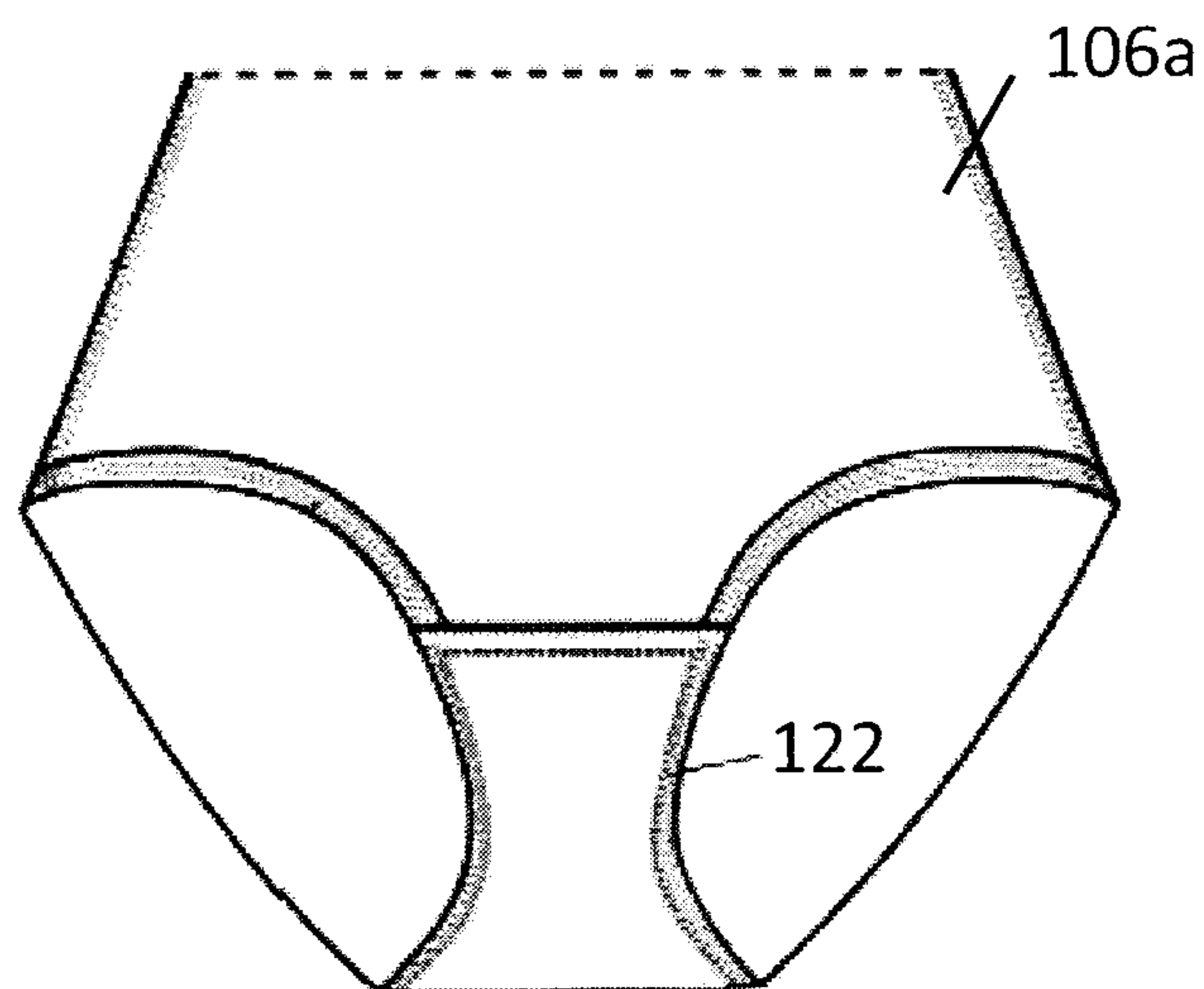


FIG. 18A

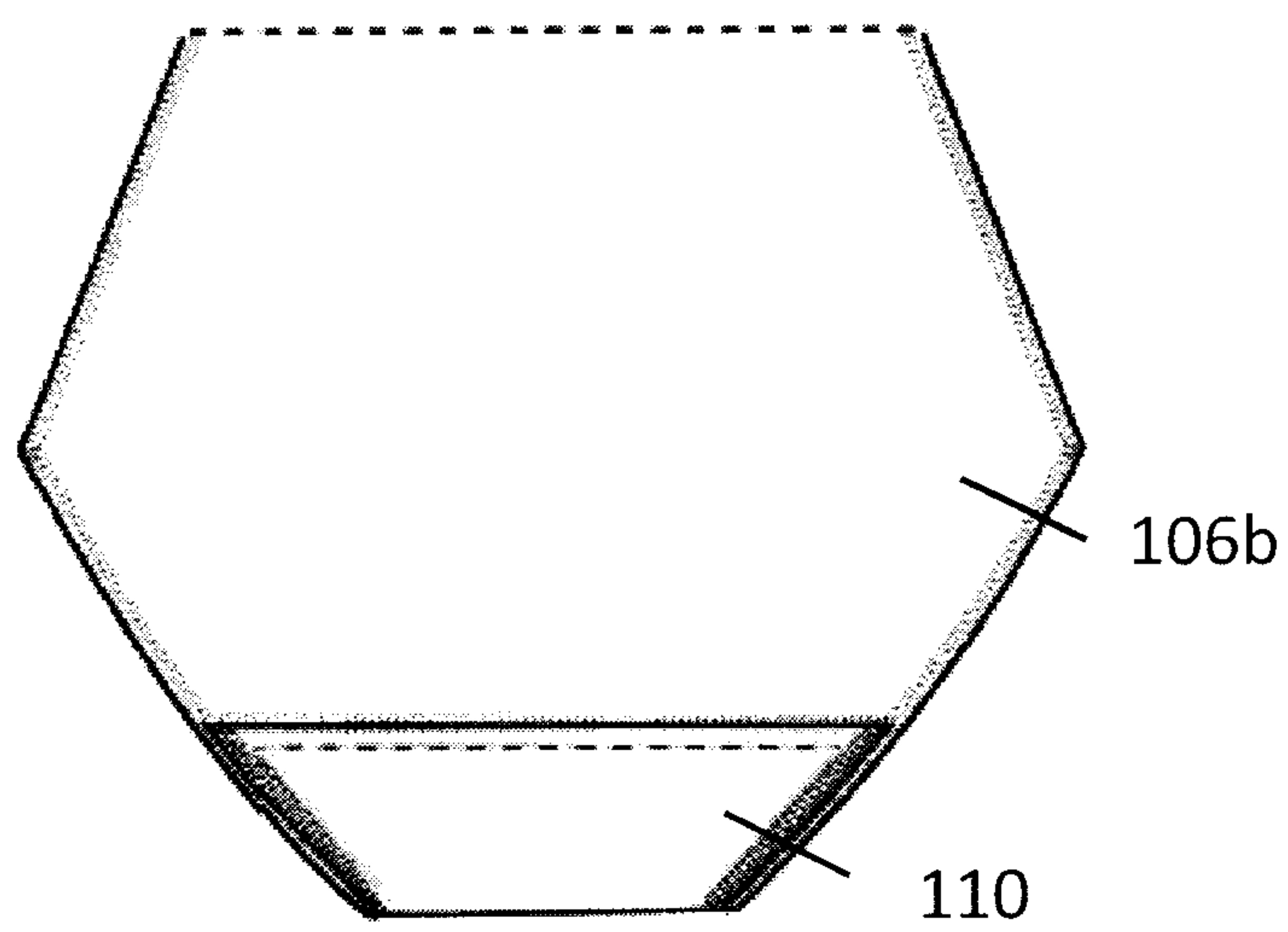


FIG. 18B

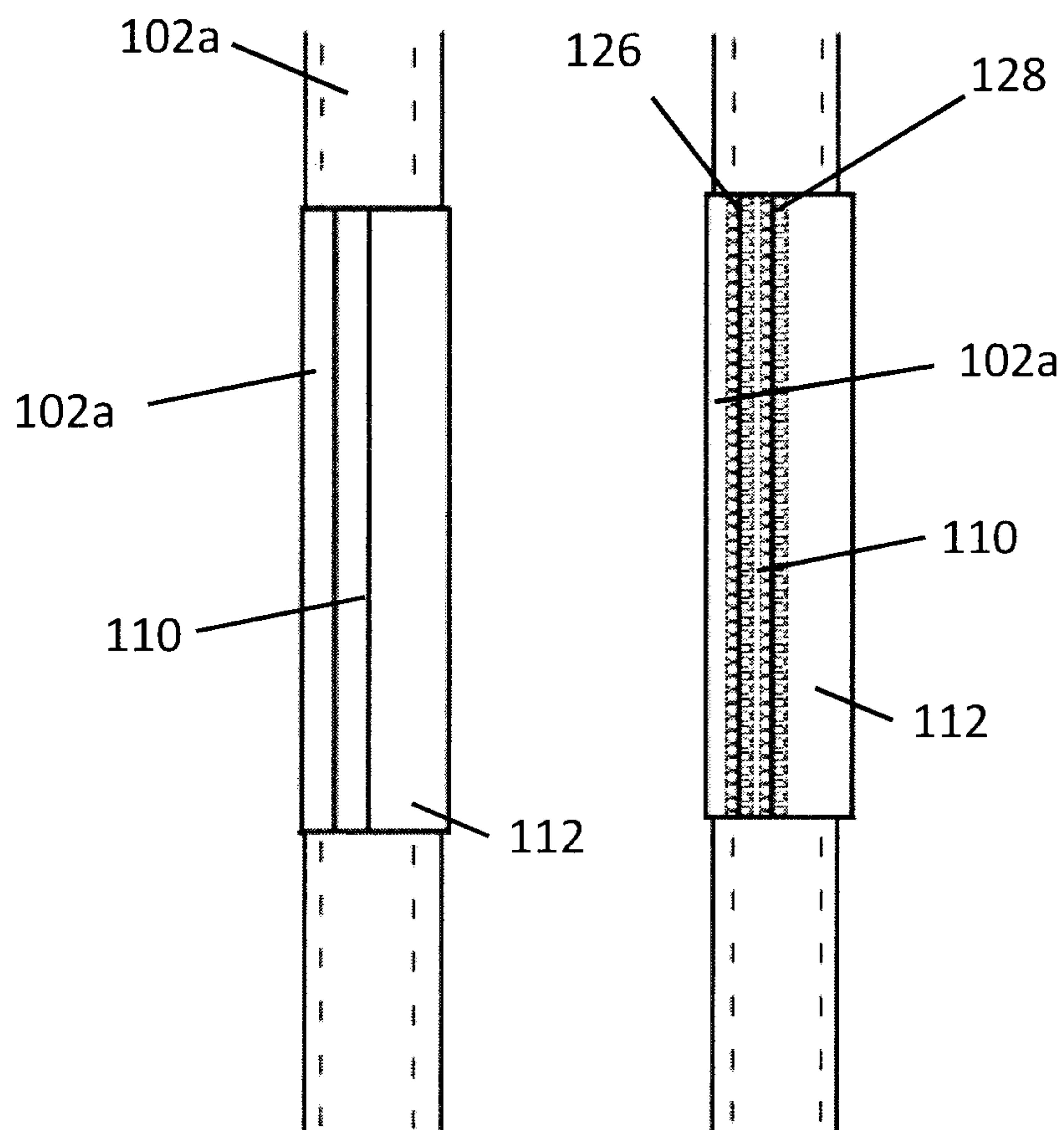


FIG. 19A

FIG. 19B

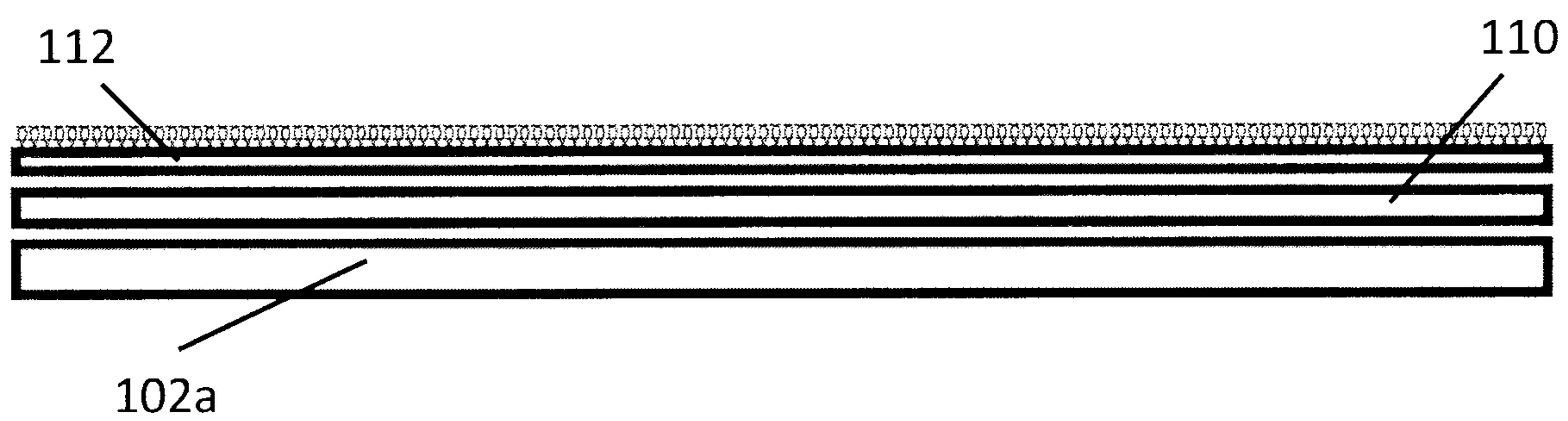


FIG. 20

TABLE A -- FABRIC CHARACTERISTICS

Fabric Function	Fabric Layer	Fabric Manufacturer and Style	Manufacturer's Reported Fabric Composition	Yarn Treatment	Fabric Treatment	Manufacturer's Reported Fabric Weight Range (oz/yd ²)	Measured Total Water Absorbency (g/m ²) (based on "Eulle Dip Test")	Measured Absorbent Capacity (ml) (based on "Eulle Capacity Test")
Absorbent	A	Darlington Fabrics Style 27210	75% 40/34 DL Nylon 24% 40 Denier Spandex	None	Lasting Degree WXSTV ¹	3.7 - 4.1	347.2	31
	B	Darlington Fabrics Style 27000	87% 70/34 Nylon 13% 40 Denier Spandex	None	Lasting Degree XXSTV ²	6.4 - 7.2	483.6	40
	C	United Knitting Style 46322	86% Polyester 14% Lycra ^{®3}	Sorbtex ^{®4}	None	7.0	806	37.5
Repellent	3	Enviro Fabrics Style OCSJ 3040	92% Organic cotton 8% Spandex	None	6.0% Amipel HGT (C) 8.0% Nepton EXT 84% water ⁵	6.9 - 7.2	Not measured	Not measured
	4	Enviro Fabrics Style OCSJ 3040 LT	92% Organic cotton 8% Spandex	None	same	6.0 - 6.3	Not measured	Not measured
	5	Darlington Fabrics Style 25590	80% 40/13 DL Nylon 20% Denier Spandex	None	XSTR	5.2 - 5.8	Not measured	Not measured

¹ Available from Piedmont Chemical, North Carolina

² Available from Piedmont Chemical, North Carolina

³ LYCRA is a registered trademark of Invista North America S.A.R.L., Corporation, Luxembourg

⁴ Sorbtex is a registered trademark of Unifi, Inc., North Carolina

⁵ Formulated by Applicants; Amipel HGT (C) and Nepton EXT are both available from Apollo Chemical Inc., North Carolina, a division of Mount Vernon Chemicals LLC

FIG. 21

