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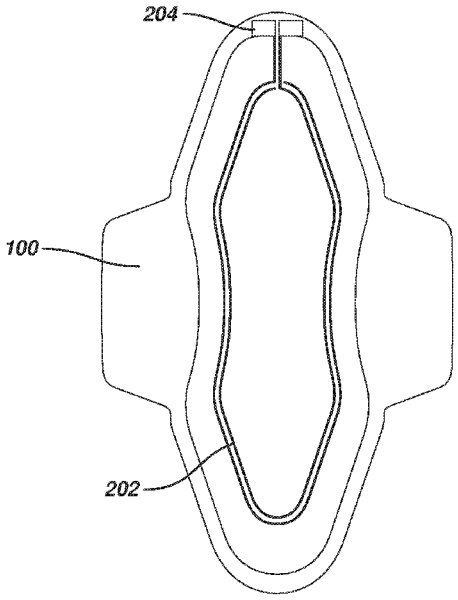
(54) Title: PERSONAL HYGIENE PRODUCT WITH A DIGITAL ELEMENT

(57) Abstract: A personal hygiene product with a digital element includes an external personal hygiene product to absorb bodily fluids and a conductive sensor assembly disposed therein. The conductive sensor assembly includes a pair of conductive elements disposed in parallel in a mirrored image about the perimeter of the personal hygiene product and at least one connector directly contacting the pair of conductive elements, said conductive sensor assembly generating a signal indicative of fluid leakage of said personal hygiene product when fluid reaches the area between the pair of conductive elements. The conductive sensor assembly is arranged and configured to communicate with a smart hand held electronic device, either directly or through a wireless connection.

FIG. 3A



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PERSONAL HYGIENE PRODUCT WITH A DIGITAL ELEMENT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This relates to personal hygiene products used for personal care, primarily for absorption or containment of bodily fluid, and more particularly, to an external personal hygiene product with a digital element that may be utilized to sense and wirelessly communicate discharge related data to the user via a smart hand held electronic device.

2. Discussion of the Related Art

The basic structure of a personal hygiene product has not varied greatly over time. The needs of users have also not varied: to prevent seepage onto the skin, clothing, or external environment through maximized absorption and predictability of the personal hygiene product's absorption capacity. External personal hygiene products include bed pads, disposable adult diapers, disposable adult briefs, disposable sanitary napkins, sanitary napkins with adhesive strips and wings, panty liners, and nursing pads. Most people will at some point in their life use a personal hygiene product for a period of time. Personal hygiene products historically involve a one-size-fits-all approach.

A woman, for example will use an estimated average of 10,000 personal hygiene products in a lifetime. Even though feminine hygiene products come in different sizes and shapes designed for varying absorbent capacity, no product is 100 percent effective in preventing spills or leakage because variance in menstruation may lead to oversaturation. Each woman's menstrual flow varies over the course of her menstruation, with some days being lighter or heavier than others. Because of menstrual variance, accidents or overflows may occur where the personal hygiene product becomes oversaturated and spills outside of the absorbent area. Continued use of an oversaturated hygiene product may lead to negative health impacts such as bacterial infections or toxic shock syndrome.

Many women manually track or monitor their menstrual cycle for predictability to avoid the unexpected start of menstruation in the absence of a personal hygiene product or accidents of the sort discussed above. There are over two hundred smart device applications available to

monitor menstruation manually. Users enter data into the application on a smart device, for example a smart phone or other hand-held device, and the application generates data predicting, for example, menstrual start day, flow pattern, and length of menstruation. Many of these smart device applications issue alerts when menstruation is expected to start and end. All available devices, however, rely on data based on the subjective and manual entry of the user and may not reliably meet the primary needs most female hygiene product users have: predictability and reliability. None of these applications are able to actively monitor the active absorption capacity of a personal hygiene product while a user is wearing or using it.

In addition to the need for predictability and reliability in use of a personal hygiene product, a personal hygiene product is situated either proximate to or inserted into the body and as a result is able to collect data about patterns of discharge and biometrics in a way that a manual-entry application is unable to capture. This data is beneficial, to avoid social embarrassment, and also for a user's overall health, for example, to provide accurate data to a physician or to alert the user if there are disruptions in normal patterns of bodily fluid discharge.

The proper combination of a personal hygiene product incorporated with a digital element capable of interfacing with a smart hand held electronic device would meet the ultimate needs of personal hygiene product consumers. The digital element needs to biocompatible and comprised of an array capable of wireless communication. Accordingly, there exists a need for providing a personal hygiene product capable of gathering, processing, and communicating data about the product's absorbent capacity and individual user's bodily fluid discharge to smart hand held electronic device of a user. There are also exists a need for an individual user to be able to interface with the data once communicated to the smart hand held electronic device.

External personal hygiene products have been proposed with a parallel conductive track about an absorbent structure, such as in US8044258 and US9408757. However, the signal from a parallel conductive track provides a variable signal, depending upon where the circuit between the parallel tracks bridges. Thus, it can be difficult to determine noise from actual potential leakage.

Accordingly, the need exists for novel conductive track for external personal hygiene products that provides a clear signal when failure of the product is imminent.

SUMMARY OF THE INVENTION

A personal hygiene product with a digital element in accordance with the present invention overcomes the limitations with the prior art as briefly discussed above.

We have determined that a personal hygiene product with a digital element is an improvement of the existing state of the art. In particular, personal hygiene product with a digital element includes an external personal hygiene product to absorb bodily fluids and a conductive sensor assembly disposed therein. The conductive sensor assembly includes a pair of conductive elements disposed in parallel in a mirrored image about the perimeter of the personal hygiene product and at least one connector directly contacting the pair of conductive elements, said conductive sensor assembly generating a signal indicative of fluid leakage of said personal hygiene product when fluid reaches the area between the pair of conductive elements. The conductive sensor assembly is arranged and configured to communicate with a smart hand held electronic device, either directly or through a wireless connection.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the invention will be apparent from the following, more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings.

Fig. 1 illustrates a top plan view of an embodiment of personal hygiene product for use with a sensor element embedded in accordance with the present invention.

Fig. 2 illustrates an exploded cross-section along line II-II of the embodiment of Fig. 1.

Fig. 3A is a diagrammatic representation of an exemplary feminine napkin with sensor.

Fig. 3B is a diagrammatic representation of an exemplary attachment of a signal acquisition device to a feminine napkin and placement in underwear.

Fig. 3C shows an exemplary connector utilizing button snaps.

Fig. 4 is a top plan view of a personal hygiene product having a parallel sensor arrangement.

Fig. 5 is a diagrammatic representation of an alternative arrangement of the sensor element having three conductive traces.

Fig. 6 is a diagrammatic representation of an alternative arrangement of the sensor element having three modified conductive traces.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A device comprising a hygiene product with a digital element capable of interface with a smart hand held electronic device is disclosed in this application. In the following sections, detailed descriptions of various embodiments are described. The descriptions of various embodiments are illustrative embodiments, and various modifications and alterations may be apparent to those skilled in the art. Therefore, the exemplary embodiments do not limit the scope of this application. The digital element is designed for use in or adjacent to the body of a living organism.

Glossary

In the description and claims below, various terms may be used for which the following definitions will apply:

"Biocompatible" as used herein refers to a material or device that performs with an appropriate host response in a specific application. For example, a biocompatible device does not have toxic or injurious effects on biological systems.

"Communication System" as used herein, may refer to a wireless communication device that can be configured to transmit and receive information from a processor to a receiver in a smart hand held electronic device.

"Digital Element" as used herein, may refer to electronic components on a substrate.

"Smart Hand-held Device" as used herein, may refer to a smartphone or tablet built on a mobile operating system and having advanced processing capabilities.

"External Personal Hygiene Product" as used herein refers to but is not limited to Hygiene Products worn outside the body.

"Feminine Hygiene Product" as used herein refers to but is not limited to a tampon, sanitary pad, panty liner, nursing pad, or other product used to absorb or contain menstruation or bodily fluid discharge.

"Hygiene Product" as used herein refers to any absorbent material or device used by humans to absorb or contain bodily fluid discharge, including but not limited to Feminine Hygiene Products, diapers, men's guards and shields, adult diapers and booster pads.

"Power Source" as used herein refers to any device or layer which can supply energy or placing a logical or electrical device in an energized state. The power source may include batteries. The batteries can be formed from alkaline cell chemistry and may be solid-state batteries or wet cell batteries.

"Sensor Array" as used herein means a sensor or a plurality of sensors, which may include, for example, resistive or capacitive to detect liquid or moisture.

"Switch" as used herein means a circuit element that controls the flow of electrical current in response to a physical or electrical input

Personal Hygiene Product with a Digital Element

The present invention is an improvement of a Personal Hygiene Product with a digital element as disclosed in US2016/0250081 and USSN 62/569,744, the entire contents of which are herein incorporated by reference.

External Personal Hygiene Product

Referring now to Figs. 1-3, there is illustrated a Personal Hygiene Product 100 having a cover layer 102, a barrier layer 104, and an absorbent material 106 disposed between the cover layer 102, a barrier layer 104. The barrier layer 104 has an inner surface 108 directed toward the absorbent material 106 and an outer, garment-facing surface 110. The Personal Hygiene Product 100 may also have a positioning adhesive 112 disposed upon the outer surface 110 of the barrier layer 104. The positioning adhesive 112 may be protected by a release liner 114.

Referring now to Fig. 3, an external electronic feminine hygiene system for external sanitary products, such as sanitary napkins, liners, and incontinence pads is shown. Figure 3A shows a Personal Hygiene Product 100 with embedded conductive elements, also referred to as sensor electrodes or traces 202. Such electrodes may be fabricated with conductive ink, metallized and transferred onto the pad, or through other methods. The ends of the traces 202 form a connection point or node 204. Figure 3B shows said Personal Hygiene Product 100 with a signal acquisition device 206 attached, both against an undergarment. Figure 3C shows an exemplary connector 208 in which metal button snaps 210 are crimped onto conductive traces 202 on the Personal Hygiene Product 100.

When fluid reaches the area between the two parallel traces 202, the resistance change is read by the tag and an alarm is trigged (e.g. vibration or message sent to a smartphone app). The transmission can be direct (using bluetooth, for exemple) or indirect (using a passive RFID). The transmission can be non-stop or a passive tag can be scanned directly by the smartphone, whenever the user desires. By continuous is meant a sampling rate of about 1Hz.

The traces 202 are in parallel arrangement, but are oriented in a mirrored configuration. Thus, trace 202a extends from the connection point 204 in a clockwise direction about the product, and trace 202b extends from the connection point 204 in a counter-clockwise direction about the product. This provides a constant signal due to a change in system resistance, no matter where the bridging between the traces 202 occurs. In contrast to a parallel arrangement shown in Fig. 4 in which a short-circuit proximate the node 304, e.g., at a point indicated at 306 would have a significantly different signal than a short-circuit distal the node 304, e.g., at a point indicated at 308.

The traces 202 may be disposed on any layer of the Personal Hygiene Product 100. In one embodiment, the traces 202 are disposed on the inner surface 108 of the barrier layer 104. Alternatively, the traces 202 may be disposed on or in the absorbent material 106 or the cover layer 102. However, we have found that conductive traces printed on porous fibrous substrates have a higher resistance due to ink adhesion and minimal gaps inherent in a porous fibrous structure. Preferably, the traces 202 are disposed on the inner surface 108 of the barrier layer 104. This separates the traces from contact with the user's body.

The traces 202 may be in the form of conductive ink (e.g. silver or carbon-based ink) printed or otherwise disposed on a substrate, a wire (e.g., copper, silver, carbon or other

conductive material) disposed on or contained within one or more structures of the Personal Hygiene Product 100.

One or more regions of the Personal Hygiene Product 100 may be embossed as is known to those of ordinary skill in the art.

In one embodiment, the sensor traces 202 are disposed towards the outer margins 116 of the Personal Hygiene Product 100 and all embossments, e.g., 118, are disposed within a region defined by the sensor traces 202.

In another embodiment shown in Fig. 5, a third conductive element 202c is disposed within the region defined by the sensor traces 202a, 202b. This provides an earlier warning of potential leakage than a simple pair of traces 202a, 202b.

The traces may be a continuous smooth line about the Personal Hygiene Product 100, or they may be as shown in Fig. 6. Although these angled line segment traces are shown for an embodiment including three conductive traces, similar angled line segment traces can be used for a pair of parallel traces.

Other embodiments:

The absorbent article may have an absorbent core, an embossing pattern and a humidity detection sensor and a resistance reader coupled to a wireless transmission element.

The Personal Hygiene Product may be used by connecting a resistance reader and wireless transmission device to each of the node or contacting zones of the sensor traces, synchronizing the wireless transmission device to an alarm device, reading the electrical resistance between the least two electrically conductive traces, and alerting when the resistance changes (from infinite to less than 1 Mega ohms).

Humidity detection sensor is located at the external periphery of the absorbent core, outside a zone defined by the embossing pattern and inside a zone defined by the edges of the absorbent core.

Connection of the humidity detection sensor to a resistance reader+ wireless transmission device

Transmission of information to an alarm device, that will alert the user, preferred: Smartphone, smart watch or any mobile telecommunication device

Width of the conductive ink traces from 0.1mm to 5 mm (preferred between about 0.5 and about 1.5 mm, more preferred about 1 mm)

Spacing between adjacent conductive ink traces ranges from 0.1 mm to 5 mm (preferred between about 1.5 and about 2.5 mm, more preferred about 2 mm).

The electrically conductive traces are not in contact; the loop is open in its initial state and is closed when a liquid gets in contact with at least 2 tracks.

The connection node of the electrically conductive tracks have a surface of between about 65 mm^2 and about 225 mm^2, more preferably about 100 mm^2 (preferably between about 8mm x 8mm and 15mm x 15mm, most preferably about 10mm x 10mm), located on the cover, or core, or backing layer, or on the upper side of the absorbent article.

Wireless transmission device may be built inside the pad or physically/electronically connected to it through the contacting zones

Minimal distance between the electrically conductive tracks and the embossing pattern ranges between 0.1 mm to 5 mm (preferred 1 mm).

Resistance of the electrically conductive traces is less than 2000 ohms / sq, prefereably about 100 ohms / sq.

Although shown and described is what is believed to be the most practical and preferred embodiments, it is apparent that departures from specific designs and methods described and shown will suggest themselves to those skilled in the art and may be used without departing from the spirit and scope of the invention. The present invention is not restricted to the particular constructions described and illustrated, but it should be constructed to cohere with all modifications that may fall within the scope of the appended claims.

What is claimed is:

1. A personal hygiene product with a digital element comprising:

a) an external personal hygiene product to absorb bodily fluids; and

b) a conductive sensor assembly disposed within the personal hygiene product, including a pair of conductive elements disposed in parallel in a mirrored image about the perimeter of the personal hygiene product and at least one connector directly contacting the pair of conductive elements, said conductive sensor assembly generating a signal indicative of fluid leakage of said personal hygiene product when fluid reaches the area between the pair of conductive elements;

wherein said conductive sensor assembly is arranged and configured to communicate with a smart hand held electronic device.

2. The personal hygiene product of claim 1 wherein the personal hygiene product comprises a cover layer, a barrier layer, and an absorbent material disposed between the cover layer and barrier layer and wherein the barrier layer has an inner surface directed toward the absorbent material and an outer, garment-facing surface.

3. The personal hygiene product of claim 2 wherein each end of the conductive elements forms a connection node arranged and configured for connection to the conductive sensor assembly.

4. The personal hygiene product of claim 2 wherein the conductive elements are disposed on the inner surface of the barrier layer.

5. The personal hygiene product of claim 2 wherein the conductive elements are disposed on the absorbent material.

6. The personal hygiene product of claim 2 wherein the conductive elements are disposed within the absorbent material.

7. The personal hygiene product of claim 2 wherein the conductive elements are disposed on the cover layer.

8. The personal hygiene product of claim 2 wherein the conductive elements comprise conductive ink.

9. The personal hygiene product of claim 2 wherein the conductive elements comprise wire.

10. The personal hygiene product of claim 2 further comprising one or more areas of embossments disposed within a region defined by the conductive elements.

11. The personal hygiene product of claim 1 further comprising a third conductive element disposed within the region defined by the pair of conductive elements.

12. The personal hygiene product of claim 1 wherein the conductive elements comprise connected, angled line segments.

13. The personal hygiene product of claim 1 wherein the conductive elements have a width of between about 0.1 mm and about 5 mm.

14. The personal hygiene product of claim 1 wherein the conductive elements are spatially separated by between about 0.1 mm and about 5 mm.

15. The personal hygiene product of claim 14 wherein the conductive elements are spatially separated by between about 1.5 mm and about 2.5 mm.

16. The personal hygiene product of claim 3 wherein the connection node of each conductive element has a surface area of between about 65 mm^2 and about 225 mm^2.

FIG. 1

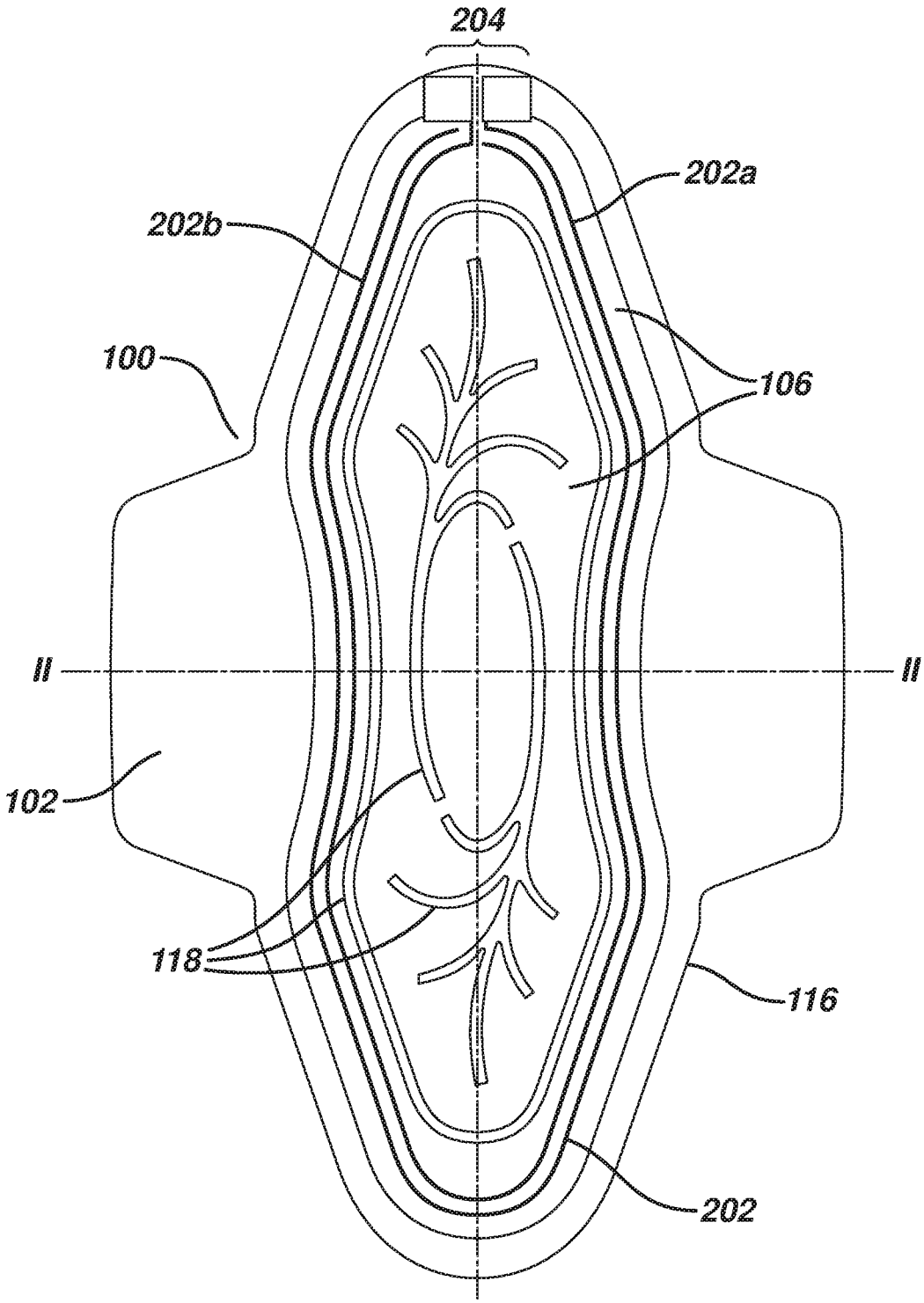

FIG. 2

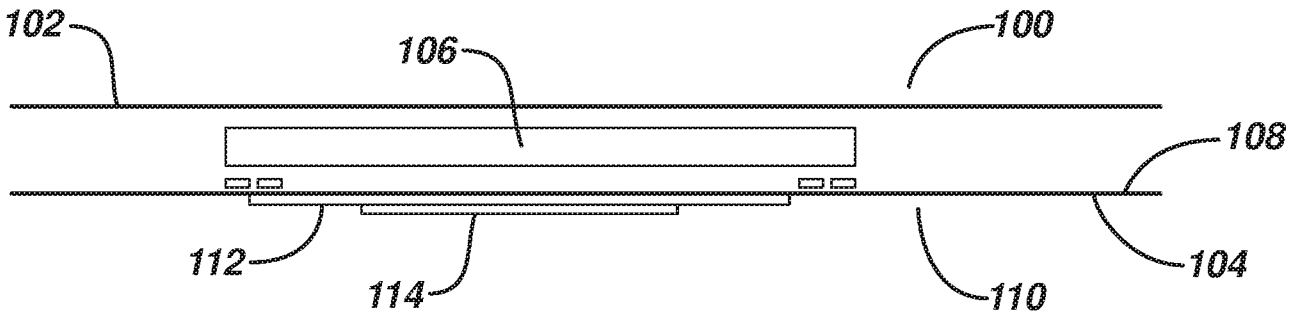

FIG. 3A

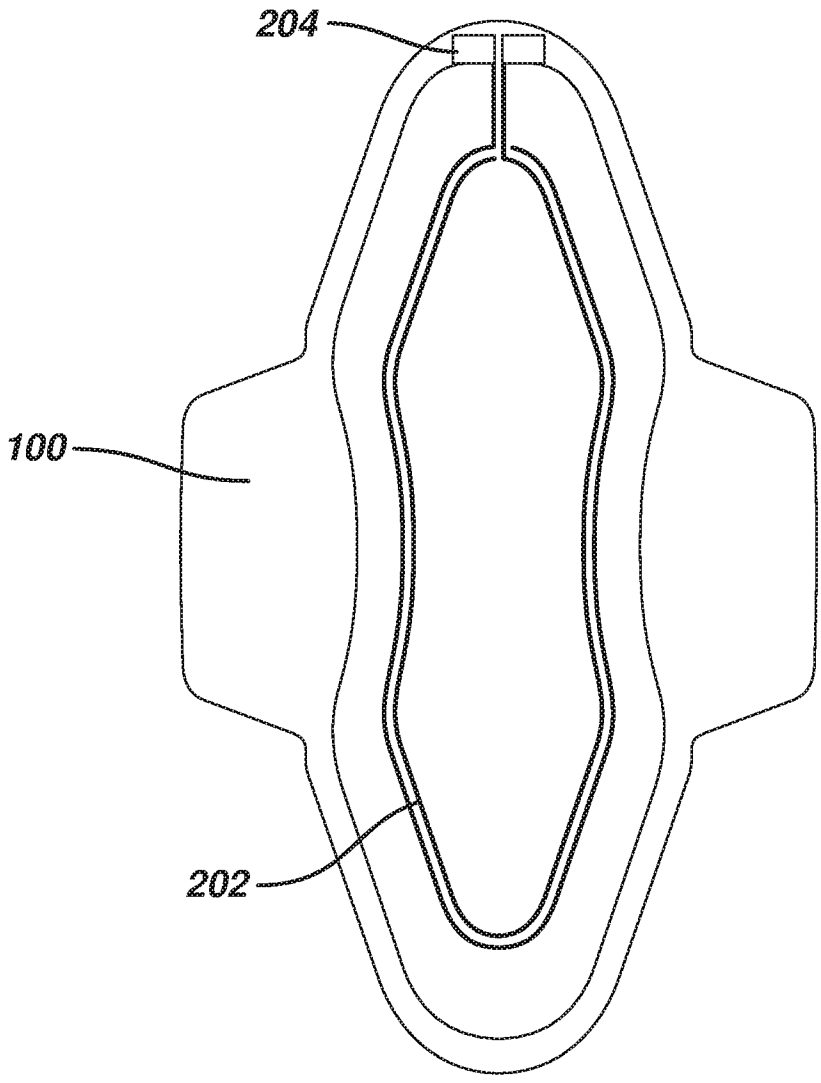

FIG. 3B

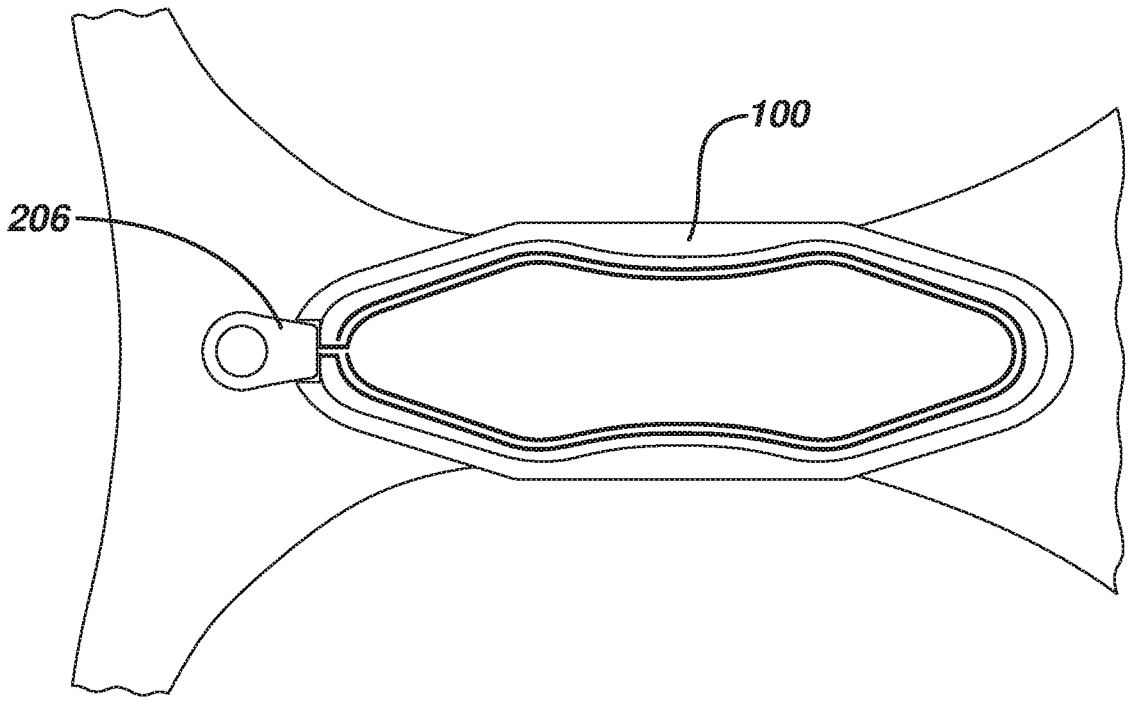

FIG. 3C

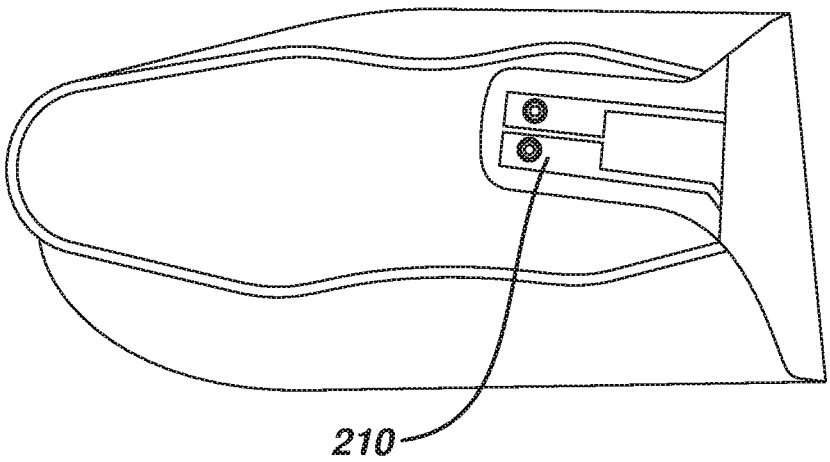

FIG. 4

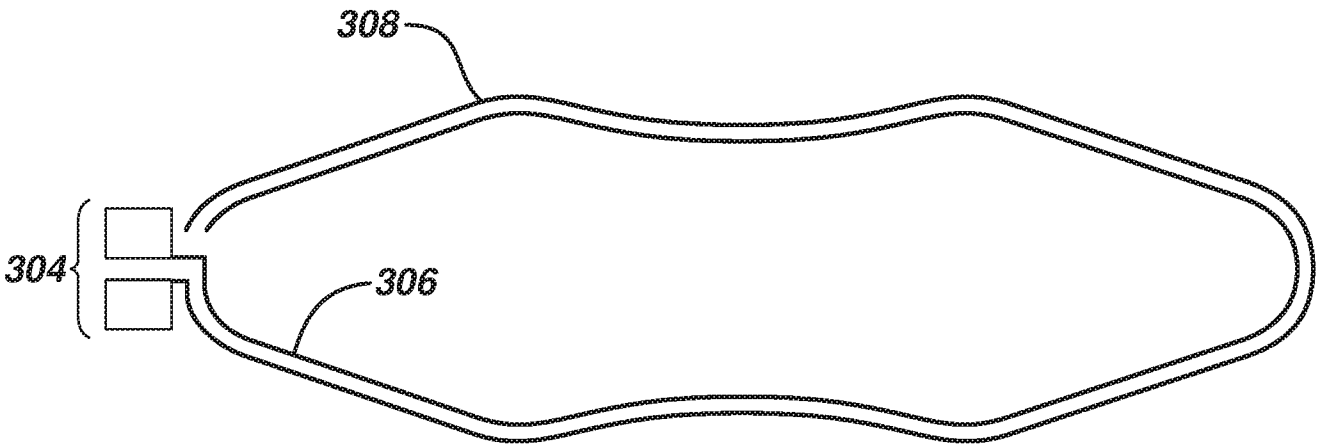

FIG. 5

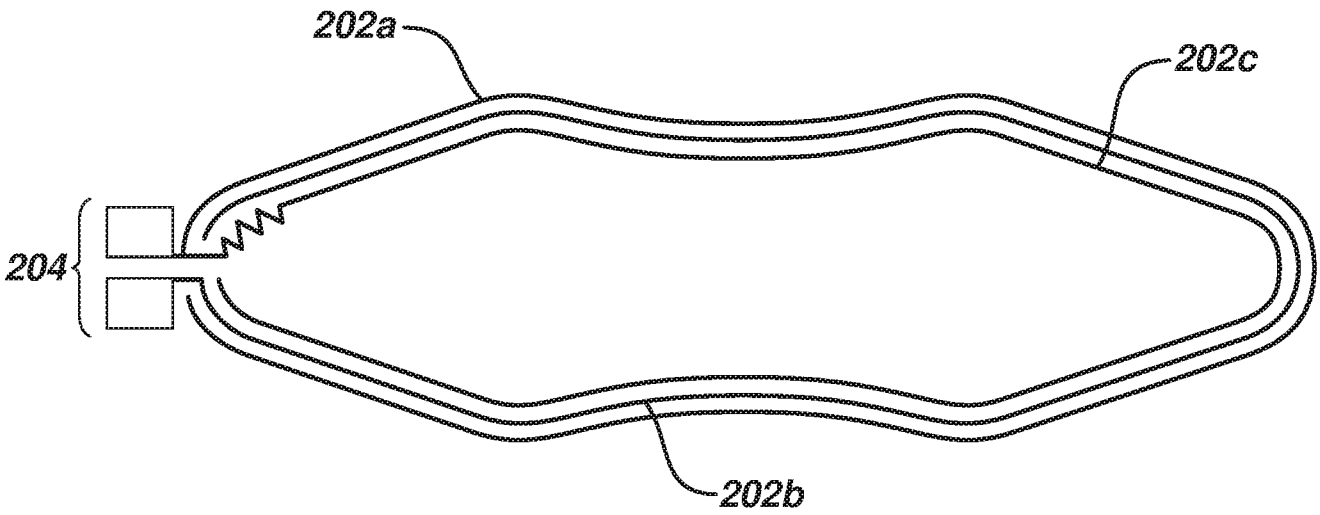

FIG. 6