



US 20150335078A1

(19) **United States**(12) **Patent Application Publication**
Zhang(10) **Pub. No.: US 2015/0335078 A1**(43) **Pub. Date: Nov. 26, 2015**(54) **BRA AND BRA COMPONENTS**(71) Applicant: **Regina Miracle International (Group)**
Limited, Kwai Chung (HK)(72) Inventor: **Wenbo Zhang, Kwai Chung (HK)**(21) Appl. No.: **14/718,862**(22) Filed: **May 21, 2015**(30) **Foreign Application Priority Data**May 26, 2014 (CN) PCTCN2014000532
Jan. 22, 2015 (CN) 201510032889.6**Publication Classification**(51) **Int. Cl.**
A41C 3/00 (2006.01)
A61B 5/00 (2006.01)
A61B 5/0408 (2006.01)(52) **U.S. CL.**CPC **A41C 3/0064** (2013.01); **A41C 3/0007**
(2013.01); **A61B 5/0408** (2013.01); **A61B**
5/6804 (2013.01); **A61B 5/0006** (2013.01)

(57)

ABSTRACT

A bra to enable monitoring of a wearer's heart rate. There is provided a bra comprising a left breast cup; a right breast cup; and a centre gore attached between the left and right breast cups. Each of the left and right breast cups comprises a lower edge region which is shaped to follow the shape of a wearer's breast and is shaped to be positioned below a wearer's breast to support the breast, and wherein the lower edge region comprises an electrically conductive fabric layer on the inner surface for contact with the user's skin. The centre gore comprises an attachment area for attachment of a transmitter and an electrically conductive pathway from the electrically conductive fabric of the lower regions of the breast cups to the attachment area. Bra components for providing electrical pathways are also provided.

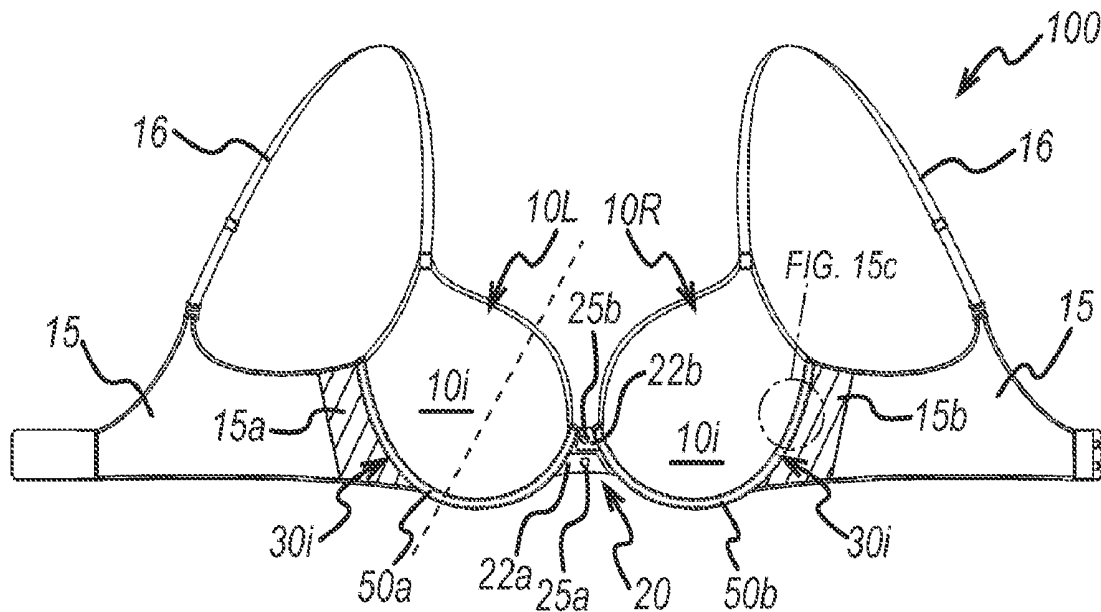


FIG. 1 (Prior Art)

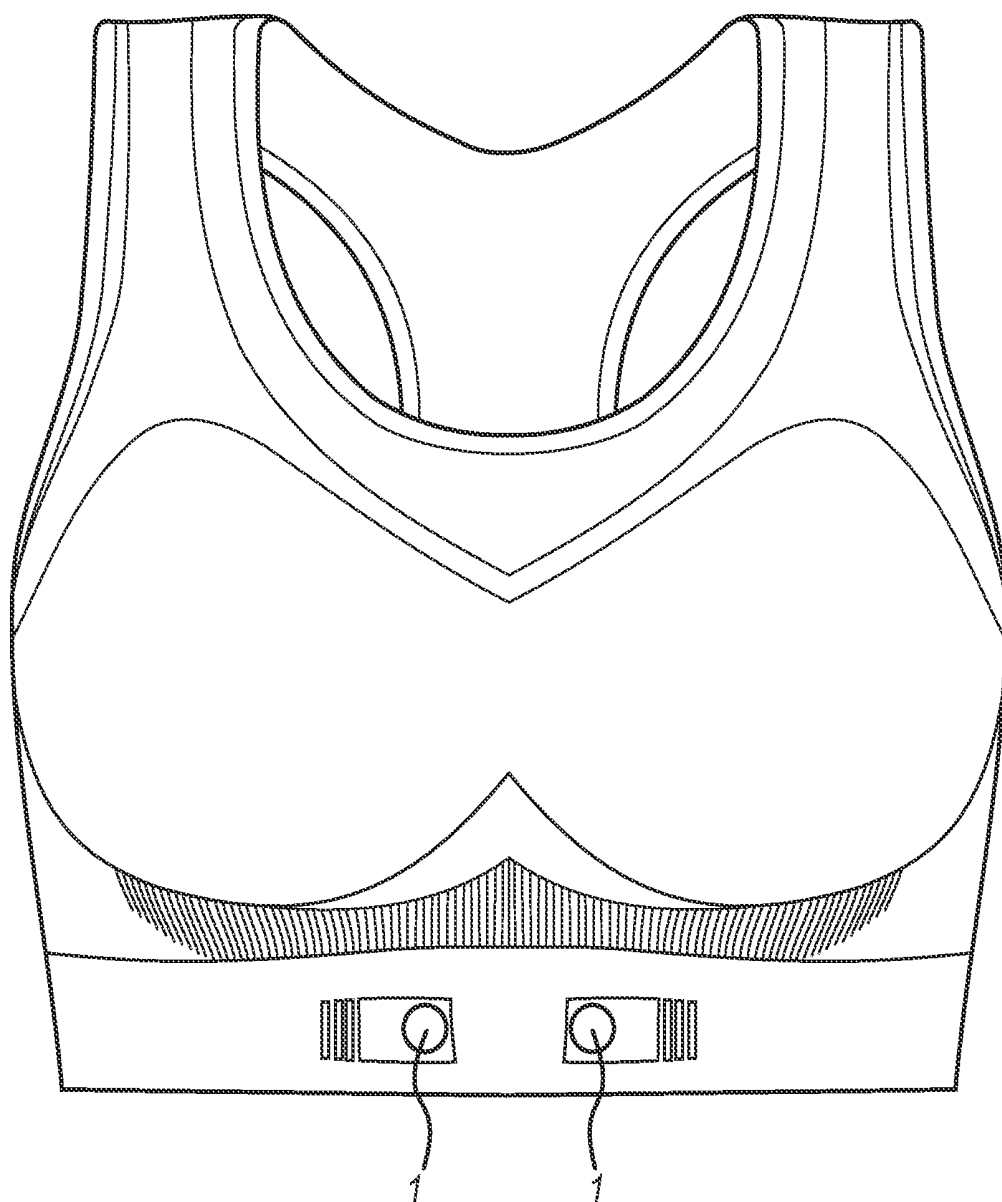


FIG. 2a

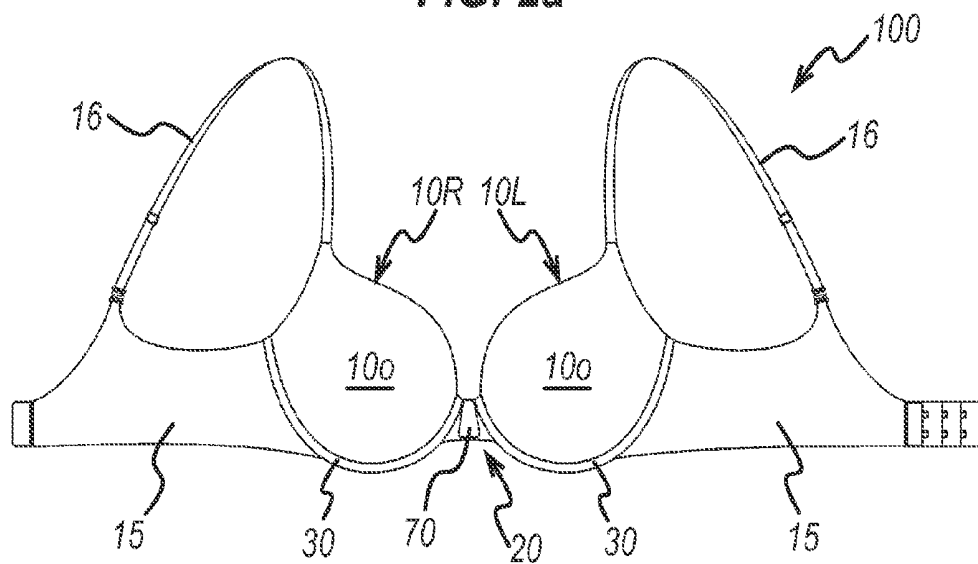
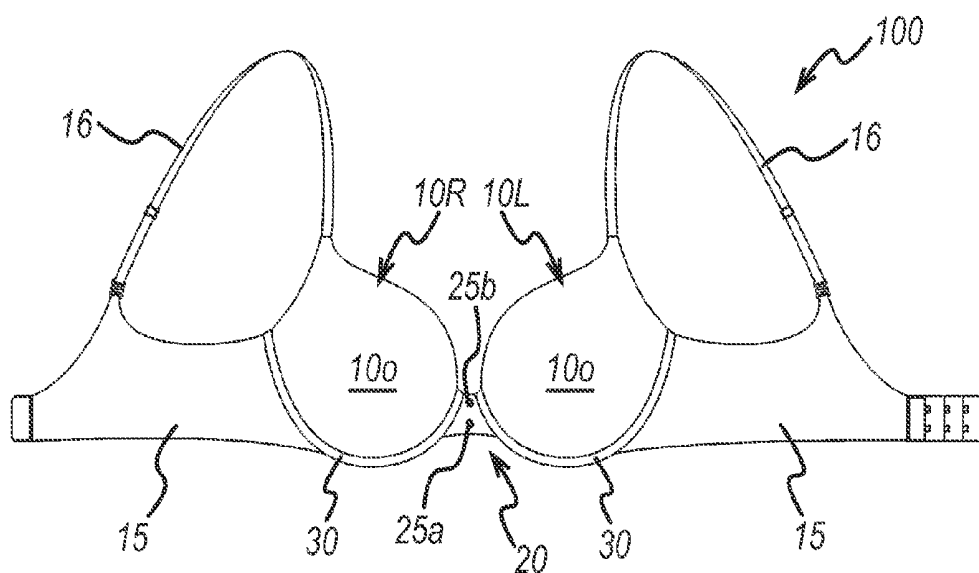


FIG. 2b



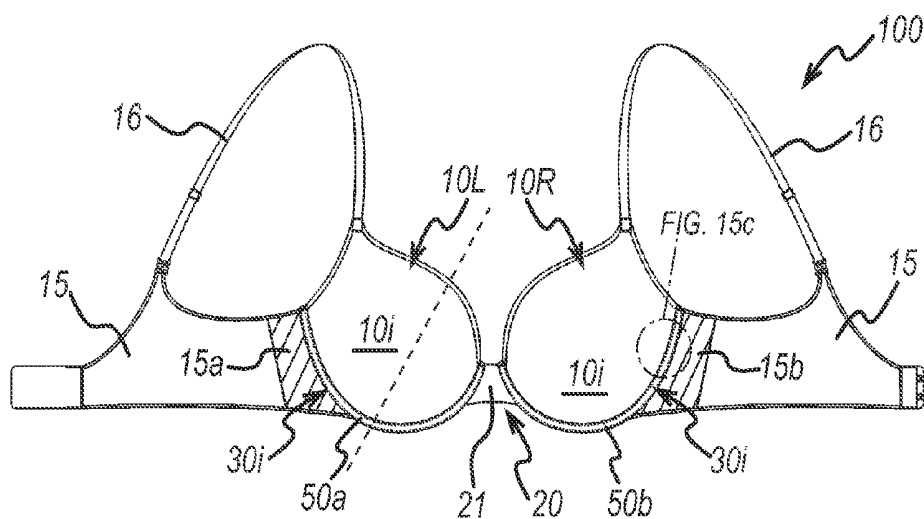


FIG. 3a

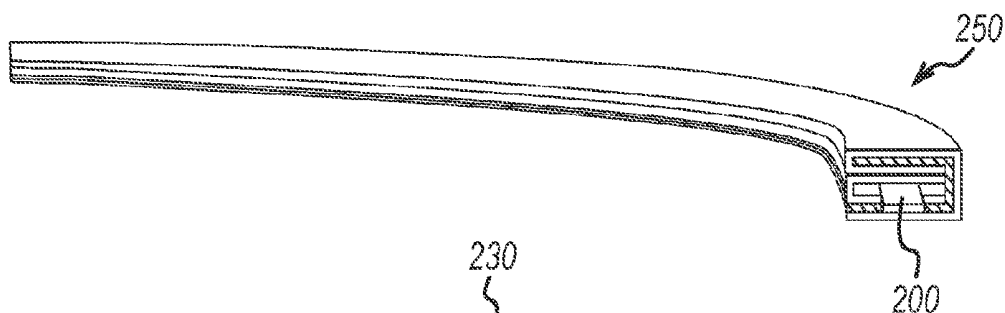


FIG. 3b

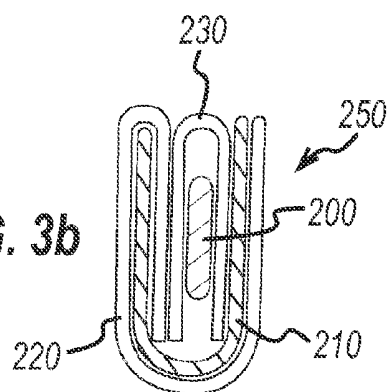


FIG. 4a

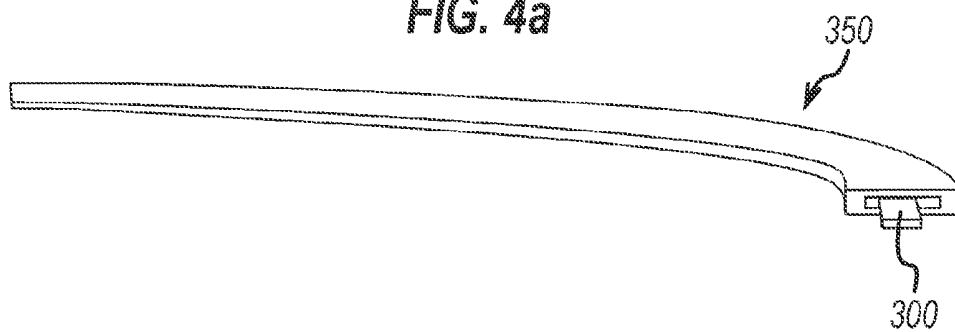
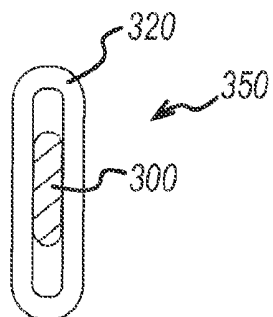
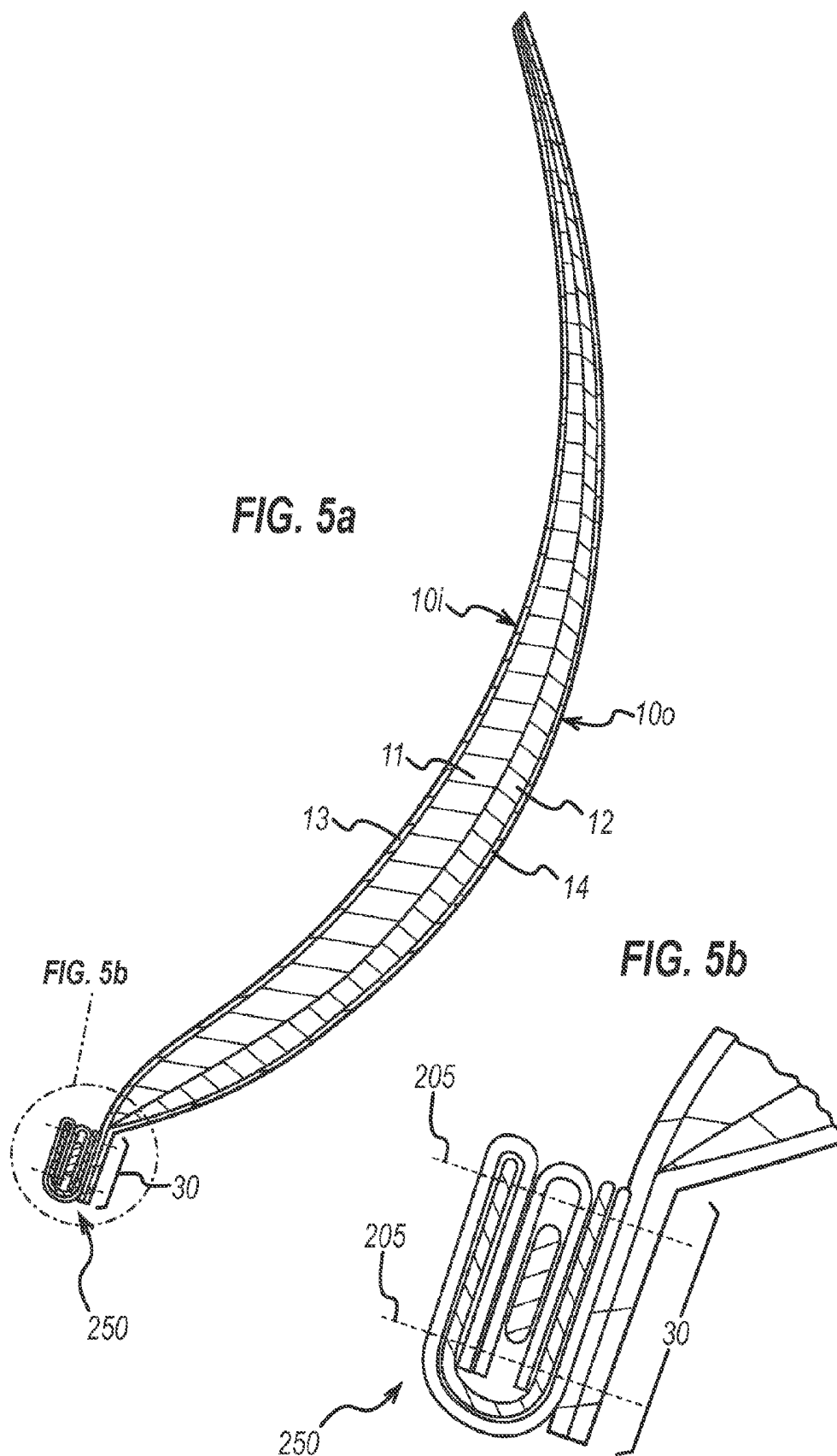


FIG. 4b





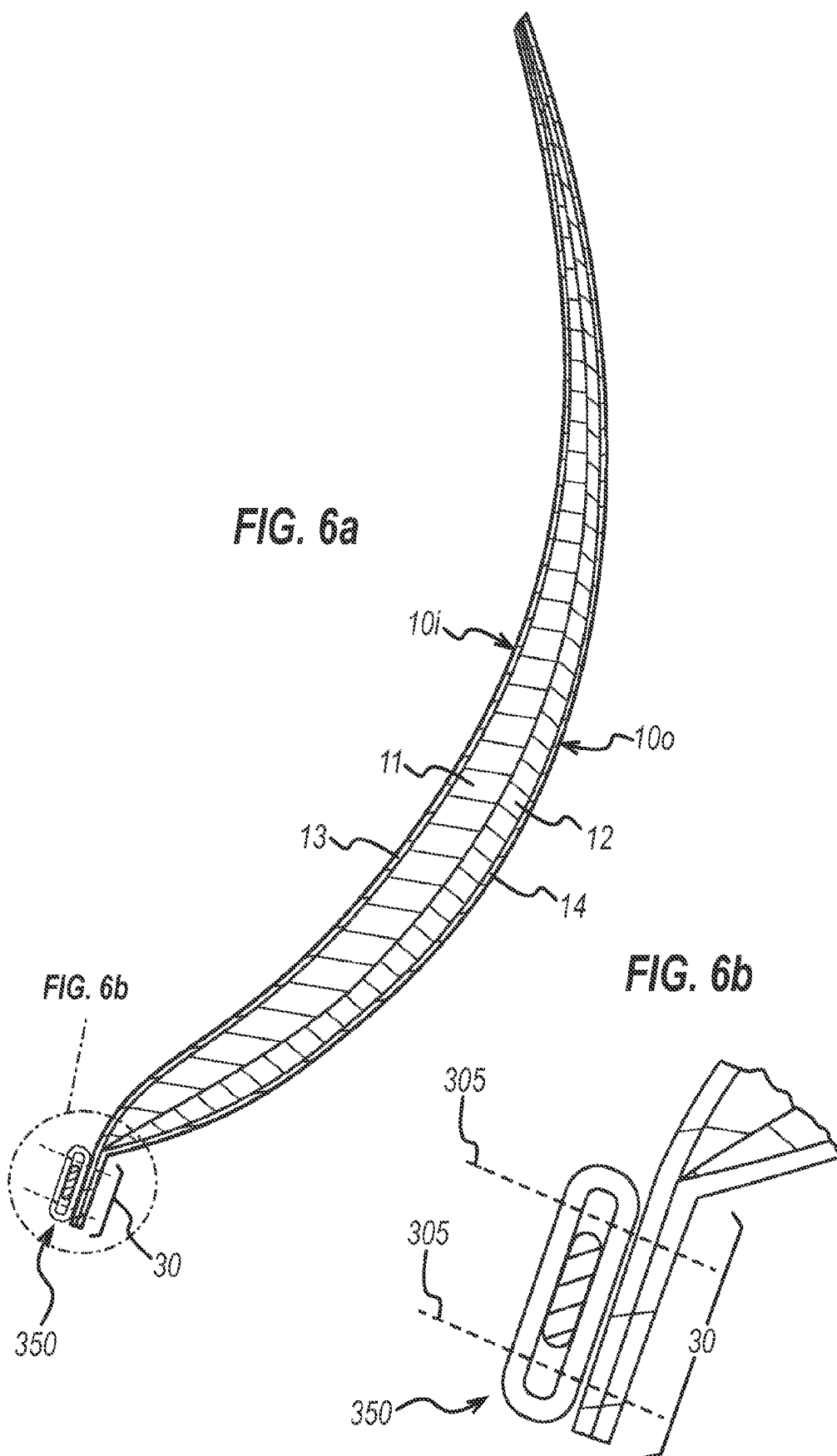


FIG. 7a

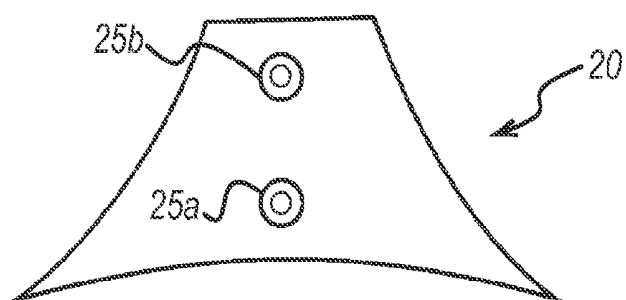


FIG. 7b

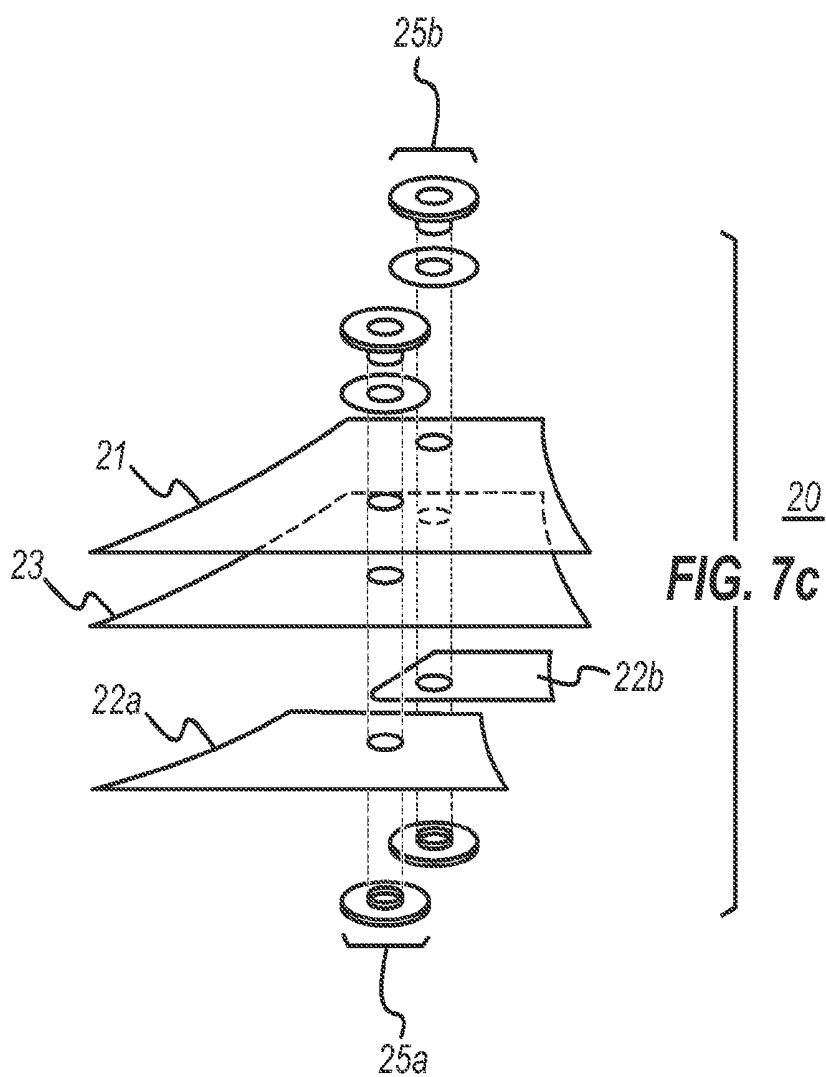
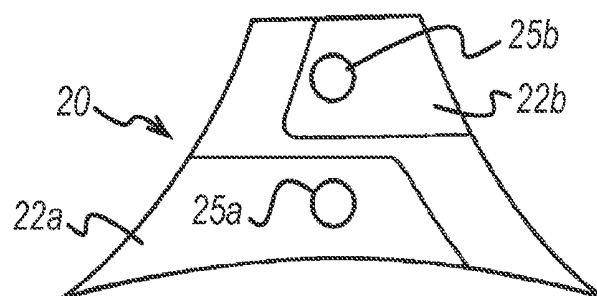


FIG. 8a

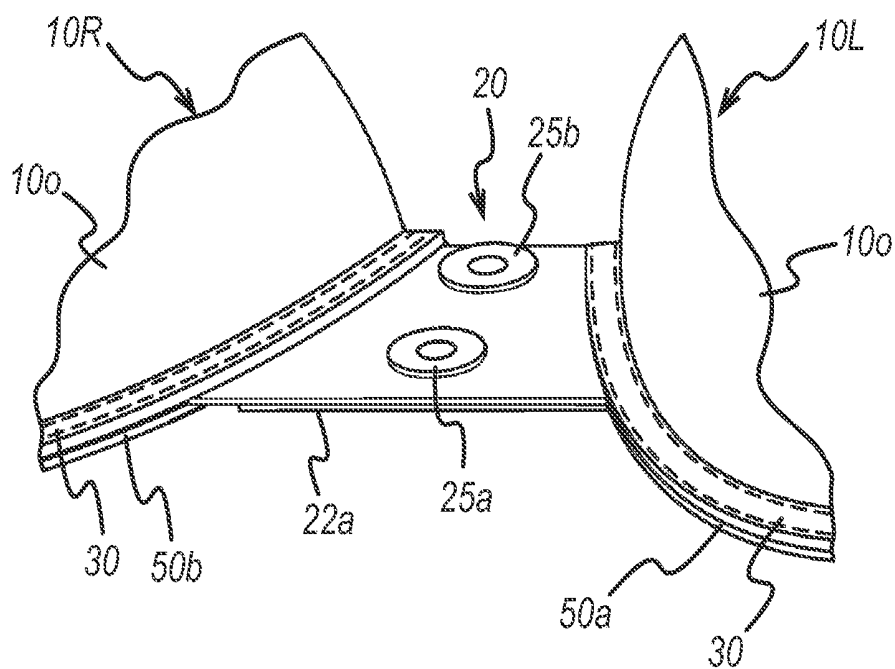


FIG. 8b

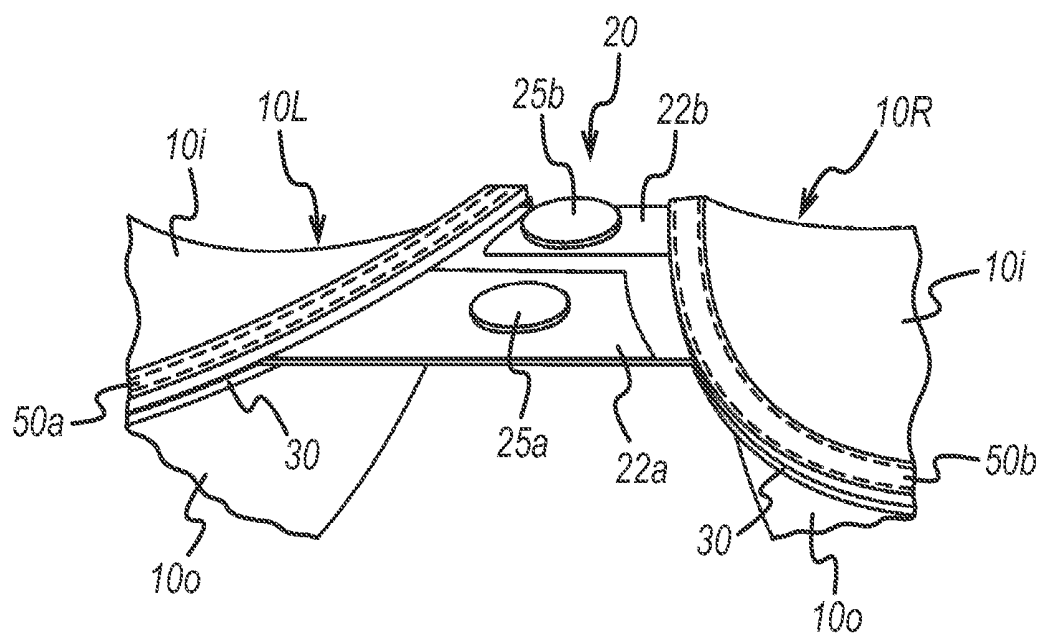


FIG. 9a

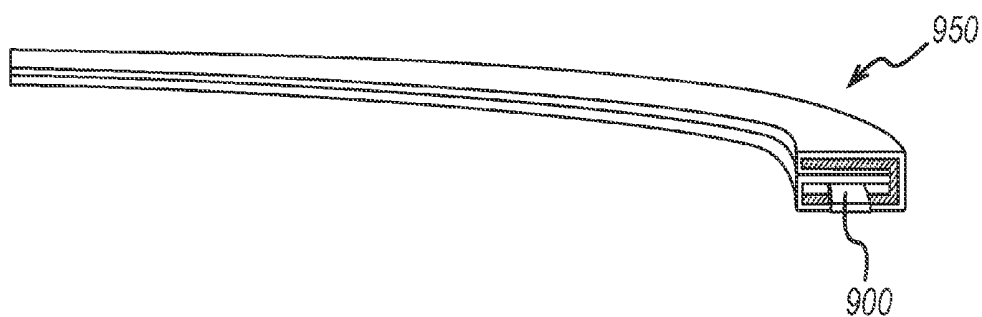
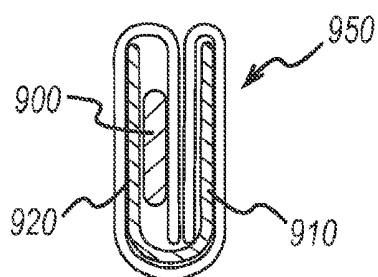


FIG. 9b



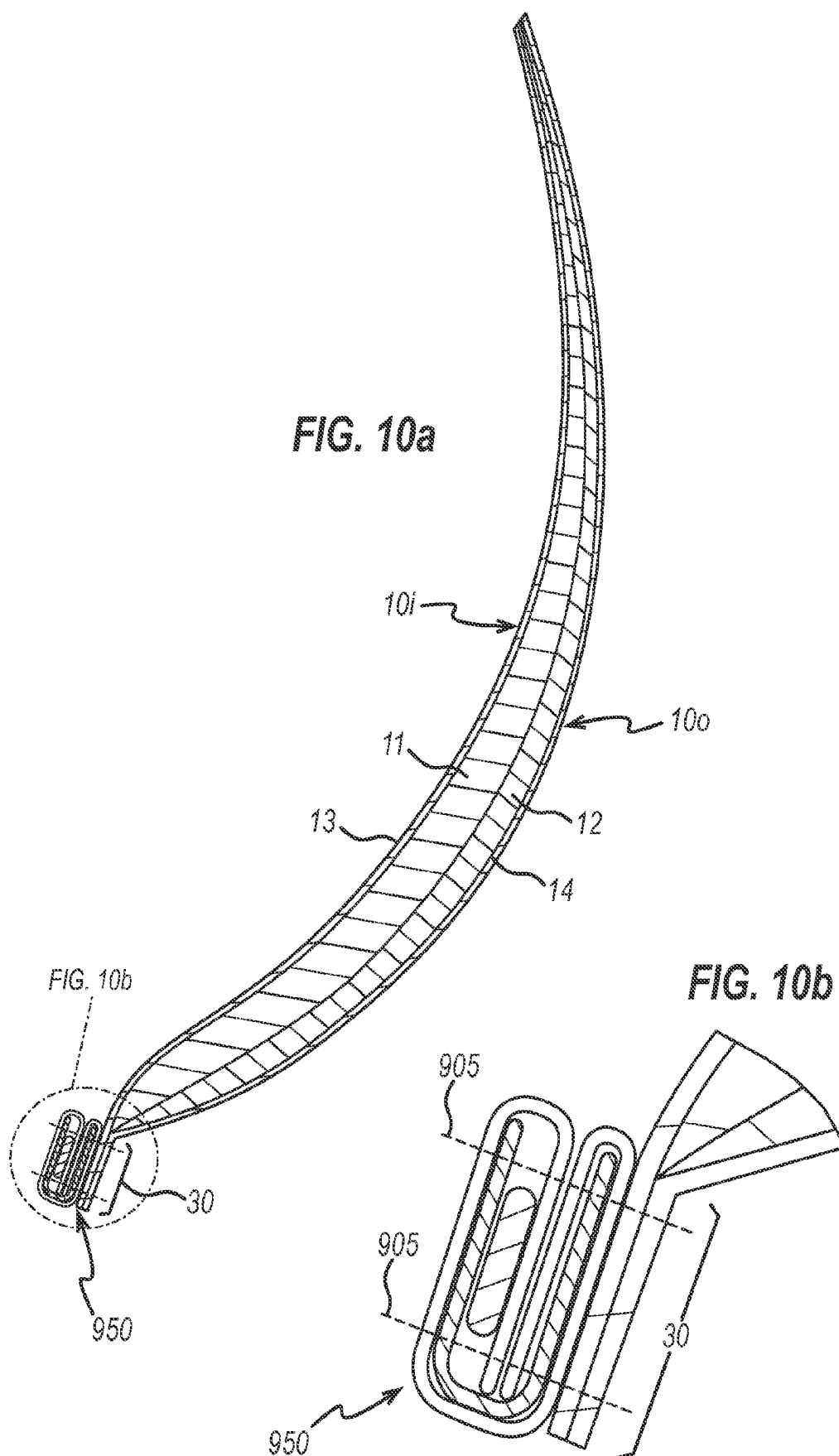


FIG. 11a

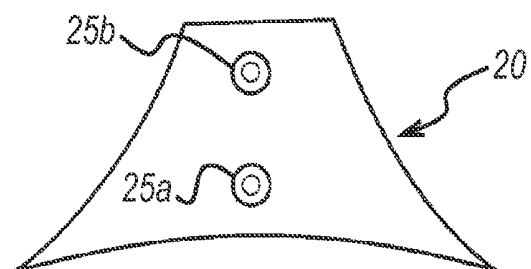


FIG. 11b

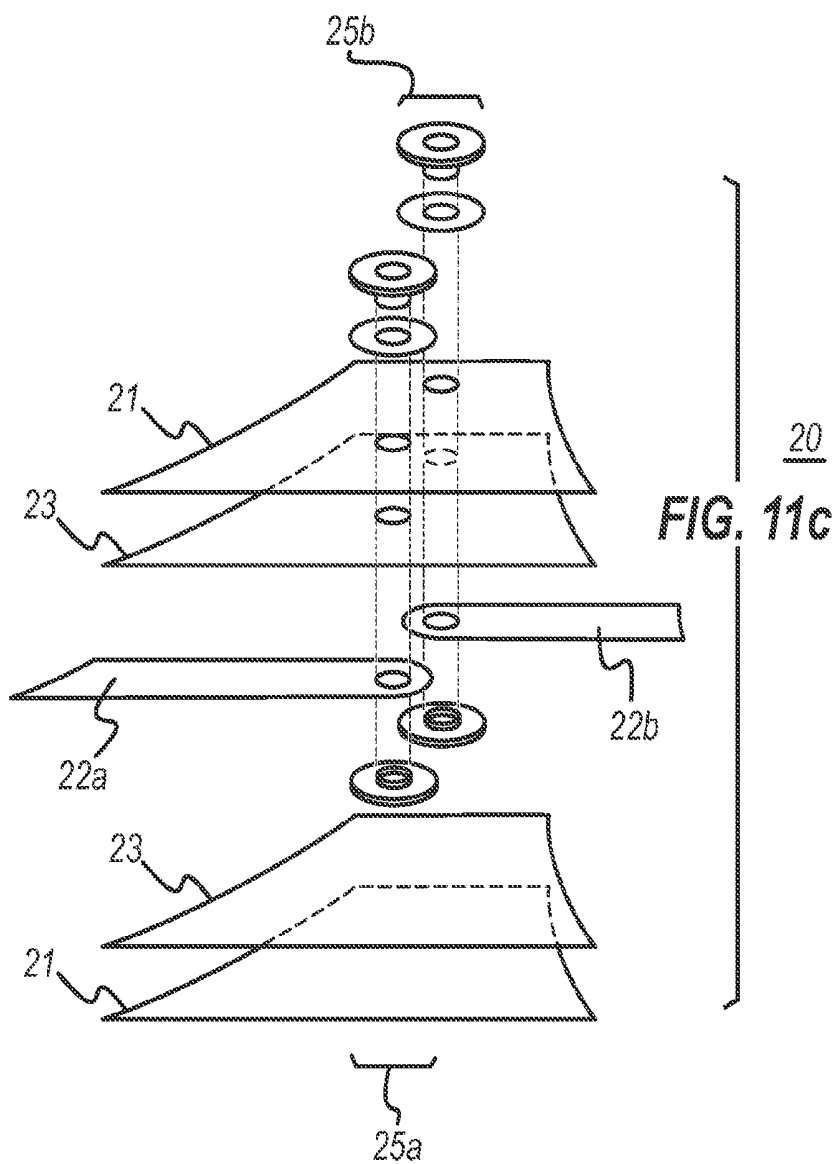
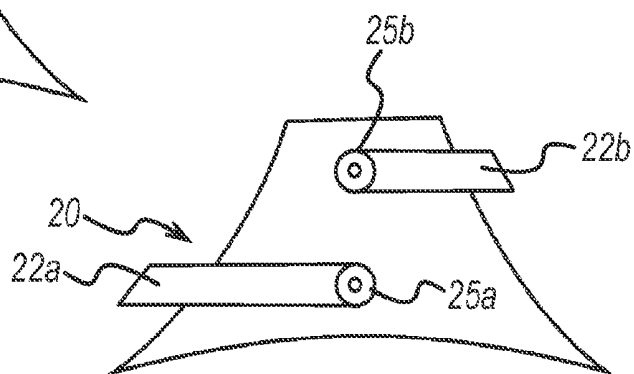


FIG. 12a

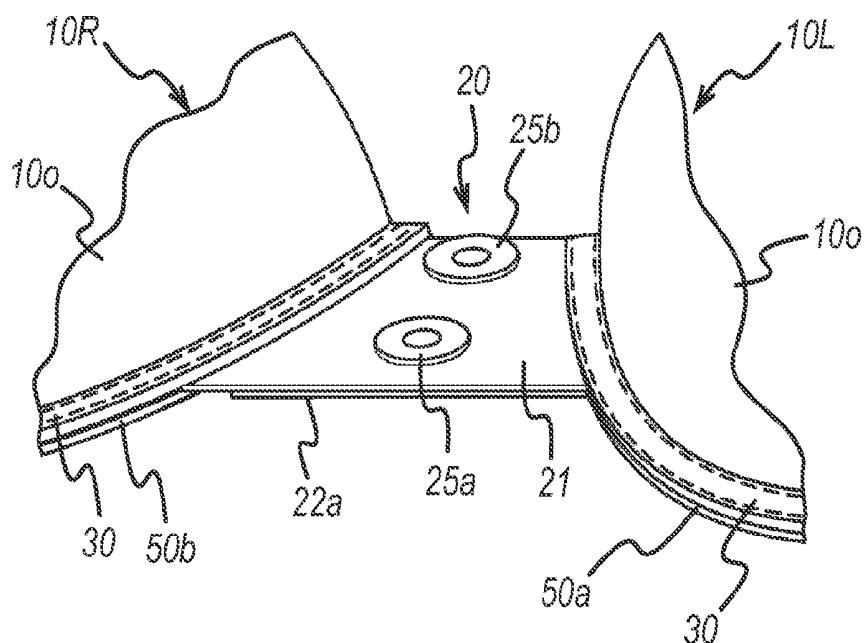


FIG. 12b

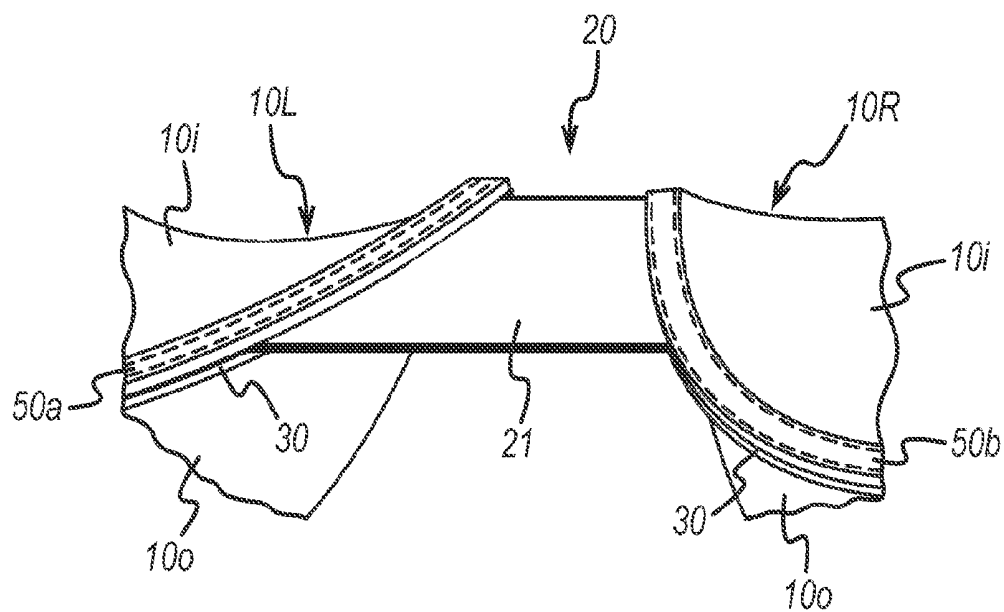


FIG. 13

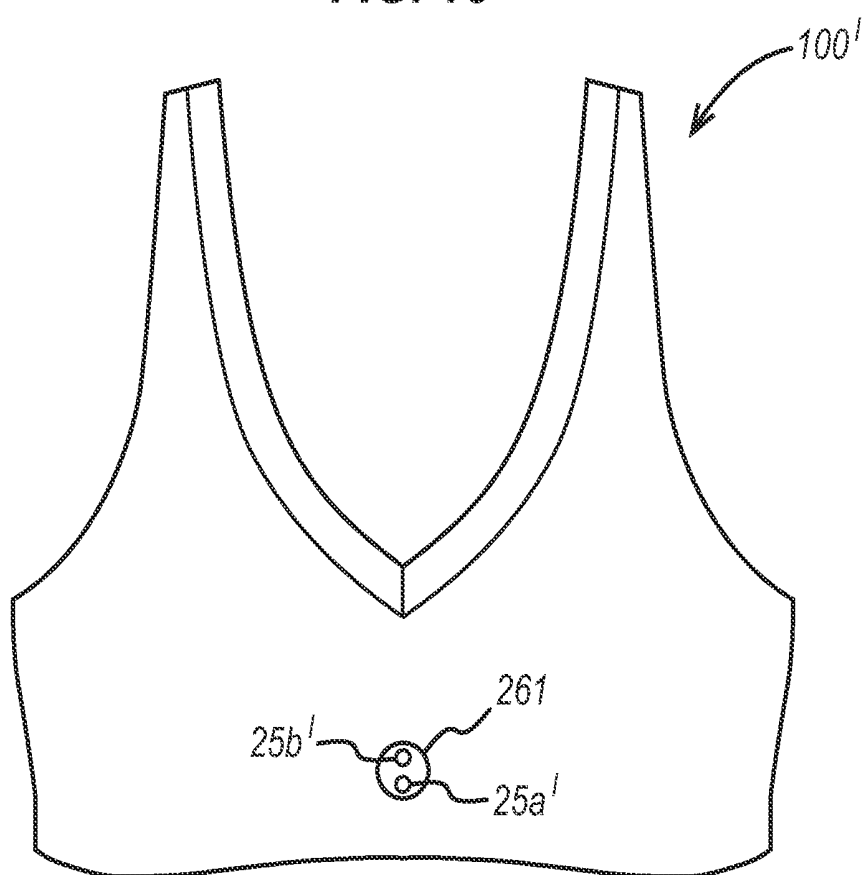


FIG. 14a

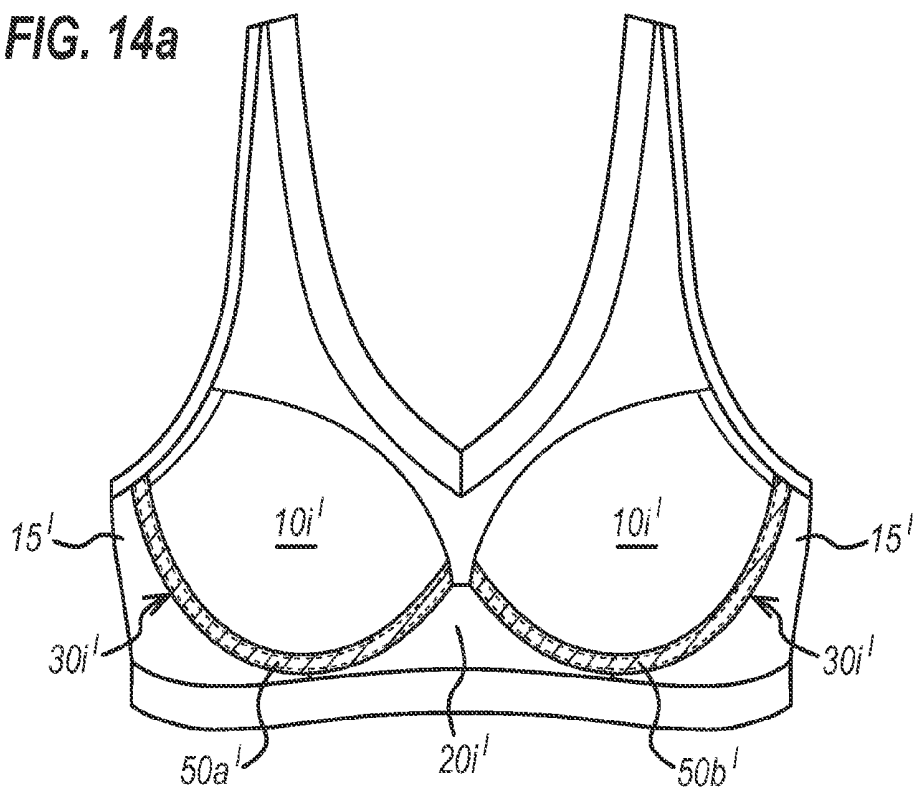


FIG. 14b

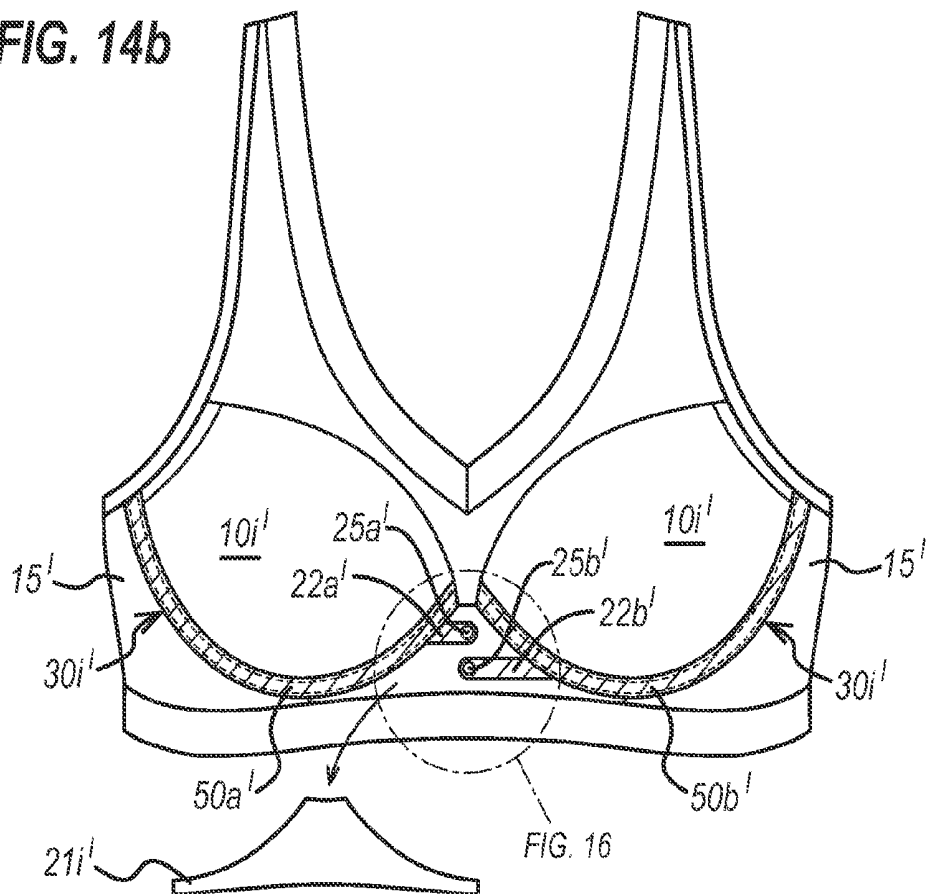


FIG. 15a

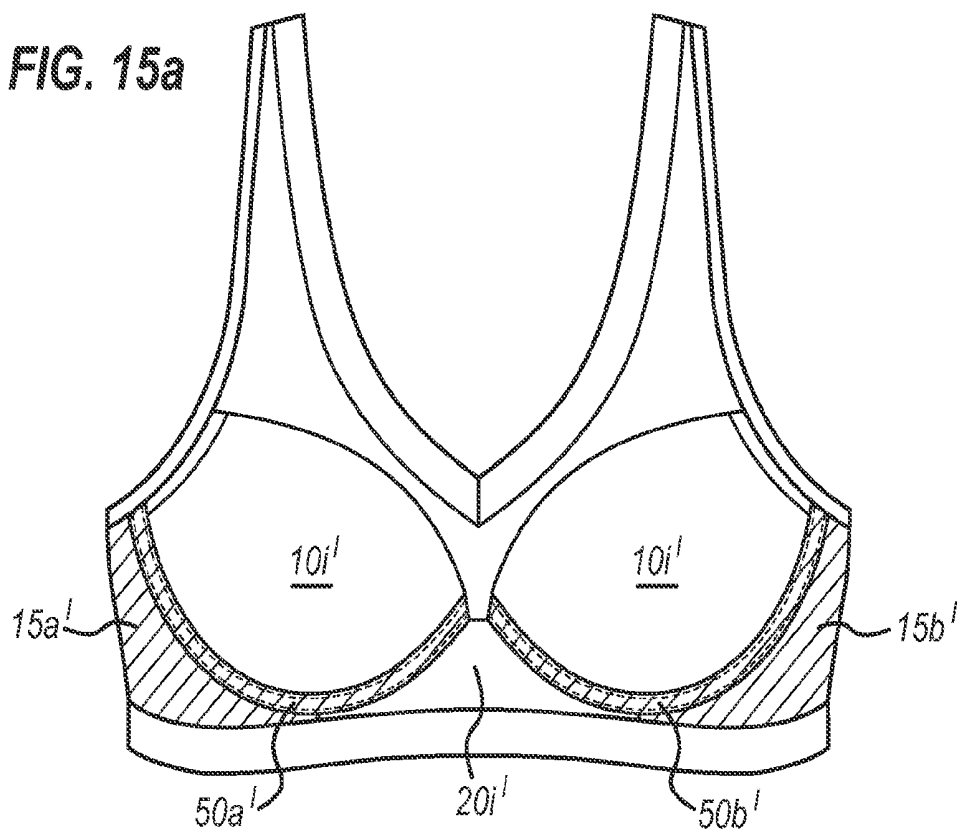


FIG. 15b

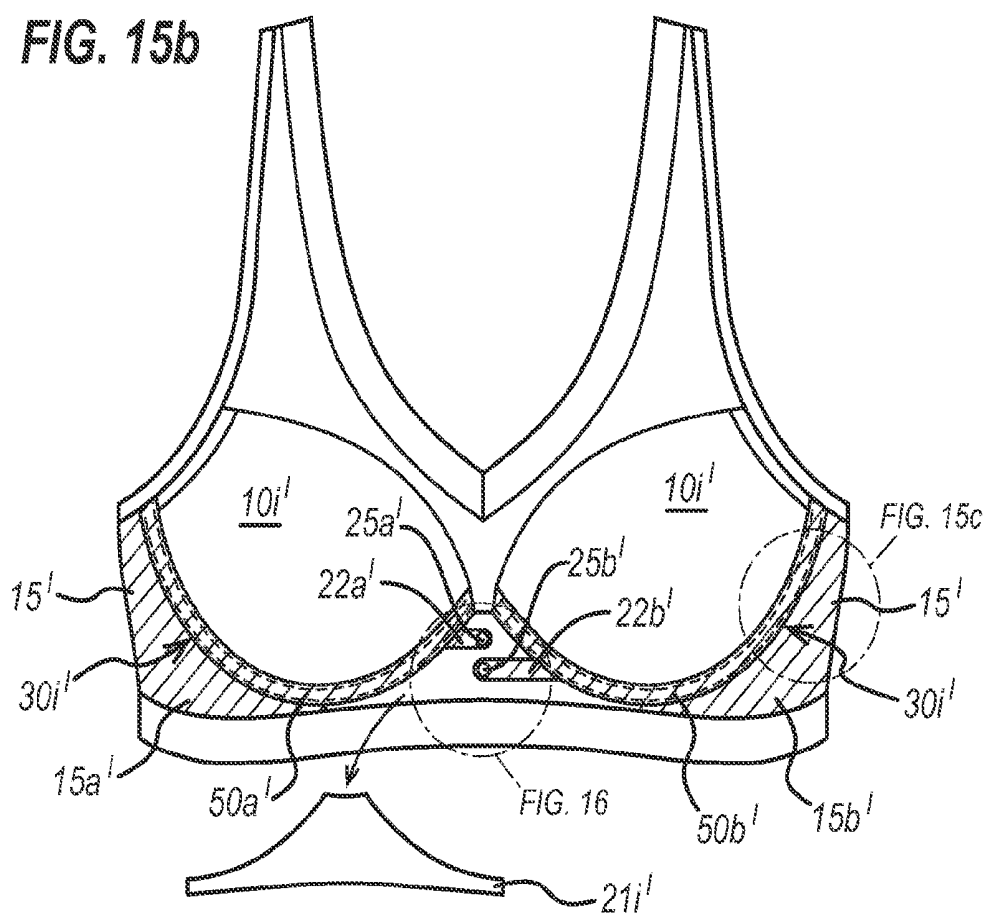


FIG. 15c

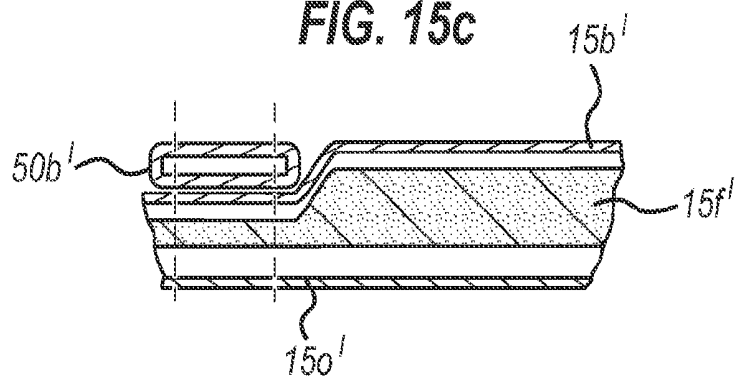


FIG. 16

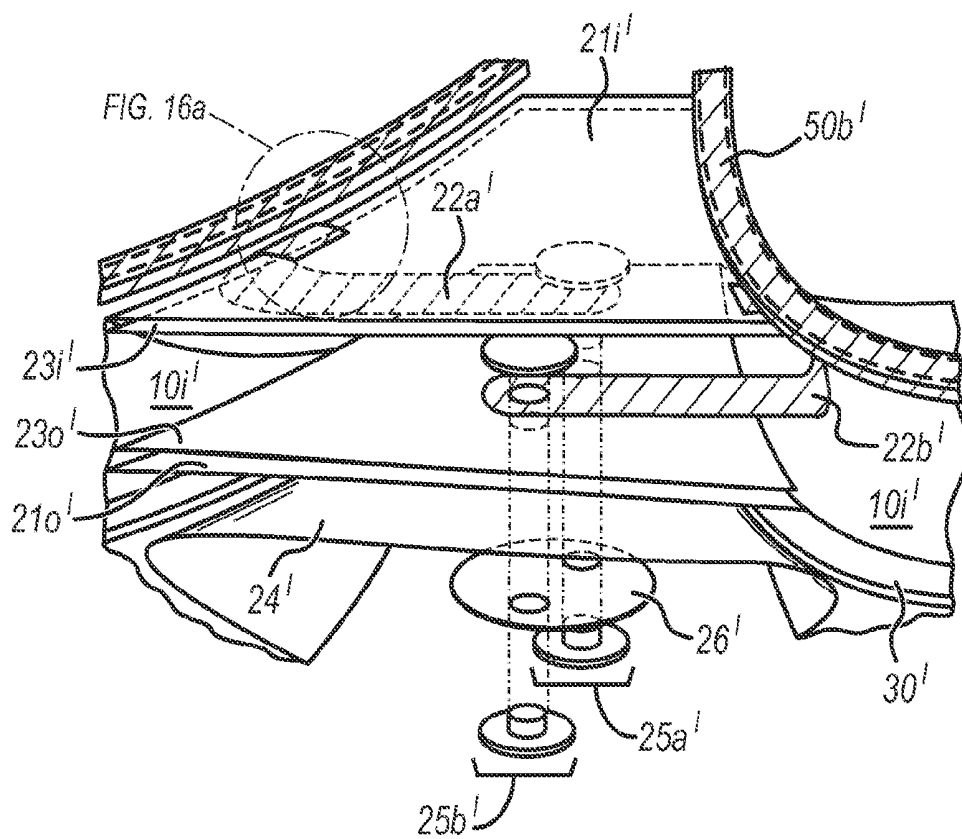


FIG. 16a

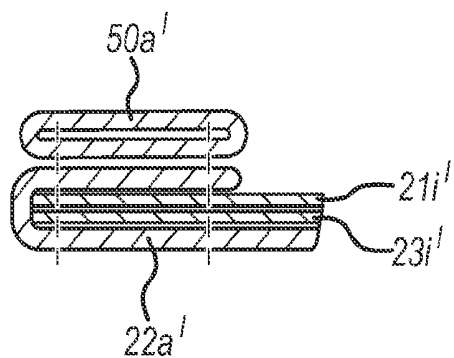


FIG. 17a

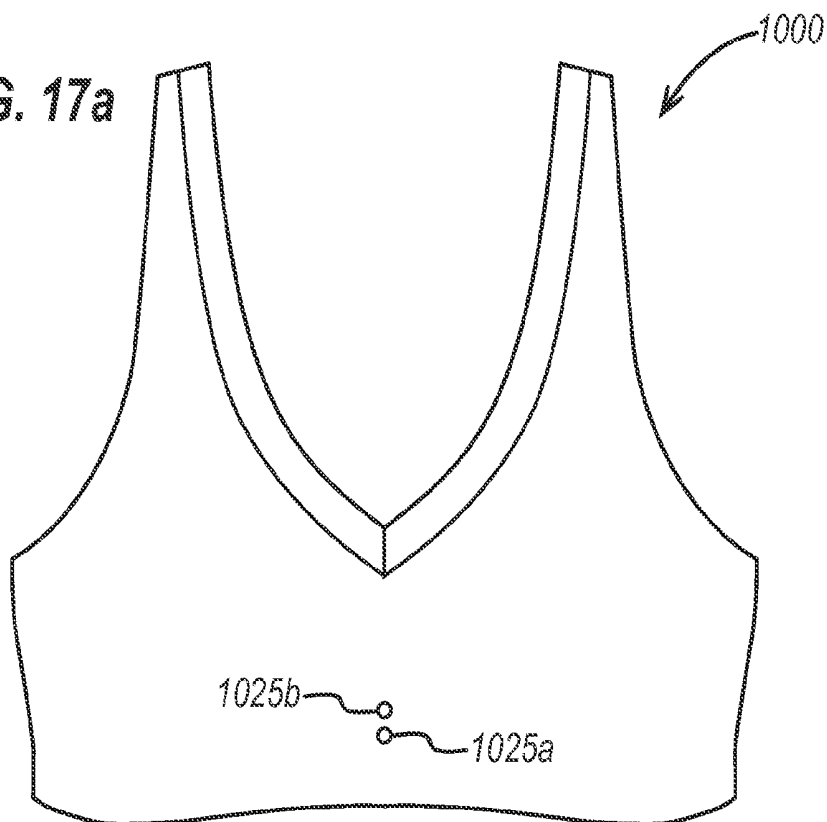


FIG. 17b

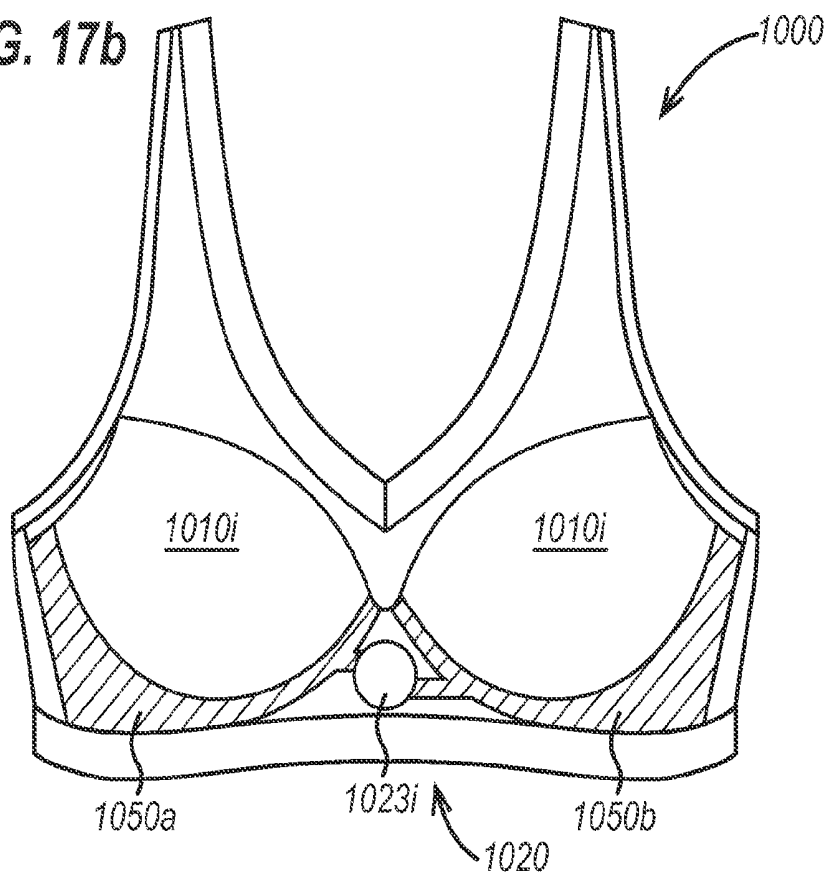


FIG. 17c

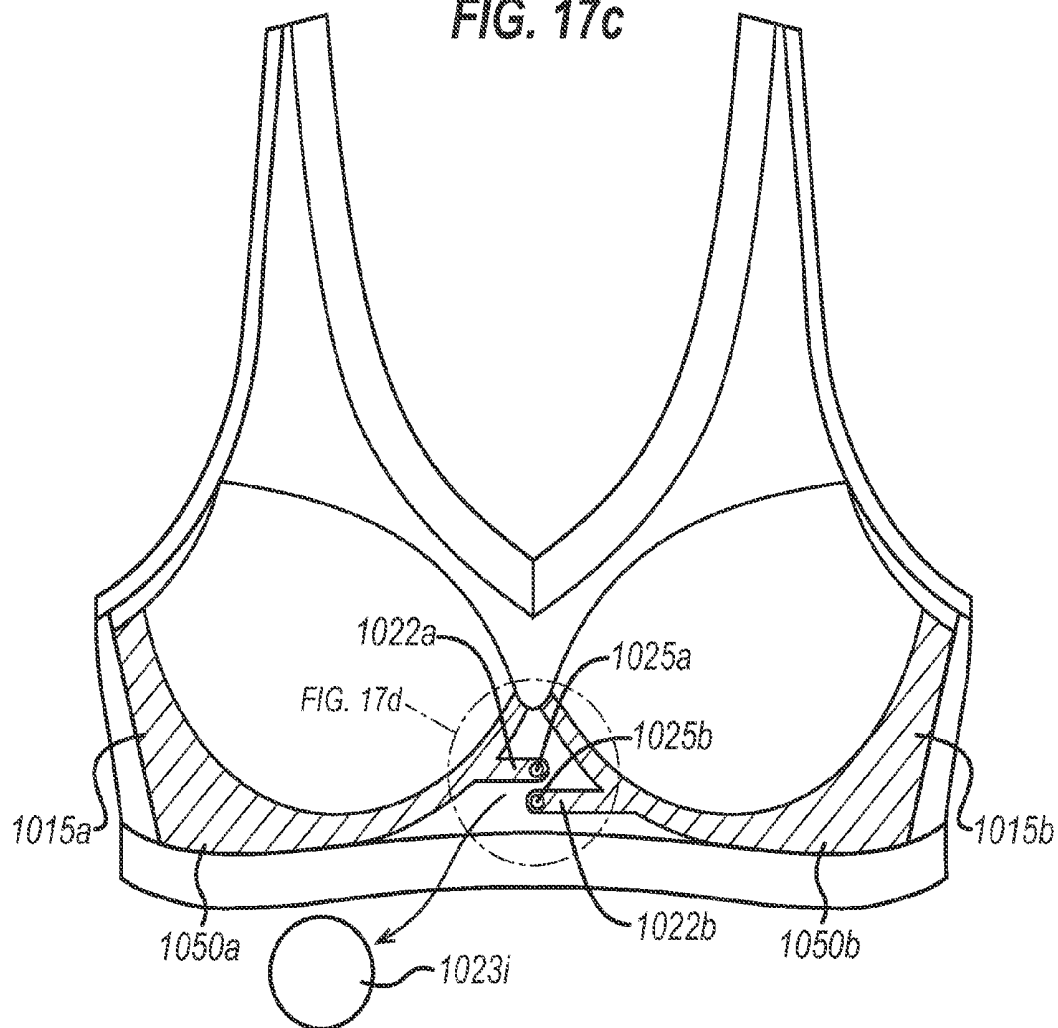


FIG. 17d

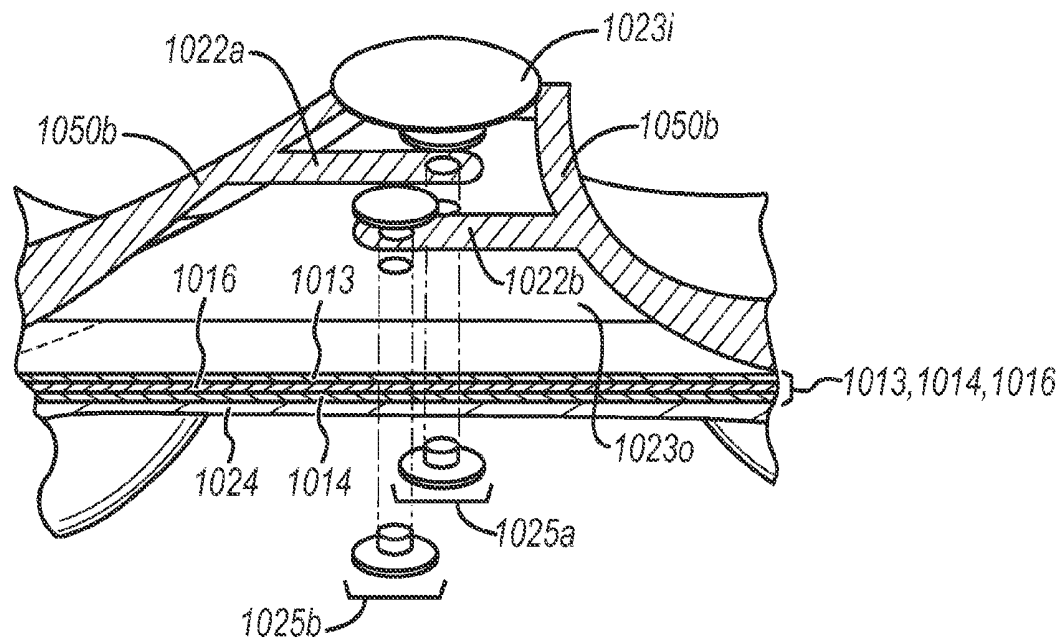


FIG. 18

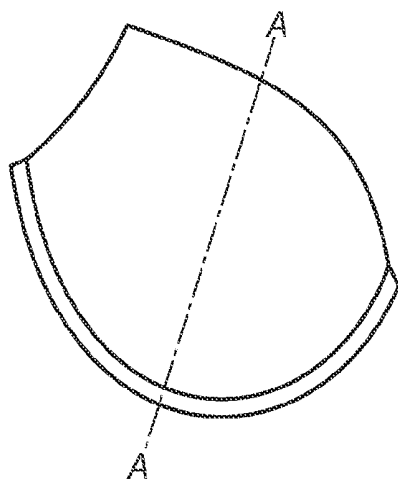
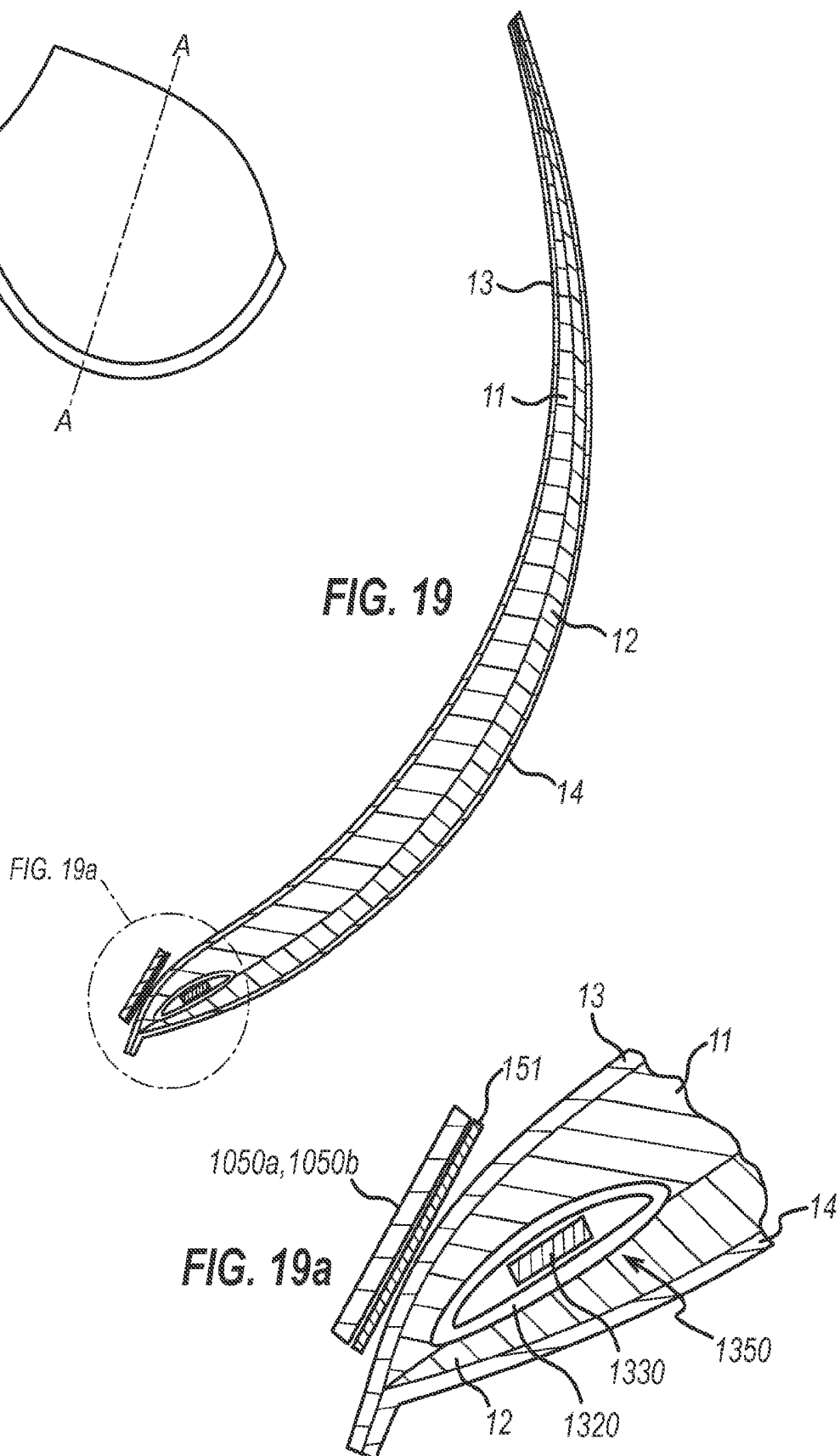
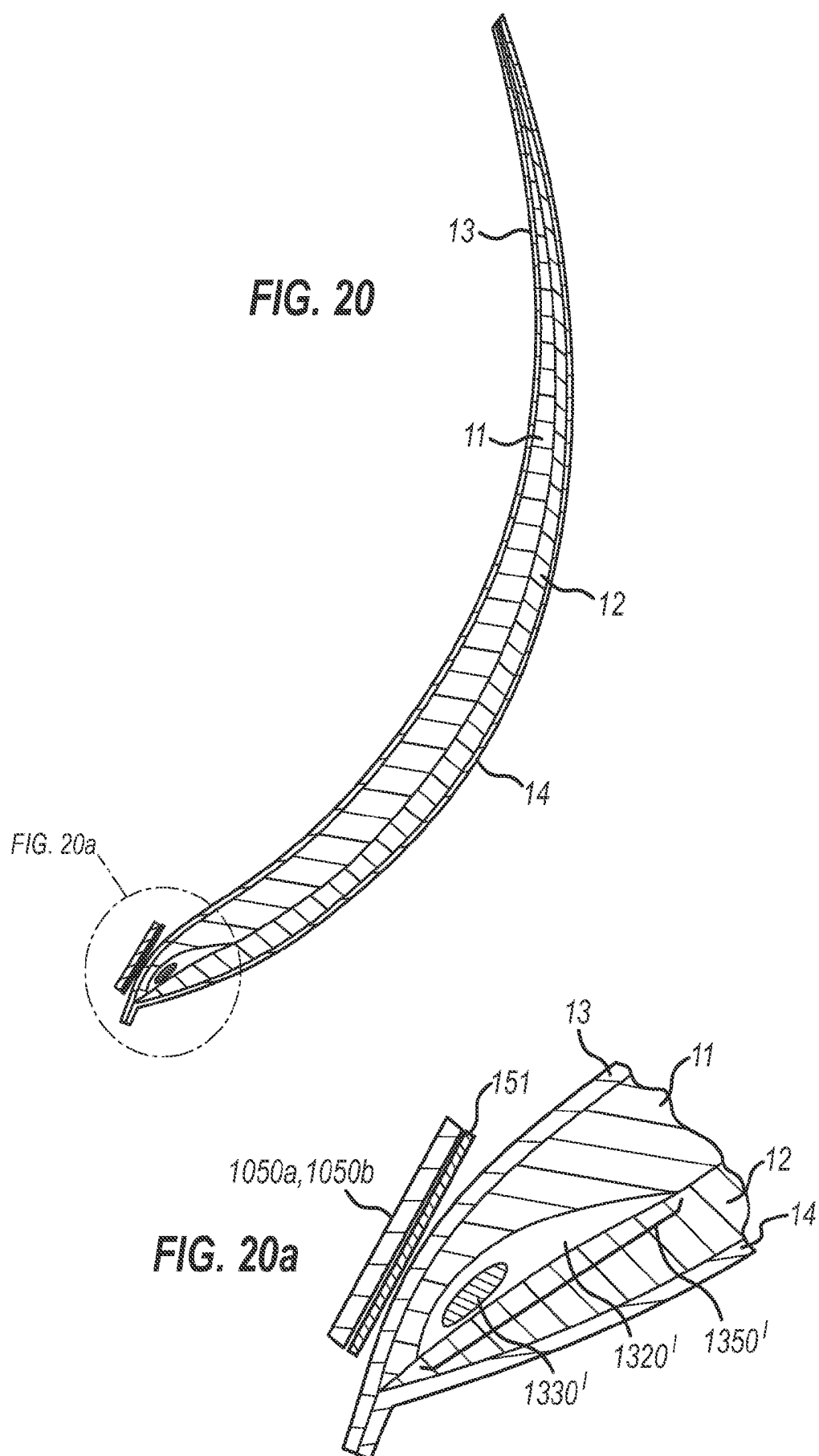


FIG. 19





BRA AND BRA COMPONENTS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and the benefit of Chinese Patent Application No. 201510032889.6, filed on 22 Jan. 2015, and of PCT International Patent Application No. PCT/CN2014/000532, filed on 26 May 2014; the disclosures of these documents are incorporated herein by reference in their entirety.

FIELD OF THE INVENTION

[0002] The present invention relates in general to a bra which has a built-in mechanism to enable monitoring of, for example, the wearer's heart rate. The present invention also relates to the components of the bra which enable it to achieve its monitoring function.

BACKGROUND

[0003] There is a growing demand for equipment that enables an individual to monitor their own heart rate, for example when exercising to ensure they are exercising at the optimum heart rate.

[0004] Chest heart rate monitors usually comprise two electrical sensors, a chest transmitter and a receiving device, e.g. a sports watch, a smart phone or cardio equipment. The electrical sensors of the heart rate monitor pick up the electrical activity of the heart and transmit the signals to the transmitter.

[0005] Chest heart rate monitors have been incorporated into sports bras. Sports bras are usually designed to be put on by being pulled over the head, with or without additional fastening means. The bras have cup regions to support the breasts and a chest band below the cup regions to maintain the positioning of the bra on the user. Sports bras have been developed which comprise a conductive fabric on the inner surface of the chest band to transmit a wearer's heart rate to a transmitter located within or on the chest band.

[0006] One example of such a prior art sports bra is the "miCoach Seamless Sports Bra" by Adidas®, which is illustrated in FIG. 1. Sensor fibers are knit into the fabric of the chest band on the inside (chest-facing side) to pick up the heart rate signals of the wearer. The chest band comprises a pocket (not shown) within the chest band at the front of the bra (accessible from the inner surface of the bra). The chest band further comprises transmitter fastening means in the form of snap buttons 1 passing through the chest band from the front surface of the chest band into the pocket to snappily receive a small transmitter that may be placed within the pocket. Heart rate signals are routed through the conducting fabric to the transmitter.

[0007] Sports bras are generally provided in four sizes (e.g. small, medium, large, extra-large), dependent on chest size. Each size can span a number of cup sizes. The position of the bra relative to the wearer's body may change with movement of the wearer as the bra is not always well fitted due to the fact that there are only four size options. The movement of the bra increases the risk of losing the heart rate signal. Furthermore, females tend to wear sports bras for exercise only, exchanging them for everyday conventional bras afterwards, for example for aesthetic or comfort reasons.

[0008] It is an object of the present invention to provide a bra for monitoring the heart rate of the wearer which may enhance the picking up of the heart rate signal and reduce the loss of the signal.

[0009] It would also be desirable to provide a bra that enables a user to monitor their heart rate during daily activities when a normal (none sport-specific) bra is worn.

SUMMARY OF THE INVENTION

[0010] In a first aspect of the present invention, there is provided an underwire casing for a bra, the underwire casing comprising an electrically conductive fabric layer.

[0011] In a first embodiment, the underwire casing comprises a fabric casing for receiving an underwire and the electrically conductive fabric layer is wrapped around the fabric casing. The underwire casing may comprise a further electrically conductive fabric layer within the fabric casing for receiving an underwire.

[0012] In a second embodiment, the electrically conductive fabric layer is formed into a tube for receiving an underwire.

[0013] In a second aspect of the present invention, there is provided a breast cup for a bra. The breast cup has an inner surface which is in contact with a wearer's body when worn, and an outer surface which faces away from the wearer's body when worn, and a lower edge region which is shaped to follow the shape of a wearer's breast and shaped to be positioned below a wearer's breast to support the breast. The lower edge region comprises an electrically conductive fabric layer on the inner surface for contact with the user's skin.

[0014] The breast cup may further comprise an underwire casing attached to the inner surface of the lower edge region, wherein the underwire casing comprises the electrically conductive fabric layer for contact with the user's skin.

[0015] In one embodiment, the underwire casing comprises a fabric casing for receiving an underwire and the electrically conductive fabric layer wrapped around the fabric casing. The electrically conductive fabric layer may wrap around the fabric casing and the underwire. The underwire casing may comprise a further electrically conductive fabric layer within the fabric casing for receiving an underwire.

[0016] In another embodiment, the electrically conductive fabric layer is formed into a tube for receiving an underwire.

[0017] In a third aspect of the present invention, there is provided a bra having an inner surface which is in contact with a wearer's body when worn, and an outer surface which faces away from the wearer's body when worn. The bra comprises: a left breast cup; a right breast cup; and a centre gore attached between the left and right breast cups. Each of the left and right breast cups comprises a lower edge region which is shaped to follow the shape of a wearer's breast and is shaped to be positioned below a wearer's breast to support the breast, and wherein the lower edge region comprises an electrically conductive fabric layer on the inner surface for contact with the user's skin. The centre gore comprises an attachment area for attachment of a transmitter and an electrically conductive pathway from the electrically conductive fabric of the lower regions of the breast cups to the attachment area.

[0018] The centre gore preferably comprises an outer layer and an inner layer, wherein the electrically conductive pathway is positioned between the inner and outer layers. At least one of the inner and outer layers is preferably waterproof and/or electrically insulating. At least one of the inner and outer layers may be a fabric layer, a coating, or a film.

[0019] The centre gore preferably comprises an electrically conductive fabric layer which forms the electrically conductive pathway from the electrically conductive fabric of the lower regions of the breast cups to the attachment area.

[0020] The electrically conductive fabric layer of the gore may be on the inner surface of the gore, in contact with the user's body when worn. Alternatively, the centre gore may comprise an outer layer and an inner layer, and the electrically conductive fabric is positioned between the inner and outer layers. A portion of the electrically conductive fabric layer may extend beyond the inner layer and fold over the inner layer, such that the electrically conductive layer of the gore contacts the electrically conductive fabric layer of the lower edge region of the breast cups.

[0021] In a preferred embodiment, the centre gore comprises a first attachment point and a second attachment point, wherein the electrically conductive fabric layer is in two portions, a first portion which passes from the electrically conductive fabric layer of the left breast cup to the first attachment point and a second portion which passes from the electrically conductive fabric layer of the right breast cup to the second attachment point. The first and second attachment points may comprise first and second holes through the centre gore. The first and second attachment points may further comprise first and second conductive fasteners secured in the first and second holes for attaching to first and second portions of a transmitter. The first and second fasteners may comprise button fasteners for snappily receiving first and second portions of a transmitter or magnetic fasteners for magnetically receiving first and second portions of a transmitter.

[0022] The bra may further comprise at least one sidewing attached to and extending from at least one of the left and right bra cups. The at least one sidewing may comprise an electrically conductive fabric layer on at least a portion of the inner surface in contact with the wearer when the bra is worn.

[0023] Each breast cup may further comprise an underwire casing attached to the inner surface of the lower edge region, wherein the underwire casing comprises the electrically conductive fabric layer for contact with the user's skin.

[0024] In one embodiment, the underwire casing comprises a fabric casing for receiving an underwire and the electrically conductive fabric layer is wrapped around the fabric casing. The electrically conductive fabric layer may wrap around the fabric casing and the underwire. The underwire casing may comprise a further electrically conductive fabric layer within the fabric casing for receiving an underwire.

[0025] In a second embodiment, the electrically conductive fabric layer is formed into a tube for receiving an underwire.

[0026] The bra may further comprise an underwire positioned within the underwire casing of each breast cup.

[0027] In a fourth embodiment of the present invention, there is provided a centre gore for attaching together two breast cups for a bra, the centre gore comprising an attachment area for attaching a transmitter and a layer of electrically conductive fabric for transmitting an electrical signal to the attachment area. The centre gore may comprise an outer layer and an inner layer, wherein the layer of electrically conductive fabric is positioned between the inner and outer layers. At least one of the inner and outer layers is preferably waterproof and/or electrically insulating. At least one of the inner and outer layers may be a fabric layer, a coating, or a film. A portion of the electrically conductive fabric layer may extend beyond the inner layer and folds over the inner layer. The

electrically conductive fabric layer of the gore is preferably on the inner surface of the gore, in contact with the wearer's body when worn.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] Preferred embodiments of the present invention will now be described with reference to the accompanying drawings, in which:

[0029] FIG. 1 shows a prior art sports bra which has attachment buttons for attachment to a transmitter placed within the chest band (not shown);

[0030] FIG. 2a shows a front view of a bra according to an embodiment of the present invention, with a transmitter attached to a centre gore;

[0031] FIG. 2b shows a front view of the bra of FIG. 2a, without a transmitter;

[0032] FIG. 2c shows a rear view of the bra of FIG. 2a or 2b;

[0033] FIG. 2d shows a rear view of a bra according to an alternative embodiment of the present invention;

[0034] FIG. 3a shows an underwire casing (including an underwire) in accordance with a first embodiment of the present invention;

[0035] FIG. 3b shows a cross sectional view of the underwire casing (including an underwire) of FIG. 3a;

[0036] FIG. 4a shows an underwire casing (including an underwire) in accordance with a second embodiment of the present invention;

[0037] FIG. 4b shows a cross sectional view of the underwire casing (including an underwire) of FIG. 4a;

[0038] FIG. 5a shows a breast cup comprising the underwire casing of FIG. 3a in accordance with the present invention;

[0039] FIG. 5b is an enlarged portion of FIG. 5a, with sew lines illustrated;

[0040] FIG. 6a shows a breast cup comprising the underwire casing of FIG. 4a in accordance with the present invention;

[0041] FIG. 6b is an enlarged portion of FIG. 6a, with sew lines illustrated;

[0042] FIG. 7a is a front view of the centre gore shown in FIGS. 2a-c, in accordance with the present invention;

[0043] FIG. 7b is a back view of the centre gore shown in FIGS. 2a-c, in accordance with the present invention;

[0044] FIG. 7c is an exploded view of the components of the centre gore shown in FIGS. 7a and 7b;

[0045] FIG. 8a is a front perspective view (taken from below) of the bra of FIGS. 2a-c showing the centre gore attached to the breast cups, in accordance with the present invention;

[0046] FIG. 8b is a back perspective view (taken from above) of the bra of FIGS. 2a-c showing the centre gore attached between the breast cups and underwire casings, in accordance with the present invention;

[0047] FIG. 9a shows an underwire casing (including an underwire) in accordance with an alternative embodiment of the present invention;

[0048] FIG. 9b shows a cross sectional view of the underwire casing (including an underwire) of FIG. 9a;

[0049] FIG. 10a shows a breast cup comprising the underwire casing of FIG. 9a in accordance with the present invention;

[0050] FIG. 10b is an enlarged portion of FIG. 10a, with sew lines illustrated;

[0051] FIG. 11a is a front view of the centre gore shown in FIG. 2d, in accordance with the present invention;

[0052] FIG. 11b is a back view of the centre gore shown in FIG. 2d without showing the lower non-stretchable fabric layer and the lower fabric layer, in accordance with the present invention;

[0053] FIG. 11c is an exploded view of the components of the centre gore shown in FIGS. 11a and 11b;

[0054] FIG. 12a is a front perspective view (taken from below) of the bra of FIG. 2d showing the centre gore attached to the breast cups, in accordance with the present invention;

[0055] FIG. 12b is a back perspective view (taken from above) of the bra of FIG. 2d showing the centre gore attached between the breast cups and underwire casings, in accordance with the present invention;

[0056] FIG. 13 shows a front view of a bra according to an embodiment of the present invention, without a transmitter attached to a centre gore;

[0057] FIG. 14a shows a back view of the bra shown in FIG. 13;

[0058] FIG. 14b shows the back view of FIG. 14a, with an inner fabric layer of the centre gore removed to show the conductive fabric layer of the centre gore;

[0059] FIG. 15a shows an alternative back view of the bra shown in FIG. 13;

[0060] FIG. 15b shows the back view of FIG. 15a, with an inner layer of the centre gore removed to show the conductive fabric layer of the centre gore;

[0061] FIG. 15c is a cross section showing a layer structure at the underwire and sidewing region;

[0062] FIG. 16 is a front perspective exploded view (as indicated in FIGS. 14b and 15b) of the bra of FIGS. 14a-b and 15a-b, showing the centre gore components, the underwire casings and the breast cups, in accordance with the present invention;

[0063] FIG. 16a, is a cross section of a layer structure as indicated on FIG. 16, showing a conductive component of the centre gore wrapping around the inner layer(s) of the centre gore to provide a conductive path with the electrically conductive underwire casing;

[0064] FIG. 17a shows a front view of a bra according to an embodiment of the present invention, without a transmitter attached to a centre gore;

[0065] FIG. 17b shows a back view of the bra shown in FIG. 17a;

[0066] FIG. 17c shows the back view of FIG. 17b, with an inner layer of the centre gore removed to show the conductive fabric layer of the centre gore;

[0067] FIG. 17d is a front perspective exploded view (as indicated in FIG. 17c) of the bra of FIGS. 17a-c, showing the centre gore components, the underwire casings and the breast cups, in accordance with the present invention;

[0068] FIG. 18 shows a bra cup with a line indicated for cross-sectional views;

[0069] FIG. 19 shows a cross-sectional view of a breast cup comprising a conductive fabric layer in accordance with the present invention;

[0070] FIG. 19a is an enlarged portion of FIG. 19, with adhesive illustrated;

[0071] FIG. 20 shows a cross-sectional view of a breast cup comprising a conductive fabric layer in accordance with the present invention; and

[0072] FIG. 20a is an enlarged portion of FIG. 20, with adhesive illustrated.

DETAILED DESCRIPTION

[0073] The present invention will now be described with reference to FIGS. 2a-12b. The present invention relates to an alternative bra for monitoring a wearer's heart rate (or any other electrical signal of interest), and to components of that alternative bra that enable the monitoring.

[0074] FIGS. 2a-c illustrate a bra 100 in accordance with the present invention. The bra 100 is a conventional bra comprising a pair of breast cups 10L, 10R intended to support the breasts of the wearer, a connecting portion, or centre gore 20, joining together the inner edges of the cups at the wearer's cleavage, and at least one strap or back wing 15 that extends from outer edges of the breast cups around the back of the wearer. The bra 100 may further include shoulder straps 16 that extend from upper edges of the breast cups over the shoulders of the wearer to attachment points on the back wing 15 crossing the wearer's back.

[0075] Each breast cup 10L, 10R has an inner surface 10i (shown in FIG. 2c) which is in contact with a wearer's body when worn and an outer surface 10o (shown in FIGS. 2a and 2b) which faces away from the wearer's body when worn. Referring to FIG. 2b, each breast cup 10L, 10R further comprises a lower edge region 30 which is shaped to follow the shape of a wearer's breast and is shaped to be positioned below a wearer's breast to support the breast when worn. The lower edge region 30 comprises an inner surface 30i which faces the wearer's body when the bra is worn.

[0076] The bra 100 in accordance with the present invention may be underwired. An underwire bra comprises an underwire for each breast cup to shape and support the lower periphery of each breast cup. The underwire comprises a generally U-shaped frame formed from metal or a rigid plastic material.

[0077] With reference to FIG. 2c, a first embodiment of a bra 100 according to the present invention is an underwired bra 100 having underwire casings 50a, 50b attached to the inner surface 30i of the lower edge regions 30 of the breast cups. The underwire casings 50a, 50b house underwires (not shown in FIG. 2c).

[0078] The underwire casings 50a, 50b comprise an electrically conductive fabric layer in contact with the wearer's skin to pick up electrical heart activity and transmit the electrical signals through the electrically-conductive fabric to the centre gore 20, attachment points 25a, 25b of the gore 20, and transmitter 70 (as shown in FIG. 2a).

[0079] As shown in the embodiment as illustrated in FIG. 2c, FIGS. 7a-7c and FIGS. 8a-8b, the centre gore 20 comprises two electrically conductive attachment points 25a, 25b (described in more detail later) for attachment of a transmitter, and two electrically conductive fabric portions 22a, 22b. The first electrically conductive fabric portion 22a is in contact with and/or extends from the electrically conductive fabric of the underwire casing 50a of the left breast cup 10L to the first attachment point 25a. Similarly, the second electrically conductive fabric portion 22b is in contact with and/or extends from the electrically conductive fabric of the underwire casing 50b of the right breast cup 10R to the second attachment point 25b.

[0080] Thus, any electrical signals picked up by the electrically conductive fabric of the underwire casings 50a, 50b is passed through the electrically conductive fabric of the casings 50a, 50b, through the electrically conductive fabric portions 22a, 22b of the centre gore 20, and to the attachment points 25a, 25b for the transmitter. The electrically conduc-

tive attachment points **25a**, **25b** (which will be described in more detail later) then transmit the electrical signal to the transmitter **70** (when attached, as shown in FIG. **2a**) for transmission of the electrical signal to a receiver (not shown).

[0081] As shown in FIG. **2c**, the sidewings **15** optionally comprise, on an inner surface, electrically conductive fabric portions **15a**, **15b** at the regions where the sidewings **15** attach to the breast cups **10i**. The electrically conductive fabric portions **15a**, **15b** of the sidewings **15** therefore extend the electrical pathway, such that the pathway passes through the electrically conductive sidewing portions **15a**, **15b**, casings **50a**, **50b**, gore **20** and attachments **25a**, **25b**. The electrically conductive portions **15a**, **15b** of the sidewings **15** may enhance signal pickup through increased contact area under firm pressure. The sidewings **15** may comprise a foam layer at the conductive portions **15a**, **15b** to increase the pressure against the user's body at this region, thus enhancing signal pickup. A cross-sectional view of the layers of the sidewing **15'** is illustrated in FIG. **15c**, and is described with reference to that figure later.

[0082] FIG. **2a** shows the transmitter **70** attached to the attachment points **25a**, **25b** of the bra **100**. The transmitter **70** is detachable and is preferably removed from the bra **100** (as shown in FIG. **2b**) when it is not needed or when the bra **100** is being washed.

[0083] The bra **100** of the first embodiment of the present invention therefore uses the underwire casings **50a**, **50b** to sense and transmit electrical heart signals to the transmitter **20** (via the central gore **20**). The location of the underwire casing **50a**, **50b**, on the inner surface **30i** of the lower edge regions **30** of the breast cups **10L**, **10R**, is a good location to pick up the heart rate signals, because the underwire casings **50a**, **50b** are firmly pressed against the wearer's skin at the appropriate location. The underwire casings **50a**, **50b** of the bra comprise underwires. The underwire assemblies (casings including underwires) are relatively fixed relative to the wearer's body as they provide their supportive function, positioned under the wearer's breasts. Furthermore, because conventional bras have various cup sizes in addition to dimensional sizes, the underwire casings **50a**, **50b** usually fit the wearer's body well, enhancing the signal pick up.

[0084] The present invention also relates to underwire casings **50a**, **50b** comprising an electrically conductive fabric layer. Preferred embodiments of the underwire casings **50a**, **50b** of FIGS. **2a-c** will now be described in more detail with reference to FIGS. **3a-6b** and FIGS. **9a-10b**.

[0085] FIGS. **3a** and **3b** illustrate a first embodiment of an underwire casing **250** in accordance with the present invention. FIG. **3a** shows an end-on perspective view of the underwire casing **250** and FIG. **3b** shows a cross-section of the underwire casing **250** shown in FIG. **3a**. The underwire casing **250** comprises a normal fabric (i.e. non-electrically conductive) casing **210** for surrounding an underwire **200**. The underwire casing **250** further comprises an electrically conductive fabric layer **220** that is wrapped around the fabric casing **210** housing the underwire **200**. As illustrated, the edge of the electrically conductive fabric layer **220** is preferably folded into the centre of a U-shaped fabric casing **210**, with the underwire **200** being positioned between the folded-in edge of the conductive fabric layer **220** and the fabric casing **210**. By folding-in the outer conductive layer **220** in this manner, the underwire can also function to transmit electrical signals, if that underwire is electrically conducting (e.g. made from metal). In a preferred variation of this embodi-

ment (shown in FIGS. **3a** and **3b**), an additional U-shaped layer of electrically conducting fabric **230** is wrapped around the underwire **200**, within the normal fabric casing **210**. This additional electrically conductive fabric layer **230** serves to cover and prevent exposure of the underwire **200**, and also to enhance the conducting path provided by the electrically conductive fabric **220** that wraps around the fabric casing **210**. This additional electrically conductive fabric layer **230** also acts as a "backup" in case the outer electrically conductive fabric layer **220** is damaged or otherwise not functioning. In another preferred variation of this embodiment (shown in FIGS. **9a** and **9b**), the underwire casing **950** comprises an electrically conductive fabric layer **920** that is wrapped around a normal (i.e. non-electrically conductive) fabric casing **910** and the underwire **900**. In this variation, a single piece of electrically conductive fabric **920** is used to wrap around the underwire casing **950** and the underwire **900**, thereby saving production cost.

[0086] FIGS. **4a** and **4b** illustrate a second embodiment of an underwire casing **350** in accordance with the invention. FIG. **4a** shows an end-on perspective view of the underwire casing **350** and FIG. **4b** shows a cross-section of the underwire casing **350** shown in FIG. **4a**. The underwire casing **350** is formed from an electrically conductive fabric layer **320** which surrounds an underwire **300**. The underwire casing may be formed from a tube (as illustrated) of electrically conductive fabric **320** or may be formed from a U-shaped fabric layer **320** which is sewn along the open edge to provide a tube.

[0087] FIGS. **5a**, **5b**, **6a**, **6b**, **10a** and **10b** illustrate the attachment of the underwire casings of the first **250**, **950** and second **350** embodiments to a breast cup of a bra, for example the breast cup **10L**, **10R** of the bra **100** illustrated in FIGS. **2a-c**. FIGS. **5a**, **5b**, **6a**, **6b**, **10a** and **10b** are cross-sectional views of a breast cup **10L**, **10R** taken along the dotted line shown in FIG. **2c**.

[0088] In particular, FIGS. **5a** and **5b** illustrate the attachment of the underwire casing **250** of FIGS. **3a** and **3b** to an inner surface **30i** of the lower edge region **30** of a breast cup **10L**, **10R**. As shown by sew lines **205**, a preferred means of attaching the underwire casing to the breast cup is to sew along the length of the upper and lower edges of an underwire casing **250** that is positioned on the inner surface **30i** of the lower edge region **30** of a breast cup **10L**, **10R** (as also shown by the sew lines in FIGS. **2c**, **8a** and **8b**), the sewing threads passing through all of the layers of the underwire casing and the lower region **30** of the breast cup **10L**, **10R**. The sew threads can therefore secure the layers of the underwire casing **250** together as well as securing the underwire casing **250** to the lower edge region **30** of the breast cup **10L**, **10R**.

[0089] Similarly, FIGS. **10a** and **10b** illustrate the attachment of the underwire casing **950** of FIGS. **9a** and **9b** to an inner surface **30i** of the lower edge region **30** of a breast cup **10L**, **10R**. As shown by sew lines **905**, a preferred means of attaching the underwire casing to the breast cup is to sew along the length of the upper and lower edges of an underwire casing **950** that is positioned on the inner surface **30i** of the lower edge region **30** of a breast cup **10L**, **10R** (as also shown by the sew lines in FIGS. **2c**, **8a** and **8b**), the sewing threads passing through all of the layers of the underwire casing and the lower region **30** of the breast cup **10L**, **10R**. The sew threads can therefore secure the layers of the underwire casing **950** together as well as securing the underwire casing **950** to the lower edge region **30** of the breast cup **10L**, **10R**.

[0090] Similarly, FIGS. 6a and 6b illustrate the attachment of the underwire casing 350 of FIGS. 4a and 4b to an inner surface 30i of the lower edge region 30 of a breast cup 10L, 10R. As shown by sew lines 305, a preferred means of attaching the underwire casing 350 to the breast cup is to sew along the length of the upper and lower edges of an underwire casing 350 that is positioned on the inner surface 30i of the lower edge region 30 of a breast cup 10L, 10R (as also shown by the sew lines in FIGS. 2c, 8a and 8b), the sewing threads passing through the layers of the underwire casing and the lower region 30 of the breast cup 10L, 10R.

[0091] As shown in FIGS. 5a-6b and FIGS. 10a-10b, the breast cup may be formed of an inner foam layer 11, an outer foam layer 12, an inner fabric layer 13 and an outer fabric layer 14. The inner 13 and outer 14 fabric layers form the lower edge region 30 of the breast cup 10L, 10R (with or without one or more of the foam layers therebetween). However, the bra of the present invention is not intended to be limited to the illustrated breast cup structure, which is shown for illustrative purposes. For example, any number of foam layers and/or fabric layers can be provided, and the breast cup may omit the foam layers altogether.

[0092] As will be understood from the above description, the underwire casings 250, 350 and 950 illustrated in FIGS. 3a-6b and FIGS. 9a-10b are preferred embodiments of those labelled 50a, 50b in FIGS. 2a-c and 8a-b.

[0093] An embodiment of the centre gore 20 of the present invention is illustrated in greater detail in FIGS. 7a-7c. 7a shows the outer surface (surface facing away from the wearer) of the centre gore 20 (as seen in FIG. 2b) and FIG. 7b shows the inner surface (surface facing the user's body) of the centre gore 20 (as illustrated in FIG. 2c). As shown in FIG. 7a, the attachment points 25a, 25b for a transmitter 70 are preferably button type fasteners, each of which comprises a recess (denoted by an inner circle) on the upper or the outer side of the centre gore 20 for snappily receiving a corresponding protrusion of the transmitter. Thus, protrusions of the transmitter snap-fit into the recesses of the button type fasteners on the front centre gore 20, attaching the transmitter 70 to the bra 100 (as shown in FIG. 2a). Other attachment points 25a', 25b' are possible, for example, magnetic connectors, as shown in FIGS. 16 and 17d.

[0094] As previously described (and as shown in FIG. 7b), the inner surface of the centre gore 20 comprises a first electrically conducting fabric portion 22a to transmit an electrical signal from the underwire casing 50a of the left breast cup 10L to the first attachment point or button type fastener 25a, and a second electrically conducting fabric portion 22b to transmit an electrical signal from the underwire casing 50b of the right bra cup 10R to the second attachment point or button type fastener 25b. The attachment point or button type fasteners 25a, 25b are themselves electrically conductive (e.g. by virtue of being metallic) to allow transmission of an electric signal from the electrically conductive fabric portions 22a, 22b to the transmitter protrusions.

[0095] An exploded perspective view of the embodiment of the centre gore as shown in FIGS. 7a and 7b is shown in FIG. 7c. Each button type fastener 25a, 25b preferably comprises a first component of a snap button, a washer/spacer, and a second component of the snap button. The snap button fasteners pass through holes in the fabric layers 21, 23, 22a, 22b of the centre gore 20. In particular, the centre gore comprises an upper fabric layer 21, which is preferably of the same fabric as the outer surface 10o of the breast cups 10L, 10R, a

non-stretchable fabric layer 23, and the conductive fabric portions 22a, 22b. The non-stretchable fabric layer 23 prevents lateral movement of the two bra cups away from each other. An additional fabric layer, of the same material as the inner surface of the breast cup 10i, may be provided between the non-stretch layer 23 and the electrically conductive fabric portions 22a, 22b.

[0096] FIGS. 8a and 8b illustrate the centre gore 20 (as shown in FIGS. 7a-7c) assembled with the breast cups 10L, 10R. In particular, FIG. 8a shows the centre gore 20 attached between the lower edge region 30 of the breast cups 10L, 10R and the underwire casings 50a, 50b of those breast cups, thereby allowing the conductive fabric portions 22a, 22b to contact the underwire casings 50a, 50b and thus completing the electrical pathway from the underwire casing 50a of the left breast cup 10L to the first attachment transmitter point 25a and completing the electrical pathway from the underwire casing 50b of the right breast cup 10R to the second attachment point 25b (as shown in FIG. 8b).

[0097] It is preferred to fix the centre gore 20 between the lower edge region 30 of the breast cups 10L, 10R and the underwire casings 50a, 50b, to provide a neat finish and to ensure a good electrical pathway between the underwire casings 50a, 50b and the electrically conductive fabric portions 22a, 22b of the centre gore 20.

[0098] A variation of the embodiment of the centre gore shown in FIGS. 2c, 7a-7c and 8a-8b is shown in FIGS. 2d, 11a-11c and 12a-12b. In this variation, as in particular shown in the exploded perspective view in FIG. 11c, the centre gore 20 comprises an upper fabric layer 21 which is preferably of the same fabric as the outer surface 10o of the breast cups 10L, 10R, an optional upper non-stretchable fabric layer 23, the conductive fabric portions 22a, 22b, an optional lower non-stretchable fabric layer 23, and a lower fabric layer which is preferably of the same fabric as the inner surface 10i of the breast cups 10L, 10R. The lower fabric layer and optionally the lower non-stretchable fabric layer are present to prevent any "short-circuiting" that may occur through direct contact of the attachment points 25a, 25b or related conductive components with the human body. Thus, in this variation, the innermost side of the centre gore, i.e. the side or surface that is in contact with the wearer's skin, preferably comprises fabric only. Thus, the difference between the gore of FIGS. 7a-c and the gore of FIGS. 11a-c is the addition of the lower fabric layer 21 and, optionally, the lower non-stretchable fabric layer 23. In addition, in this variation, the conductive fabric portions 22a, 22b preferably comprises thin strips of fabric as illustrated in FIGS. 11b and 11c, to save production cost. As shown in FIG. 2d, the inner surface of the sidewings 15 of the bra 100 optionally comprise electrically conductive fabric portions 15a, 15b to enhance the signal pickup, as described previously with respect to FIG. 2c.

[0099] Another variation of an embodiment of a centre gore which prevents or minimises "short circuiting", and a bra portion 100' comprising such a centre gore, is now described with reference to FIGS. 13-16a. FIG. 13 shows a front (outside) view of a bra portion 100' comprising a centre gore 20' having attachment points 25a', 25b' for a transmitter (not shown). The attachment points 25a', 25b' are conductive connectors for attaching to the transmitter (not shown), which in this embodiment, are magnetic connectors. Other fastener means, such as a snap-fit connector, are also possible. As shown, the outer surface of the bra optionally comprises a waterproof and/or insulating outer layer 26' which prevents or

minimises short circuiting (across the attachment points **25a'**, **25b'**) due to moisture (e.g. sweat or rain) on the outer surface of the bra. The waterproof and/or insulating outer layer **26'** is preferably a fabric, film or coating.

[0100] FIG. **14a** shows a back (inside) view of the bra portion **100'** of FIG. **13**. FIG. **15a** shows an alternative back (inside) view of the bra portion **100'** of FIG. **13**. The bra portions **100'** include a portion of the sidewing **15'** attached to and extending from the breast cups **10i'**. The difference between the bra portions of FIGS. **14a** and **15a** is that the bra portion **100'** of FIG. **15a** includes conductive fabric portions **15a'**, **15b'** in the region of the sidewings **15'** which attach to and extend from the breast cups, which will be described in more detail later, with reference to FIG. **15c**.

[0101] As shown in FIGS. **14a** and **15a**, the bra portions **100'** comprise, on the inner surface that contacts the wearer, conductive casings **50a'**, **50b'** along the lower regions **30i'** of the bra cups **10i'** to pick up an electric signal from the wearer, as described previously with reference to FIGS. **2a-12b**. Referring to FIGS. **14b** and **15b**, the bra portions **100'** are shown with an inner layer **21i'** of the centre gore **20'** removed, to show the conductive fabric portions **22a'**, **22b'** of the centre gore **20'**, which are substantially as described with reference to FIGS. **11b** and **11c**. Although the electrical pathway through the centre gore **20'** preferably consists of an electrically conductive fabric **22a'**, **22b'**, it will be understood that other electrical pathways may be provided, such as wires.

[0102] FIG. **16** shows the structure of the centre gore **20'** of the bra portion **100'** of FIGS. **13** and **14a-b** and the bra portion **100'** of FIGS. **13** and **15a-b**, as indicated in FIGS. **14b** and **15b**. The structure of the centre gore **20'** is the same for both bra portions **100'**.

[0103] Referring to FIG. **16**, the centre gore **20'** comprises an inner fabric layer **21i'** (shown removed from the bra portion **100'** in FIGS. **14b** and **15b**), an inner waterproof and/or insulating layer **23i'**, the electrically conductive fabric portions **22a'**, **22b'**, an outer waterproof and/or insulating layer **23o'**, an outer fabric layer **21o'** and an additional outer fabric layer **24'**. As shown, the gore **20'** comprises electrically conductive button-type fasteners **25a'**, **25b'** to couple (preferably magnetically) with a transmitter. The inner and outer fabric layers **21i'**, **21o'** may comprise non-stretchable fabric, as described with respect to FIGS. **11a-c**. An additional inner fabric layer (not shown) may be provided if desired, such that the difference between the gore **20'** of FIG. **16** and the gore **20** shown in FIG. **11c** is the addition of the waterproof and/or insulating layers **23i'**, **23o'**, **26'**.

[0104] As shown in FIG. **16**, the electrically conductive fabric portions **22a'**, **22b'**, and the inner parts of the button connectors **25a'**, **25b'** are sandwiched between two insulating and/or waterproof layers **23i'**, **23o'**, preventing or minimising short circuiting between the inner parts of the connectors **25a'**, **25b'** and the electrically conductive fabric portions **22a'**, **22b'**.

[0105] The additional waterproof and/or insulating layer **26'** provided between the outermost fabric layer **24'** of the gore **20'** and the outer surface of the attachment points **25a'**, **25b'** prevents or minimises short circuiting across the outer parts of the button connectors **25a'**, **25b'**. The outer additional waterproof and/or insulating layer **26'** may not be required if the main moisture encountered is through sweat gathering on the inside of the bra.

[0106] As stated previously, it is preferred to fix the centre gore **20'** between the lower edge region **30i'** of the breast cups

10i' and the underwire casings **50a'**, **50b'**, to provide a neat finish and to ensure a good electrical pathway between the underwire casings **50a'**, **50b'** and the electrically conductive fabric portions **22a'**, **22b'** of the centre gore **20'**. To achieve the electrical pathway when the electrically conductive fabric portions **22a'**, **22b'** are sandwiched between the inner and outer waterproof and/or insulating layers **23i'**, **23o'** and inner fabric layer **21i'**, the electrically conductive fabric portions **22a'**, **22b'** are configured to extend beyond the inner waterproof and/or insulating layer **23i'** and beyond the inner fabric layer **21i'**, and wrap around the edges of the inner waterproof and/or insulating layer **23i'** and the inner fabric layer **21i'**, as shown in FIGS. **16** and **16a**. Thus, the electrically conductive fabric portions **22a'**, **22b'** are able to form an electrically pathway with the electrically conductive casings **50a'**, **50b'**. As shown in FIGS. **16** and **16a**, the layers of the gore **20'** and each of the underwire casings **50a'**, **50b'** are preferably sewn together (where the dashed lines represent sew lines).

[0107] As described previously, the difference between the bra portion **100'** of FIGS. **14a-b** and that of FIGS. **15a-b** is the presence of electrically conductive fabric portions **15a'**, **15b'** in the sidewing regions of the bra portion **100'** of FIGS. **15a-b**. FIG. **15c** shows the layer structure of the sidewing of FIGS. **15a-b**, where FIG. **15c** shows a cross-section of a portion of FIG. **15b**, as indicated. The underwire casing **50b'** is sewn to the electrically conductive fabric portion **15b'** of the sidewing, a foam layer **15f'** and an outer fabric layer **15o'** of the sidewing. As described previously, the foam layer **15f'** increases the pressure felt in the sidewing enhancing the signal pick up, whilst also providing an even distribution of pressure in this region. The foam layer **15f'** preferably comprises a laminate of an outer fabric layer, a foam, and an inner fabric layer.

[0108] A cross-sectional view of the bra cup **10i'** of the bra portion of FIGS. **13-16a** (taken along the section shown in FIG. **18**), looks substantially as shown in FIGS. **6a** and **6b**, where, with further reference to FIGS. **16** and **16a**, the underwire casings **50a'**, **50b'** are attached by sewing to the breast cups **10i'**, along the length of the upper and lower edges of the casings **50a'**, **50b'** positioned on the inner surface **30i'** of the lower edge region **30i'**. The sewing threads pass through the layers of the underwire casing **50a'**, **50b'** and the lower region of the breast cups **10i'**.

[0109] As described with reference to FIGS. **6a-6b**, the breast cups **10i'** may be formed of an inner foam layer **11**, an outer foam layer **12**, an inner fabric layer **13** and an outer fabric layer **14**. The inner **13** and outer **14** fabric layers form the lower edge region of the breast cup (with or without one or more of the foam layers therebetween). The casings **50a'**, **50b'** may house an underwire (not shown in FIG. **16a**), if desired.

[0110] A preferred method of manufacturing a bra according to the present invention is therefore to first attach the centre gore **20**, **20'** to the breast cups **10L**, **10R**, for example by sewing the centre gore **20**, **20'** to the breast cups **10L**, **10R** at the inner portion (e.g. towards the cleavage area) of the lower edge regions **30**, **30'**. The sidewing or sidewings **15**, **15'** are then attached to the breast cup **10L**, **10R** along the outer portion (e.g. at the other end to the cleavage area) of the lower edge region **30**, **30'**. As will be understood, the sidewing(s) **15**, **15'** can equally be attached first, with the centre gore **20**, **20'** attached afterwards. Furthermore, as will be understood by FIGS. **13**, **14-b** and **15a-b**, at least a portion of the sidewing may be formed as a unitary piece with the bra cups. An

additional sidewing portion may then be attached to the sidewing portion that was formed as a unitary piece with the breast cup.

[0111] As described above with reference to FIGS. 2c and 15a-c, the sidewings 15, 15' can comprise electrically conductive fabric portions 15a, 15b, 15a', 15b' at a region adjacent the breast cups 10i, 10i' to enhance signal pickup through increased contact area under firm pressure.

[0112] The next step is to attach the underwire casing 50a, 50b, 50a', 50b' to the breast cup along the lower edge region 30, 30'. As discussed previously, this can be achieved by sewing along the upper and lower edges of the underwire casing 50a, 50b, 50a', 50b' along the length of the lower edge regions 30, 30', as shown in FIGS. 2c, 2d, 8a, 8b, 12a, 12b, and 16. However, the underwire casing can be attached by any other suitable means.

[0113] The final step is to insert the underwire into the underwire casings (e.g. insert underwire 200, 300, 900 into casings 250, 350, 950) and sew across the ends of the casings 50a, 50b, 50a', 50b' to secure the underwires within the casings 50a, 50b, 50a', 50b'. If underwiring is not required, this step can be omitted.

[0114] The present invention also provides corresponding methods for manufacturing the bra components, i.e. the centre gore 20, 20' and the underwire casings 250, 350, 950, as can be readily determined by analogy to the above bra component descriptions.

[0115] Alternative bras in accordance with the present invention are also provided. In a second embodiment of the present invention, the bra 100 comprises all of the features of the first embodiment as described with reference to FIGS. 2a-2d, 7a-7c, 8a-8b, 11a-11c, 12a-12b, and 13-16a, but a conductive fabric layer (or layers) is incorporated into or attached to the inner surface 30i, 30i' of the lower edge region 30, 30' of the breast cups 10L, 10R, instead of the underwire casing 50a, 50b, 50a', 50b'. Thus, the electrically conductive fabric layer provides the same function as the underwire casing, and is provided in the same location as the underwire casing, thus offering the same benefits as the underwire casing in terms of providing an electrical pathway for transmission of a signal to the transmitter. Electrical signals from the heart can be sensed and transmitted by the electrically conductive fabric of the lower edge region 30, 30' to the centre gore 20, 20', through the electrically conductive fabric portions 22a, 22b, 22a', 22b' of the centre gore 20, 20', through the attachment points 25a, 25b, 25a', 25b' of the centre gore and to the transmitter 70 (when attached).

[0116] The second embodiment of the present invention is therefore applicable to non-underwire bras and also molded bras which have the underwire (or optionally, underwire casing without an underwire) within the layers of the bra (rather than being attached to the outside of the breast cup at the lower edge region).

[0117] FIGS. 17a-20a illustrate molded bras or bra portions with an electrically conductive fabric layer attached, in accordance with the second embodiment of the invention. FIG. 17a shows a front (outside) view of a bra portion 1000 comprising a centre gore 1020 having attachment points 1025a, 1025b for a transmitter (not shown). The attachment points 1025a, 1025b are conductive connectors for attaching to the transmitter, which in this embodiment, are magnetic connectors.

[0118] If desired, the outer surface of the bra 1000 may comprise an optional waterproof and/or insulating layer to

prevent or minimise short circuiting across the outer parts of the attachment points 25a', 25b', as previously described with reference to FIGS. 13 and 16.

[0119] The back, inner view of the bra portion 1000 is shown in FIGS. 17b and 17c. As shown in FIGS. 17b and 17c, the bra 1000 comprises conductive fabric portions 1050a, 1050b attached to the inner surface of the bra, along the lower periphery of each breast cup 1010i. As shown, the conductive fabric portions 1050a, 1050b may extend into the sidewing regions 1015a, 1015b, as described previously with respect to FIG. 15b. FIG. 17c shows the back, inner, view of the bra portion 1000 of FIG. 17b, with an inner layer 1023i of the central gore 1020 removed to expose the inner parts of the attachment points 1025a, 1025b and to fully expose the conductive fabric portions 1050a, 1050b. As shown in FIG. 17c, the conductive fabric layer is formed of two parts, corresponding to a part 1050a, 1050b for each breast cup 1010i, the conductive fabric portions 1022a, 1022b extending to the attachment points and corresponding sidewing region 1015a, 1015b. The inner layer 1023i is an insulating and/or waterproof layer to prevent or minimise short circuiting across the attachment points 1025a, 1025b and the conductive fabric portions 1022a, 1022b extending to the attachment points.

[0120] FIG. 17d shows an exploded perspective view of the centre gore 1020 region as indicated in FIG. 17c. The bra 1000 is a molded bra, which can be formed by molding multiple fabric and foam layers under heat and pressure. As will be understood from FIGS. 17c and 17d, the bra portion 1000 can be formed as a unitary piece, comprising an inner fabric layer 1013 and an outer fabric layer 1014 that together form the inner and outer layers of the centre gore 1020 and the bra cups. Additional foam layers may be provided in the structure, for example between the inner and outer fabric layers 1013, 1014 of the gore 1020, as shown in FIG. 17d (layer 1016) or between the inner and outer fabric layers 13, 14 of the breast cups, as shown in FIGS. 19-20a (layers 11 and 12). Returning to FIG. 17d, the gore 1020 comprises an outer waterproof and/or insulating layer 1023o, with the conductive fabric portions 1022a, 1022b and the attachment points 1025a, 1025b being sandwiched between the inner and outer waterproof and/or insulating layers 1023i, 1023o. As shown in FIG. 17d, the gore 1020 may further comprise an outer fabric layer 1024.

[0121] The foam layer 1016 of the fabric-foam laminate 1013, 1014, 1016 may act as an insulating layer to minimise or prevent short circuiting, making an outer waterproof and/or insulating layer (as described with reference to FIG. 16) unnecessary.

[0122] FIGS. 19a-20a illustrate a cross-section through the bra cup of FIGS. 17a-d, taken along the line shown in FIG. 18. FIG. 19 and FIG. 20 illustrate two different underwire configurations 1350, 1350' which are formed within the molded bra. FIG. 19 shows a bra cup, much as shown in FIGS. 6a and 6b, having an inner fabric layer 13, and outer fabric layer 14, and two foam layers 11, 12 sandwiched therebetween. The cross-sections differ due to the underwire or underwire casings shown. FIGS. 19 and 19a show an underwire casing 1320 between the inner and outer foam layers 11, 12, which may or may not comprise an underwire 1330. The underwire casing may be made of TPR (thermoplastic rubber), PP (polypropylene), nylon, TPU (thermoplastic polyurethane), TPE (thermoplastic elastomer), TPEE (thermoplastic polyester elastomer), non-elastic fabric, or any other suitable material.

[0123] FIGS. 20 and 20a show a cushioned plastic underwire 1350' sandwiched between the inner and outer fabric layers 11, 12. The cushioned plastic underwire 1350' may comprise a polypropylene underwire 1330' encased in thermoplastic rubber casing 1320'.

[0124] For both cross-sections, the breast cups are provided with an electrically conductive fabric layer 1050a, 1050b at their lower periphery, as illustrated in FIGS. 17b and 17c. The electrically conductive fabric layer 1050a, 1050b may be attached by any suitable means. In the preferred embodiment, the electrically conductive fabric layer 1050a, 1050b is attached with adhesive 151.

[0125] The bra in accordance with the second embodiment may be manufactured in the same way as the first embodiment. In particular, the centre gore 20 may first be attached to the breast cups 10L, 10R; the sidewing or sidewings 15 are attached to the breast cups 10L, 10R, before or after attachment of the central gore 20; and the conductive fabric layer is attached to the breast cup along the lower edge region 30. As discussed previously, this can be achieved by sewing along the upper and lower edges of the electrically conductive fabric layer or layers. If the lower edge region of the breast cups is provided with electrically conductive fabric (e.g. by incorporating electrically conductive yarn), the last step is not required.

[0126] Alternatively, as described with respect to FIGS. 17-20, a bra portion 1000 comprising breast cups, centre gore 1020 and sidewing regions can be formed as a unitary piece in a molding process, with the electrically conductive fabric layer 1050a, 1050b being attached thereafter, followed by the attachment of the attachment points 1025a, 1025b, and the waterproof and/or insulating film, coating or fabric 1023i.

[0127] By providing the sensors as conductive fabric attached to or incorporated within the inner surface of the lower edge regions of the breast cups, there is the ability to enhance the picking up of the heart rate signal and reduce the loss of signal since the sensors fit the wearer's body well and the sensors are well located. As discussed above, this may be achieved by attaching an underwire casing comprising an electrically conductive fabric to the lower edge regions or by providing the lower edge regions with an electrically conductive fabric (e.g. by incorporating electrically conductive yarn into the lower edge regions or attaching an electrically conductive fabric layer to the lower edge regions).

[0128] It will be appreciated that this description is by way of example only; alterations and modifications may be made to the described embodiment without departing from the scope of the invention as defined in the claims.

1. An underwire casing for a bra, the underwire casing comprising an electrically conductive fabric layer.

2. The underwire casing of claim 1, wherein the underwire casing comprises a fabric casing for receiving an underwire and wherein the electrically conductive fabric layer is wrapped around the fabric casing.

3. A breast cup for a bra, the breast cup having an inner surface which is in contact with a wearer's body when worn, and an outer surface which faces away from the wearer's body when worn, and a lower edge region which is shaped to follow the shape of the wearer's breast and shaped to be positioned below the wearer's breast to support the breast, wherein the lower edge region comprises an electrically conductive fabric layer on the inner surface for contact with the wearer's skin.

4. The breast cup of claim 3, wherein the breast cup further comprises an underwire casing attached to the inner surface

of the lower edge region, wherein the underwire casing comprises the electrically conductive fabric layer for contact with the wearer's skin.

5. A bra having an inner surface which is in contact with a wearer's body when worn, and an outer surface which faces away from the wearer's body when worn, wherein the bra comprises:

- a left breast cup;
- a right breast cup; and
- a centre gore attached between the left and right breast cups;

wherein each of the left and right breast cups comprises a lower edge region which is shaped to follow the shape of a wearer's breast and is shaped to be positioned below a wearer's breast to support the breast, and wherein the lower edge region comprises an electrically conductive fabric layer on the inner surface for contact with the wearer's skin;

wherein the centre gore comprises:

- an attachment area for attachment of a transmitter; and
- an electrically conductive pathway from the electrically conductive fabric of the lower edge regions of the breast cups to the attachment area.

6. The bra of claim 5, wherein the centre gore comprises an outer layer and an inner layer, and the electrically conductive pathway is positioned between the inner and outer layers.

7. The bra of claim 6, wherein at least one of the inner and outer layers is waterproof and/or electrically insulating.

8. The bra of claim 6, wherein at least one of the inner and outer layers is one of the group consisting of: a fabric layer, a coating, a film.

9. The bra of claim 5, wherein the centre gore comprises an electrically conductive fabric layer which forms the electrically conductive pathway from the electrically conductive fabric of the lower edge regions of the breast cups to the attachment area.

10. The bra of claim 9, wherein the electrically conductive fabric layer of the gore is on the inner surface of the gore, in contact with the wearer's body when worn.

11. The bra of claim 9, wherein the centre gore comprises an outer layer and an inner layer, and the electrically conductive fabric is positioned between the inner and outer layers.

12. The bra of claim 11, wherein a portion of the electrically conductive fabric layer of the gore extends beyond the inner layer and folds over the inner layer, such that the electrically conductive layer of the gore contacts the electrically conductive fabric layer of the lower edge region of the breast cups.

13. The bra of claim 9, wherein the centre gore comprises a first attachment point and a second attachment point, wherein the electrically conductive fabric layer is in two portions, a first portion which passes from the electrically conductive fabric layer of the left breast cup to the first attachment point and a second portion which passes from the electrically conductive fabric layer of the right breast cup to the second attachment point.

14. The bra of claim 5, wherein the bra further comprises: at least one sidewing attached to and extending from at least one of the left and right breast cups; wherein the at least one sidewing comprises an electrically conductive fabric layer on at least a portion of the inner surface in contact with the wearer when the bra is worn.

15. The bra of claim 5, wherein each breast cup further comprises an underwire casing attached to the inner surface

of the lower edge region, wherein the underwire casing comprises the electrically conductive fabric layer for contact with the wearer's skin.

16. A centre gore for attaching together two breast cups for a bra, the centre gore comprising an attachment area for attaching a transmitter and a layer of electrically conductive fabric for transmitting an electrical signal to the attachment area.

17. The centre gore of claim **16**, comprising an outer layer and an inner layer, wherein the layer of electrically conductive fabric is positioned between the inner and outer layers.

18. The centre gore of claim **17**, wherein at least one of the inner and outer layers is waterproof and/or electrically insulating.

19. The centre gore of claim **17**, wherein a portion of the electrically conductive fabric layer extends beyond the inner layer and folds over the inner layer.

20. The centre gore of claim **16**, wherein the electrically conductive fabric layer of the gore is on the inner surface of the gore, in contact with the wearer's body when worn.

* * * * *

专利名称(译)	胸罩和胸罩组件		
公开(公告)号	US20150335078A1	公开(公告)日	2015-11-26
申请号	US14/718862	申请日	2014-05-26
申请(专利权)人(译)	维珍妮国际 (集团) 有限公司		
当前申请(专利权)人(译)	维珍妮国际 (集团) 有限公司		
[标]发明人	ZHANG WENBO		
发明人	ZHANG, WENBO		
IPC分类号	A41C3/00 A61B5/00 A61B5/0408		
CPC分类号	A41C3/0064 A41C3/0007 A61B5/0006 A61B5/6804 A61B5/0408 A41C3/122 A41D13/1281 A61B5/024 A61B5/02438 A61B5/02444		
优先权	201510032889.6 2015-01-22 CN		
其他公开文献	US10092043		
外部链接	Espacenet USPTO		

摘要(译)

胸罩，能够监测佩戴者的心率。提供了一种胸罩，其包括左乳房罩杯；右乳房罩杯；以及连接在左右乳房罩杯之间的中心孔。左和右乳房罩杯中的每一个包括下边缘区域，该下边缘区域成形为遵循穿着者的乳房的形状并且成形为定位在穿着者的乳房下方以支撑乳房，并且其中下边缘区域包括导电织物层在内表面上以与使用者的皮肤接触。中心孔包括用于附接发射器的附接区域和从罩杯的下部区域的导电织物到附接区域的导电路径。还提供了用于提供电通路的胸罩部件。

