US010660377B2

(12) **United States Patent**
Randall et al.

(10) **Patent No.: US 10,660,377 B2**
(45) **Date of Patent: May 26, 2020**

(54) **BRASSIERE AND FRONT PANEL FOR BRASSIERE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 321 days.

(21) Appl. No.: **15/593,557**

(22) Filed: **May 12, 2017**

(65) **Prior Publication Data**

US 2017/0360118 A1 Dec. 21, 2017

Related U.S. Application Data

(60) Provisional application No. 62/337,027, filed on May 16, 2016.

(51) **Int. Cl.**
A41C 3/14 (2006.01)
A41C 3/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***A41C 3/14*** (2013.01); ***A41C 3/0007*** (2013.01); ***A41C 3/0057*** (2013.01); ***A41C 3/02*** (2013.01); ***A41C 3/128*** (2013.01); ***A41C 3/142*** (2013.01)

(58) **Field of Classification Search**
CPC A41C 3/14; A41C 3/142; A41C 3/128; A41C 3/0057; A41C 3/0007; A41C 3/02
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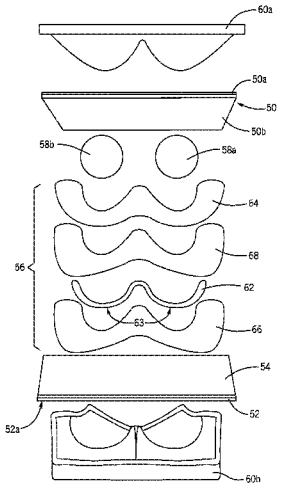
(57) **ABSTRACT**

A brassiere includes bra cups holding a wearer's breasts. A shaping foam layer is sandwiched between outer and inner layers of each bra cup and extends from a lower to an upper edge of each cup. A support shelf assembly spans across a lower portion of each bra cup and includes a support component located proximate the lower edge of the cups, a non-stretch stabilizer fabric layer spanning between both cups and along a full length of the support component, and a supportive foam layer spanning between both cups and along the support component. The inner, outer, shaping foam, stabilizer fabric, and supportive foam layers span across a center gore that connects the bra cups to form a front panel of the brassiere. The support shelf assembly is molded between the inner layer and the shaping foam layer and is an embedded, integral part of the front panel.

14 Claims, 8 Drawing Sheets



(51) **Int. Cl.**
A41C 3/02 (2006.01)
A41C 3/12 (2006.01)

(58) **Field of Classification Search**
USPC 450/40
See application file for complete search history.

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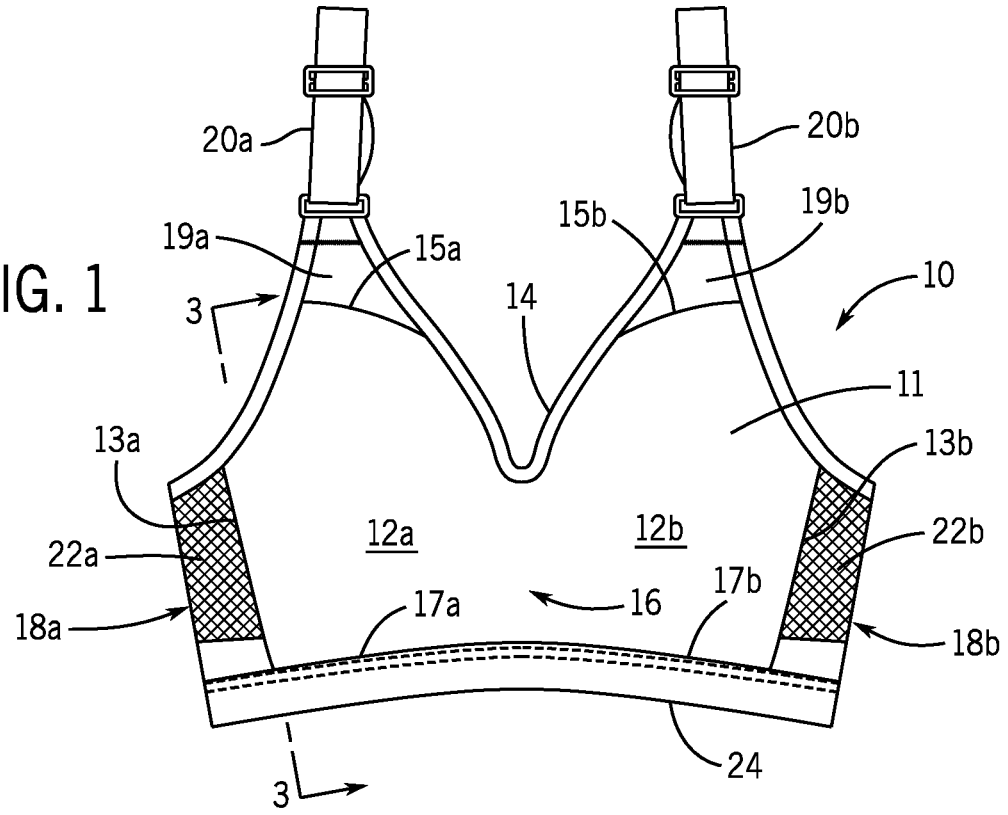
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16
17b
18a
18b
24
3

FIG. 1

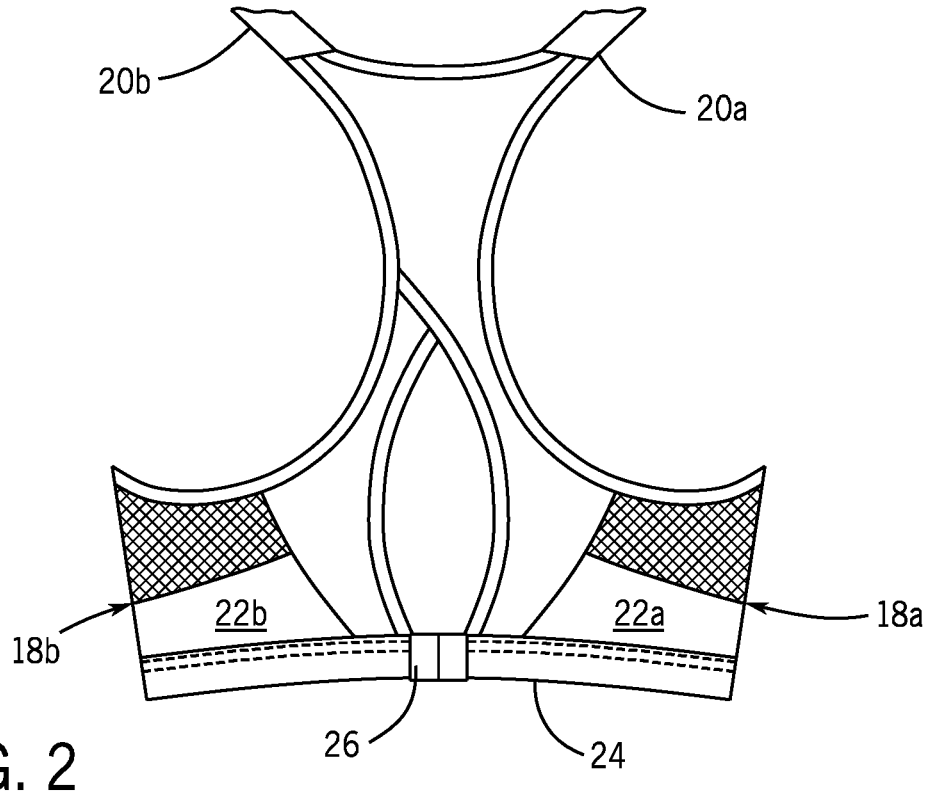
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FIG. 2

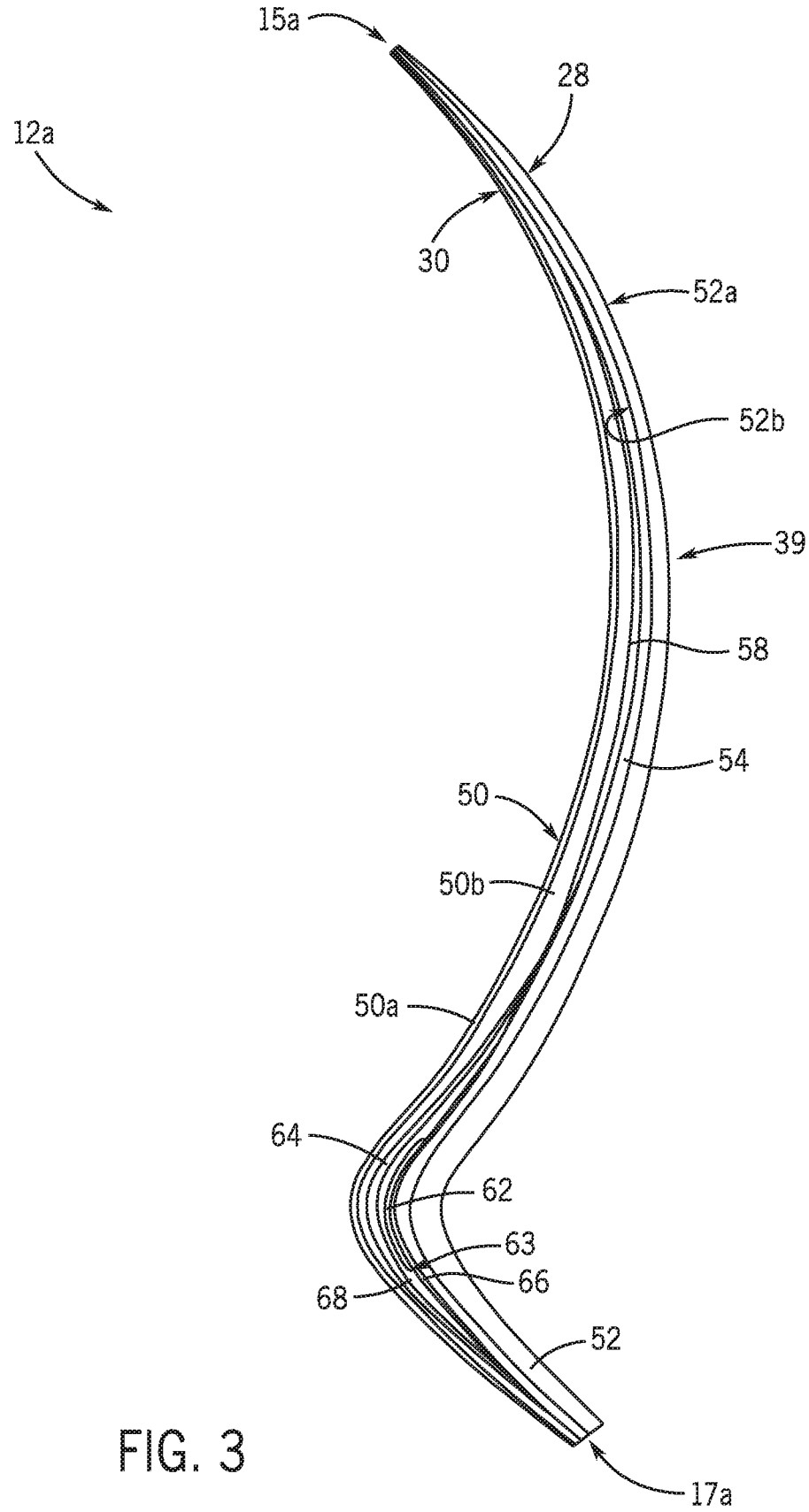

FIG. 3

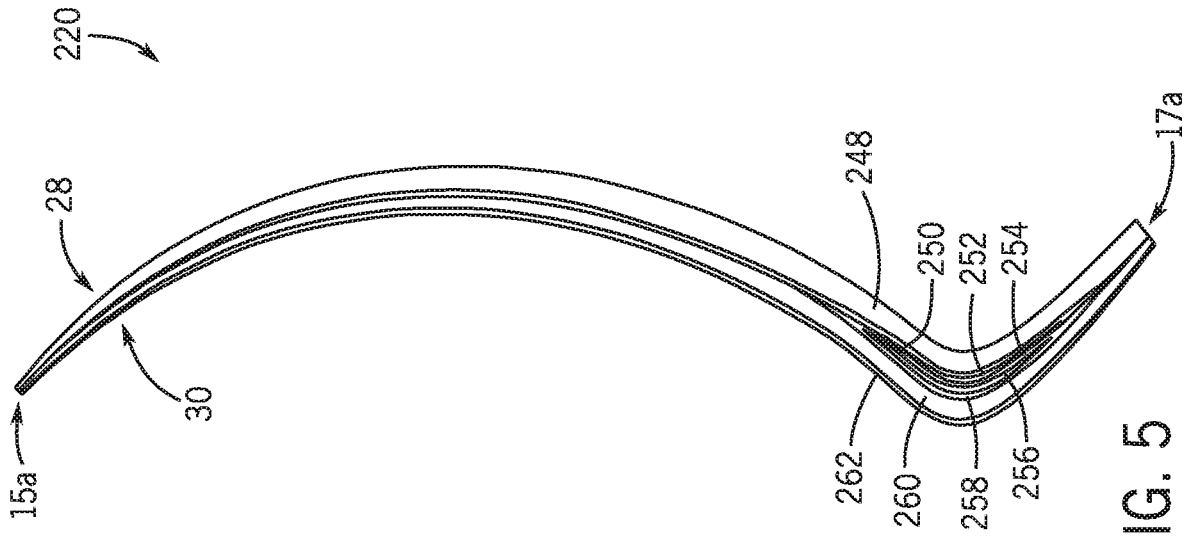
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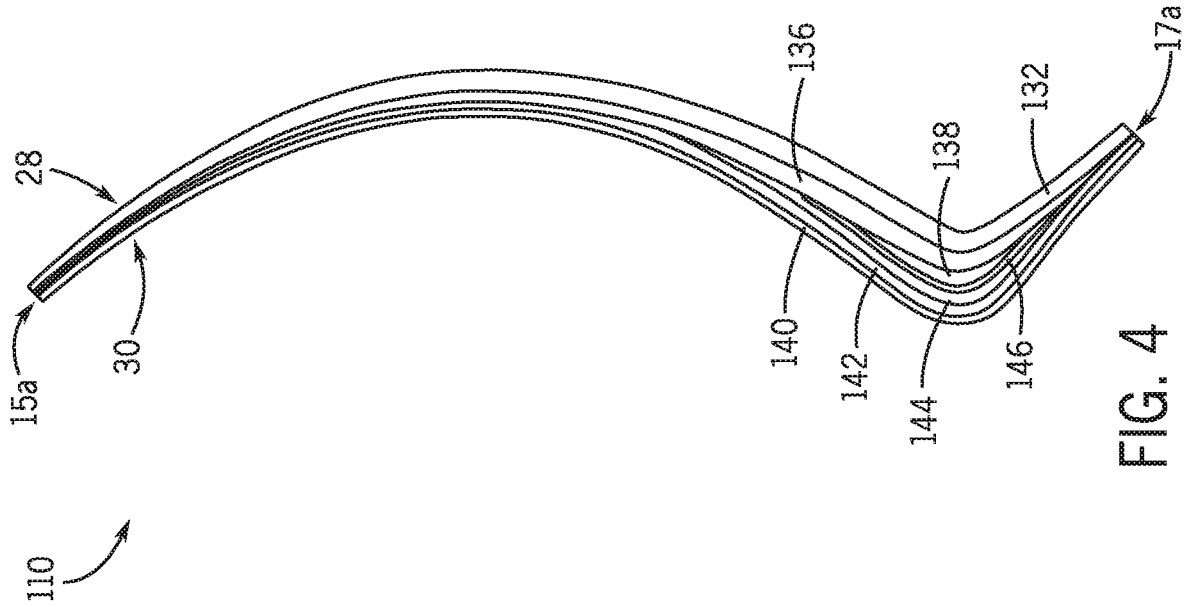
FIG. 5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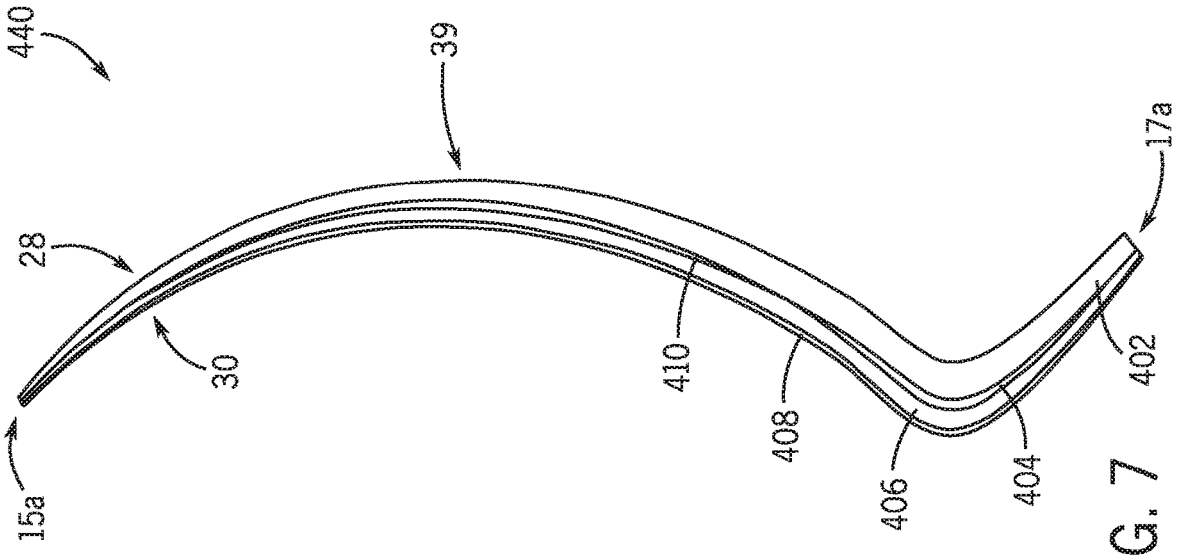
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FIG. 7

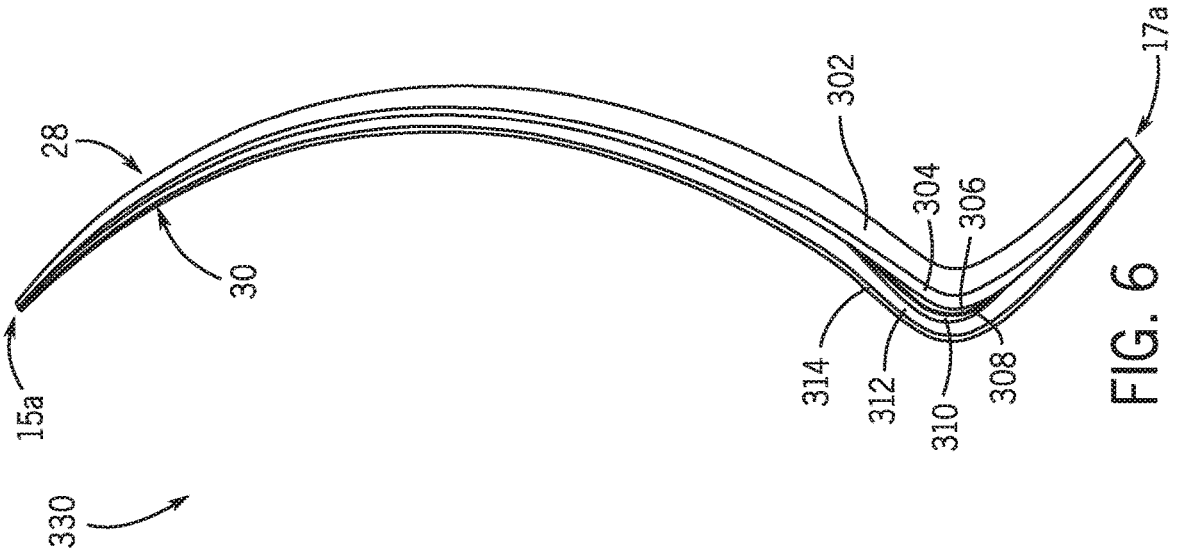
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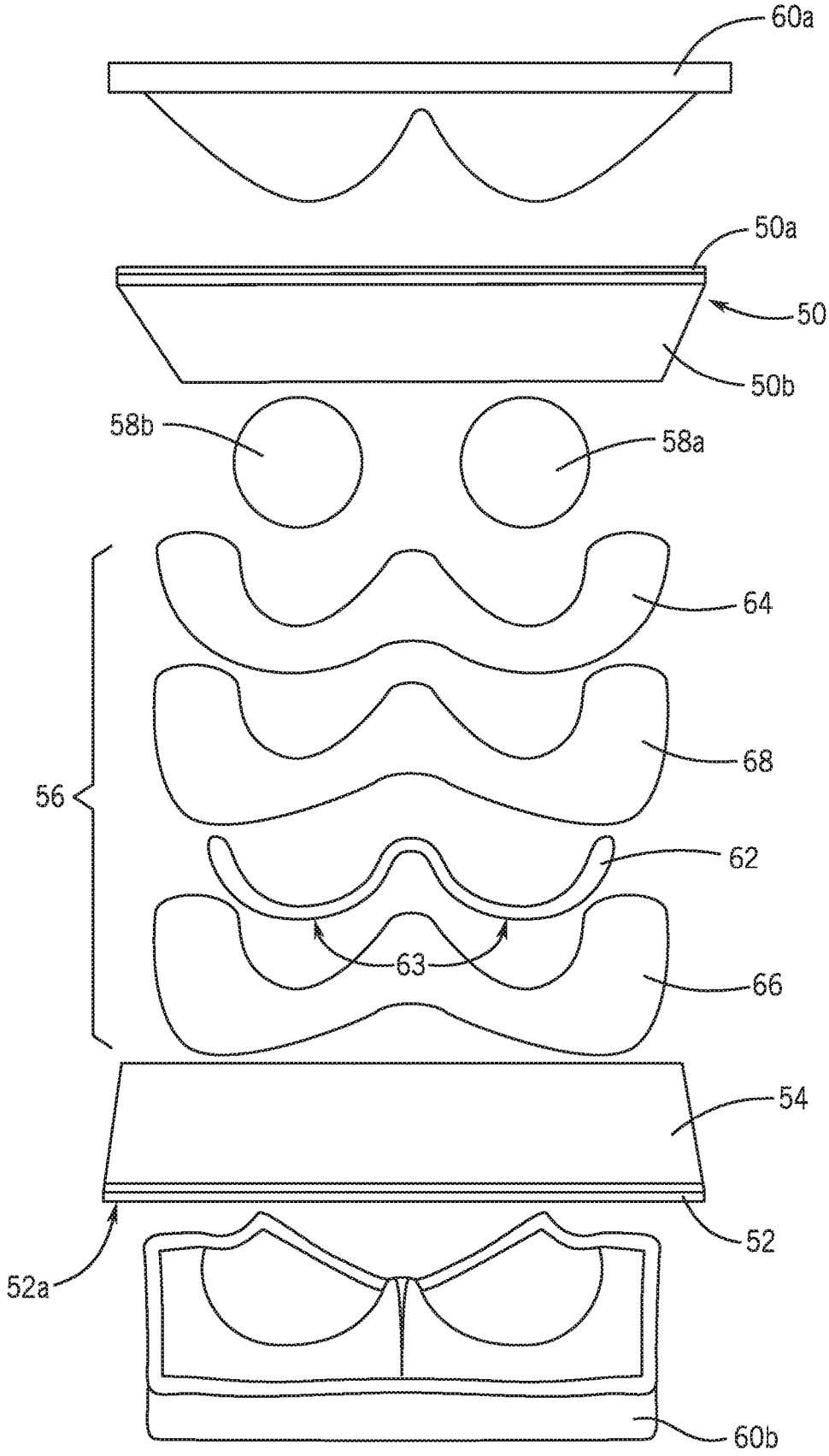
FIG. 6

FIG. 8



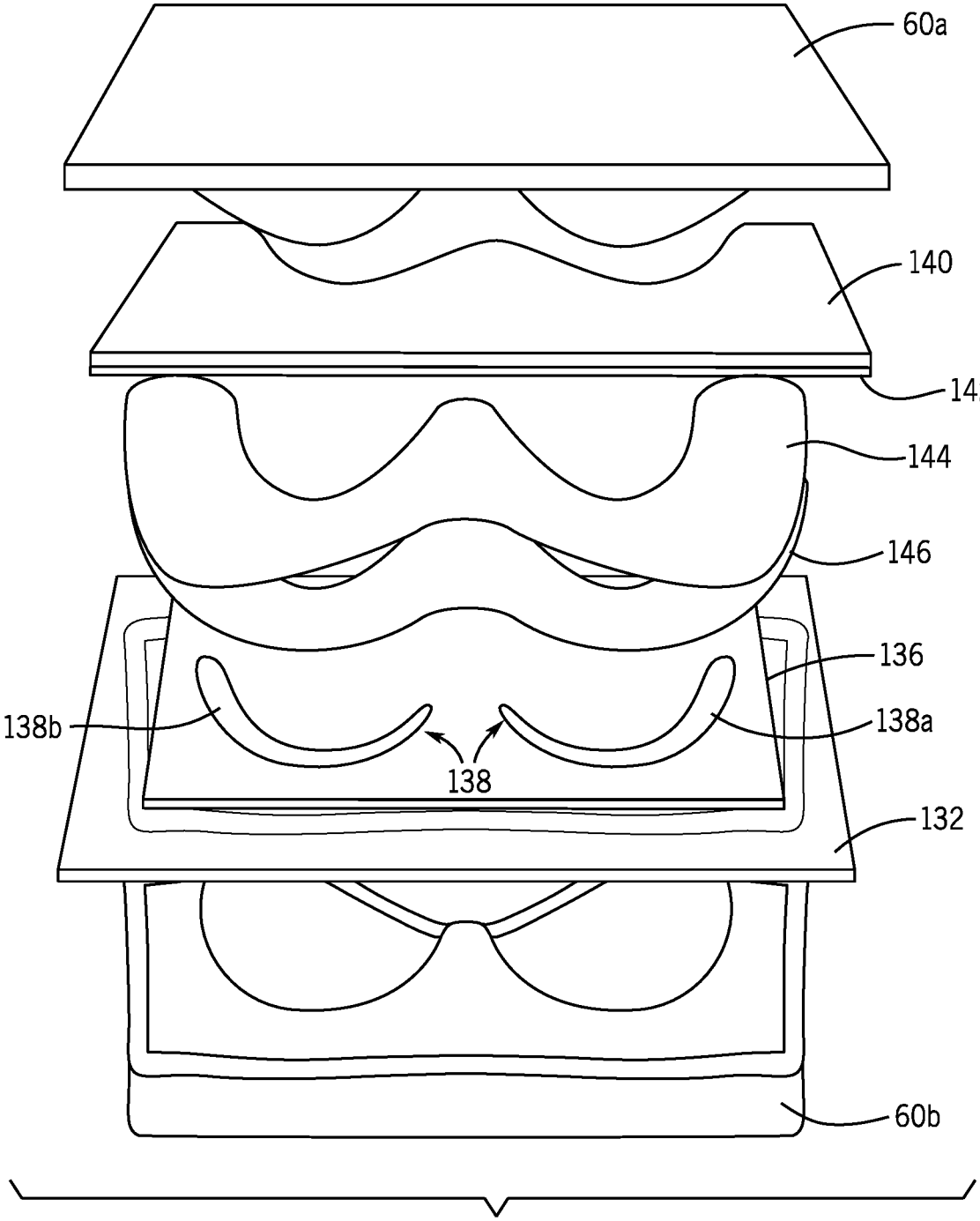


FIG. 9

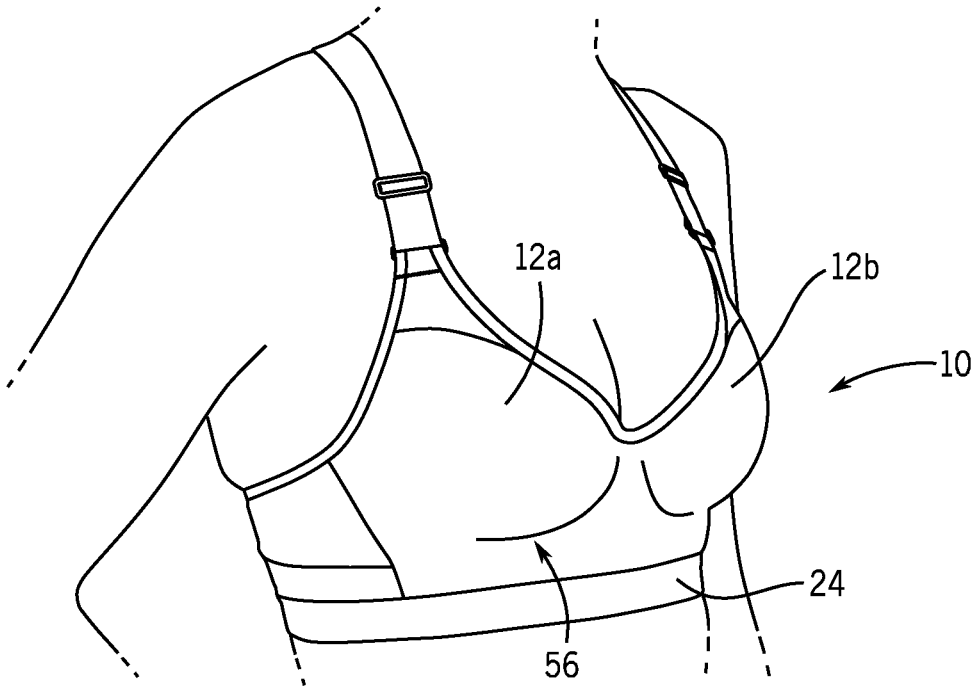


FIG. 10

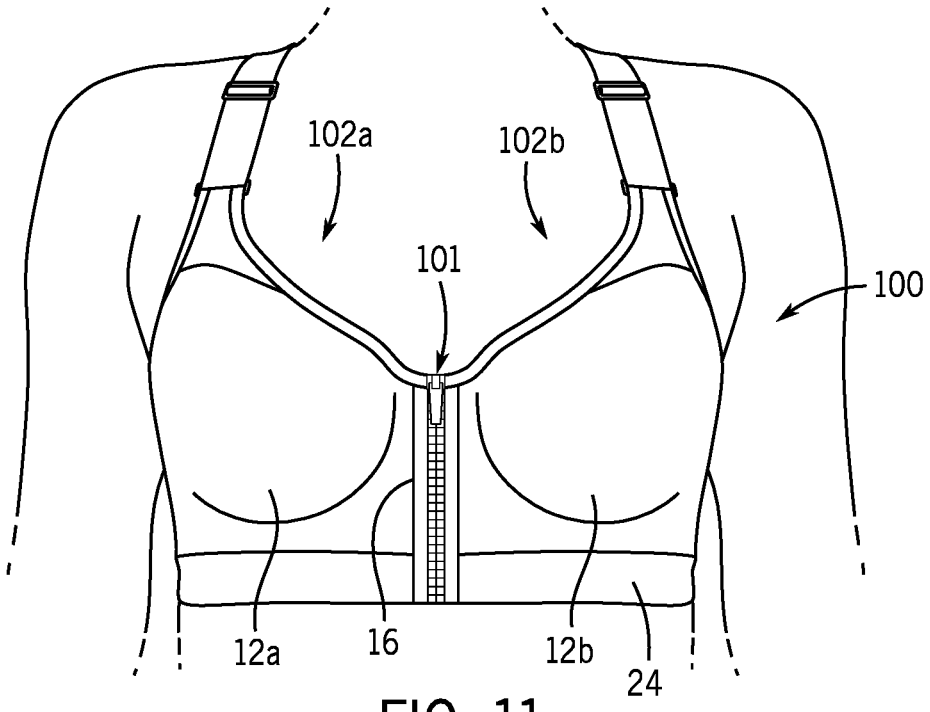


FIG. 11

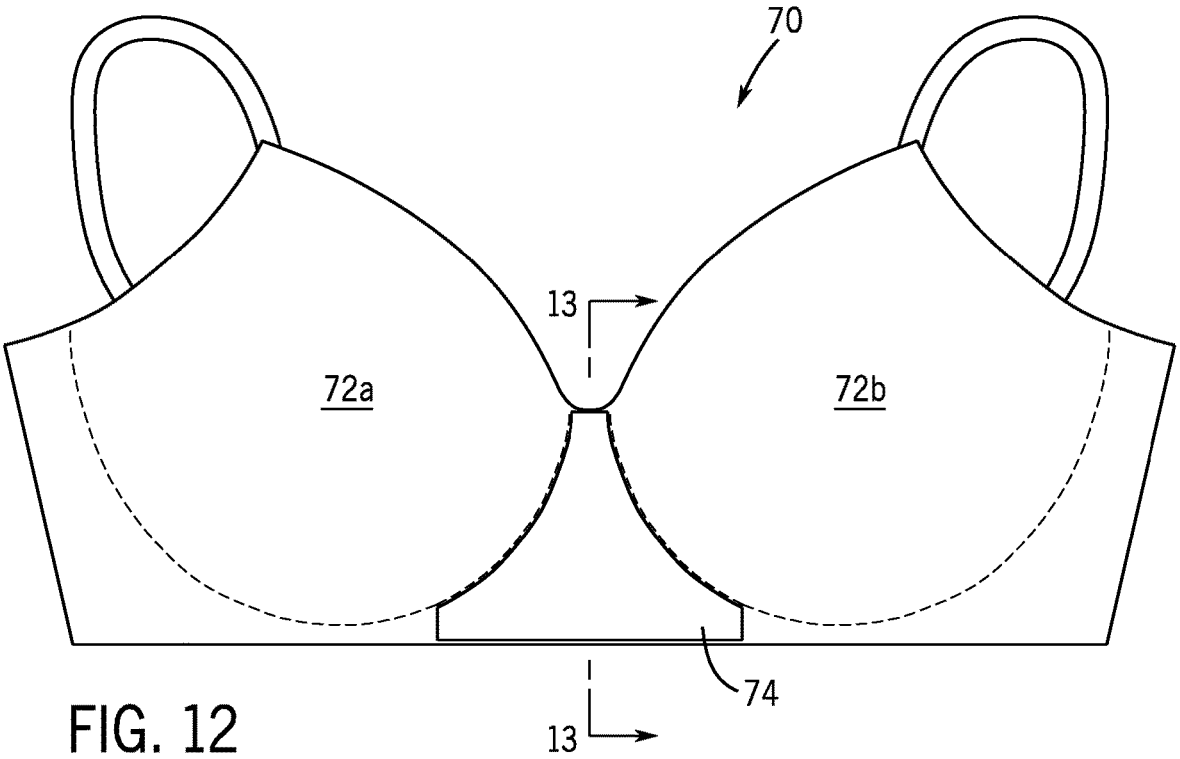


FIG. 12

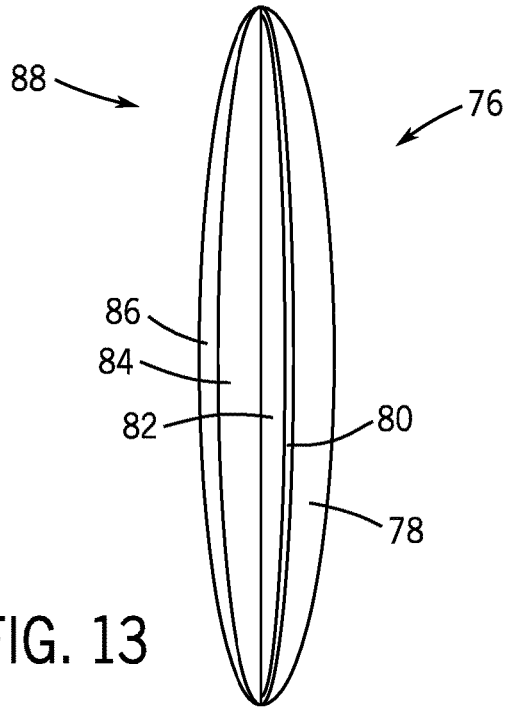


FIG. 13

BRASSIERE AND FRONT PANEL FOR BRASSIERE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of and priority to U.S. Provisional Application Ser. No. 62/337,027, filed on May 16, 2016, which is hereby incorporated by reference herein.

FIELD

The present application relates to brassieres, and applies to both sports bras and lingerie.

BACKGROUND

U.S. Pat. No. 8,747,184 discloses a support structure for placement in a lower periphery of a breast cup for a brassiere. The support structure includes a support component shaped to follow the curve of at least the underside of a wearer's breast. The support component includes a first region formed by a first polymer material and a second region formed by a second polymer material, wherein the first polymer material is harder than the second polymer.

Chinese Utility Model Publication No. CN205624537U discloses a cup for a bra comprising a foam-fabric inner layer for contact with the skin, characterized in that an outer sandwich cloth layer is provided on the side of the foam-fabric inner layer away from the skin. An inner steel ring is sandwiched between the inner edges of the foam-fabric inner layer and the outer sandwich cloth layer. The outer sandwich cloth layer has at least two fabric layers and a support comprising hot melt yarn between the two fabric layers.

SUMMARY

This Summary is provided to introduce a selection of concepts that are further described below in the Detailed Description. This Summary is not intended to identify key or essential features of potentially claimed subject matter, nor is it intended to be used as an aid in limiting the scope of potentially claimed subject matter.

According to one example of the present disclosure, a front panel for a brassiere includes a pair of bra cups, each bra cup in the pair of bra cups configured to hold one of a wearer's breasts. An inner layer of each bra cup is configured to contact the wearer's skin and an outer layer of each bra cup opposes the inner layer. A support shelf assembly spans across at least a lower portion of each bra cup. The support shelf assembly comprises a plastic support component located proximate a lower edge of each respective bra cup, a non-stretch stabilizer fabric layer spanning between both bra cups and along a full length of the support component, and a first supportive foam layer spanning between both bra cups and along the support component. The support shelf assembly is molded between the inner and outer layers of each bra cup such that the support shelf assembly is an embedded, integral part of the front panel.

According to another example of the present disclosure, a brassiere includes a pair of bra cups, each bra cup in the pair of bra cups configured to hold one of a wearer's breasts. An inner layer of each bra cup is configured to contact the wearer's skin and an outer layer of each bra cup opposes the inner layer. A shaping foam layer is sandwiched between the outer layer and the inner layer of each bra cup. The shaping foam layer extends from a lower edge of each bra cup to an upper edge of each bra cup. A support shelf assembly spans across at least a lower portion of each bra cup. The support shelf assembly comprises a support component located proximate the lower edge of each respective bra cup, a non-stretch stabilizer fabric layer spanning between both bra cups and along a full length of the support component, and a first supportive foam layer spanning between both bra cups and along the support component. The inner layer, outer layer, and shaping foam layer of each bra cup and the stabilizer fabric layer and first supportive foam layer of the support shelf assembly span across a center gore that connects the bra cups to form a front panel of the brassiere. The support shelf assembly is molded between the inner layer and the shaping foam layer of each bra cup such that the support shelf assembly is an embedded, integral part of the front panel.

BRIEF DESCRIPTION OF THE DRAWINGS

Examples of brassieres, front panels for brassieres, and methods for manufacturing brassieres are described with reference to the following figures. These same numbers are used throughout the figures to reference like features and like components.

FIG. **1** illustrates one example of a front half of a sports bra according to the present disclosure.

FIG. **2** illustrates one example of a back half of the sports bra of FIG. **1**.

FIGS. **3-7** illustrate several examples of cross sections of a bra cup for use in a bra according to the present disclosure.

FIG. **8** illustrates the layers of the bra cup of FIG. **3** as they would be placed in a mold for molding the cups of the sports bra.

FIG. **9** illustrates the layers of the bra cup of FIG. **4** as they would be placed in a mold for molding the cups of the sports bra.

FIG. **10** illustrates a perspective view of a sports bra according to the present disclosure as worn by a wearer.

FIG. **11** illustrates an alternative embodiment of a sports bra according to the present disclosure as worn by a wearer.

FIG. **12** illustrates a lingerie-type bra according to the present disclosure.

FIG. **13** illustrates a cross-sectional view of the area noted in FIG. **12**.

DETAILED DESCRIPTION

A brassiere (bra) pad construction for incorporation into a bra cup of a sports bra or a lingerie-type bra includes an outer layer comprising a spacer fabric and an inner layer comprising a different type of fabric. One or more layers of foam are molded and/or laminated to an inner face of the spacer fabric. A plastic support component is molded between the one or more layers of foam and/or the spacer fabric. The support component is part of a support shelf assembly that extends along a lower edge of a front panel of the bra. Various examples will be described herein below.

FIG. **1** illustrates a front portion of a sports bra **10** according to the present disclosure. The sports bra **10** includes a front panel **11** having a pair of bra cups **12***a*, **12***b* and a plunging neckline **14**. Each bra cup **12***a*, **12***b* in the pair of bra cups is configured to hold one of a wearer's breasts (see FIGS. **10** and **11**). The neckline **14** plunges to a central connection area known as a center gore **16**, which connects the bra cups **12***a*, **12***b*. Laterally outer edges **13***a*, **13***b* of each of the bra cups **12***a*, **12***b* are connected to underarm areas

18*a*, 18*b*. Upper edges 15*a*, 15*b* of the bra cups 12*a*, 12*b* are coupled to straps 20*a*, 20*b*, for example by fabric pieces 19*a*, 19*b*. In another example, the straps 20*a*, 20*b* can be directly connected to the upper edges 15*a*, 15*b* of the bra cups 12*a*, 12*b*. The straps 20*a*, 20*b* continue to the back portion of the sports bra 10, which is shown in FIG. 2, and there connect to wings 22*a*, 22*b*, which make up the underarm areas 18*a*, 18*b*, respectively. As shown, the straps 20*a*, 20*b* connect to one another in a racer back shape; however, a T-shape or another shape could be provided. In an alternative embodiment, the straps 20*a*, 20*b* continue straight down to the wings 22*a*, 22*b*. The straps 20*a*, 20*b* may be made of an elastic material. As shown herein, the straps 20*a*, 20*b* are adjustable; however, the length of the straps 20*a*, 20*b* could alternatively be fixed.

A torso band 24 runs around the lower edge of the sports bra 10, is coupled to lower edges 17*a*, 17*b* of the bra cups 12*a*, 12*b*, and includes a clasp or connector 26 in the back of the bra 10, where the wings 22*a*, 22*b* of the sports bra 10 can be partially disconnected from and reconnected to one another in order to provide a desired fit around a wearer's torso. The connector 26 can be Velcro, hook and eye, snaps, or any other type of connector known to those having ordinary skill in the art. The torso band 24 can be made of an elastic material to provide stretch as the wearer moves or pulls the sports bra 10 over her head. The torso band 24 can be used to provide a finished edge for the bottom of the bra cups 12*a*, 12*b* and wings 22*a*, 22*b*, such as if the torso band 24 is folded in half so as to overlap the bottom edge of the sports bra 10. Alternatively, the elastic torso band can be connected to only an outer or an inner face of the bottom edge of the sports bra 10.

Note that the extent of the front panel 11 is also defined by the upper edges 15*a*, 15*b* of the bra cups 12*a*, 12*b*, the outer edges 13*a*, 13*b* of the bra cups 12*a*, 12*b*, and the lower edges 17*a*, 17*b* of the bra cups 12*a*, 12*b*. As will be described herein below, the front panel can be formed of layers of single, continuous sheets of fabric and foam, some of which have the same extent as the outline of the front panel 11 shown herein. This creates a strong, supportive front panel 11 for the sports bra 10, which provides the necessary support and motion control for the wearer's breasts during exercise, as well as makes the front panel 11 easy to manufacture.

FIG. 3 shows a cross section through the bra cup 12*a* of FIG. 1, taken along the line III-III. Although this cross section is taken close to the underarm area 18*a* of the sports bra 10, this cross section is essentially the same across the entire bra cup 12*a*, except for relative dimensional changes in the thickness, height, and curvature of the bra cup 12*a*. Additionally, it should be noted that the cross section through the bra cup 12*b* is identical, although it will not be described separately herein. In fact, the bra cup 12*b* is a mirror image of the bra cup 12*a*, and therefore any description of the bra cup 12*a* applies in kind to the bra cup 12*b*. FIG. 3 shows how the bra cup 12*a* has two sides. Specifically, an outer side 28 faces away from the wearer when the sports bra 10 is being worn. An inner side 30 faces the wearer and touches the wearer's skin when the sports bra 10 is being worn.

Starting at the inner side 30, the bra cup 12*a* includes an inner layer 50 configured to contact the wearer's skin. In the present example, the inner layer 50 of the bra cup 12*a* comprises liner fabric 50*a* laminated to foam 50*b*, and the liner fabric 50*a* is configured to contact the wearer's skin. Because the inner face of the liner fabric 50*a* is in direct contact with the wearer's skin, it is therefore a soft, comfortable fabric, such as polyester or some type of blend. In one example, the liner fabric 50*a* is made of 100% polyester weft knit interlock and has a weight of 95 g/m^2 having 48 courses per inch and 52 wales per inch (32 gauge). The outer face of the liner fabric 50*a* is laminated to foam 50*b* prior to assembly with the remainder of the bra cup 12*a*. The foam 50*b* is coextensive with the liner fabric 50*a*. In one example, prior to molding the bra cup 12*a*, the foam 50*b* has a uniform thickness along the height of the bra cup 12*a* and is about 2 mm thick. The foam 50*b* can be medium density stretch foam, and in one example has a density of 45 kg/m^3.

Turning to the outer side 28, the bra cup 12*a* also includes an outer layer 52 opposing the inner layer 50. In the example shown herein, the outer layer 52 of the bra cup 12*a* comprises a spacer fabric. As is known, spacer fabrics are three-dimensional fabrics that have an inner face layer, an outer face layer, and a pile/connecting layer. Here, the outer face layer is shown at 52*a*, and is left exposed rather than covered with another layer of fabric. The outer face layer 52*a* can be a solid color (FIG. 11) or can be printed with a pattern (FIG. 10). The pattern can be printed directly onto the outer face layer 52*a* of the spacer fabric outer layer 52 after the spacer fabric is knit. In this example, the pile/connecting layer is not died or printed, but only the outer face layer 52*a* is printed. The layers of the spacer fabric outer layer 52 can be knitted with polyethylene terephthalate (PET), polyurethane (PU), and/or polyester fibers, among other types of fibers that provide stretch and breathability to the spacer fabric outer layer 52.

The opposite, inner face layer 52*b* of the spacer fabric outer layer 52 is directly molded to a shaping foam layer 54. The shaping foam layer 54 is sandwiched between the outer layer 52 and the inner layer 50 of the bra cup 12*a* and the shaping foam layer 54 extends from the lower edge 17*a* of the bra cup 12*a* to the upper edge 15*a* of the bra cup 12*a*. The shaping foam layer 54 can be medium density stretch foam, and in one example has a density of 45 kg/m^3. The thickness of the shaping foam layer 54, before it is molded as part of the bra cup 12*a*, ranges from about 1 mm to about 5 mm, depending on what part of the bra cup 12*a* it forms. In one example, the shaping foam layer 54 is 2 mm thick before being molded. This uniform thickness may continue up the bra cup 12*a* to a location approximately halfway between an apex 39 of the bra cup 12*a* and the upper edge 15*a*. Thereafter, the thickness of the shaping foam layer 54 tapers off drastically toward the upper edge 15*a* of the bra cup 12*a* to provide a smooth neckline transition.

It can be seen that the thickness of the liner fabric 50*a* is roughly the same along the entire height of the bra cup 12*a*, while the foam 50*b* of the inner layer 50, the shaping foam layer 54, and the spacer fabric outer layer 52 are relatively thicker in some areas as opposed to others. For instance, near the neckline 14 at the upper edge 15*a* and near the torso band 24 at the lower edge 17*a*, the spacer fabric outer layer 52 and the foam layers 50*b*, 54 become thinner. This relative change in thickness can be achieved by molding of the cup, for example, if the male and female halves of the mold are closer to one another at the upper and lower edges 15*a*, 17*a* than in the area of the bra cup 12*a* configured to be situated immediately under the wearer's breasts, in the creases between her breasts and her torso. Thus, both the way the bra cup 12*a* is molded and the pre-molding thickness differential of a given layer can influence the final thickness of that given layer.

In addition to having foam layers 50*a*, 54 that are of different thicknesses in different areas before and/or after being molded, the bra cup 12*a* can also include a covering

foam layer **58** sandwiched between the shaping foam layer **54** and the inner layer **50**. A separate piece of foam can be provided for each bra cup **12***a*, **12***b* as the covering foam layer **58**. (See FIG. **8**, pieces **58***a*, **58***b*.) The covering foam layer(s) **58** is/are centered at the apex **39** of each respective bra cup **12***a*, **12***b*. The covering foam layer **58** can be relatively high density foam in comparison to the other foam layers so as to provide coverage and prevent nipple show-though. In another example, the covering foam layer **58** includes a layer of 100% spandex laminated to a layer of foam. Because the spacer fabric outer layer **52** and the shaping foam layer **54** are provided up the entire height of the bra cup **12***a*, these layers **52**, **54** work together with the covering foam layer **58**, which can be as thick as 4 mm, to provide modesty to the bra cup and further prevent nipple show-through.

Each of the layers of the bra cup **12***a* described herein above is also shown in FIG. **8**, which shows the layers that make up both bra cups **12***a* and **12***b* as they would be placed in a mold having a male half **60***a* and a female half **60***b*. The layers making up a support shelf assembly **56**, configured to be situated immediately under the wearer's breasts, are also shown in FIG. **8**. Referring now to both FIGS. **3** and **8**, the support shelf assembly **56** spans across at least a lower portion of each bra cup **12***a*, **12***b*, for example, in an area located below the apexes **39** and above (or extending to) the lower edges **17***a*, **17***b* of the bra cups **12***a*, **12***b*. The support shelf assembly **56** comprises a plastic support component **62** located proximate the lower edge **17***a*, **17***b* of each respective bra cup **12***a*, **12***b*. In this example, the support component **62** is an undulating, W-shaped molded body configured to support an underside of the wearer's breasts. In cross-section, the support component **62** has a crescent shape that mimics the crease under the wearer's breasts. A non-stretch stabilizer fabric layer **64** spans between both bra cups **12***a*, **12***b* and along the support component **62**. A first supportive foam layer **66** also spans between both bra cups **12***a*, **12***b* and along the support component **62**. The support shelf assembly **56** further comprises a second supportive foam layer **68** spanning between both bra cups **12***a*, **12***b* and along the support component **62**. The second supportive foam layer **68** is located on an opposite side (here, an inner side) of the support component **62** than the first supportive foam layer **66**.

In the present embodiment, the stabilizer fabric layer **64**, the first supportive foam layer **66**, and the second supportive foam layer **68** of the support shelf assembly **56** all have an undulating shape that mimics a curvature of an underside of the wearer's breasts. The stabilizer fabric layer **64** extends along a full length of the support component **62**. Note that in the present embodiment, the stabilizer fabric layer **64**, the first supportive foam layer **66**, and the second supportive foam layer **68** of the support shelf assembly **56** are each single, continuous layers of material spanning both of the bra cups **12***a*, **12***b* and extending along the full length of the support component **62**, which arrangement provides structural integrity to the supportive portion of the bra cups **12***a*, **12***b*. Note too that the inner and outer layers **50**, **52** and the shaping foam layer **54** of each bra cup **12***a*, **12***b* and the first supportive foam layer **66**, the second supportive foam layer **68**, and the stabilizer fabric layer **64** of the support shelf assembly **56** all extend below a lower edge **63** of the support component **62**. The shape, length, and height of these layers provide extra support in the area of the support shelf assembly **56**, beyond that which a bendable, moldable plastic support component **62** could provide on its own. This is especially so given that the support shelf assembly **56** is molded between the inner and outer layers **50**, **52** of each bra cup **12***a*, **12***b* such that the support shelf assembly **56** is an embedded, integral part of the front panel **11**. This molding/embedding process will be described further herein below.

In the present example, referring also to FIGS. **1** and **10**, the inner and outer layers **50**, **52** and the shaping foam layer **54** of each bra cup **12***a*, **12***b* and at least the first supportive foam layer **66** and the stabilizer fabric layer **64** of the support shelf assembly **56** all extend to the lower edge **17***a*, **17***b* of each bra cup **12***a*, **12***b* and are coupled to the elastic torso band **24**. This provides stability and relative stiffness not only in the immediate area of the support component **62**, but also beneath the support component **62**, because the support shelf assembly **56** extends below the wearer's breasts and lays flat against her torso (see FIG. **10**). Such relative stiffness, when compared to the remainder of the bra cups **12***a*, **12***b*, prevents the portion of the bra cups **12***a*, **12***b* below the support component **62** from folding over due to the weight of the wearer's breasts and/or movement thereof during exercise. Additionally, such an arrangement allows the layers **64**, **66**, **68** of the support shelf assembly **56** to provide additional support to that already provided by the support component **62** without adding bulk or weight near the tops of the bra cups **12***a*, **12***b*.

The first supportive foam layer **66** is provided on the outer face of the support component **62** and provides extra support thereto. In one example, the first supportive foam layer **66** is about 3 mm thick prior to molding and has a density of 45 kg/m^3. In another example, the first supportive foam layer **66** is not provided, and instead the shaping foam layer **54** is thicker in the area along the support component **62**.

The second supportive foam layer **68** provides extra padding between the support component **62** and the wearer's chest, in order to provide comfort to the wearer. The second supportive foam layer **68** also provides extra support to the underside of the wearer's breasts. In another example, the foam **50***b* of the inner layer **50** is thicker near where it is molded to the support component **62** via the stabilizer fabric layer **64**, and the bra cup **12***a* does not include a second supportive foam layer **68**. However, if a second supportive foam layer **68** is provided, this second supportive foam layer **68** can have the same or a different density than the foam **50***b* of the inner layer **50**, and the padding and support of the support shelf assembly **56** can thereby be controlled. In one example, the second supportive foam layer **68** is about 5 mm thick prior to molding and has a density of 45 kg/m^3.

The stabilizer fabric layer **64** is provided between the second supportive foam layer **68** and the foam **50***b* of the inner layer **50**. The stabilizer fabric layer **64** provides the support shelf assembly **56** with extra support and creates a more stable bond between the foam **50***b* and the foam **68**. In another example, the stabilizer fabric layer **64** and the second supportive foam layer **68** are swapped, such that the stabilizer fabric layer **64** is immediately next to the support component **62**. The stabilizer fabric layer **64** is made of non-stretch fabric, which provides support to the wearer's breasts. In one example, the stabilizer fabric layer **64** is made of 100% polyester weft knit interlock and has a weight of 100 g/m^2 having 48 courses per inch and 48 wales per inch (28 gauge). In another example, the stabilizer fabric layer **64** is made of 100% polyester weft knit interlock and has a weight of 95 g/m^2 having 48 courses per inch and 52 wales per inch (32 gauge).

When constructing the bra cups **12***a*, **12***b* of the present disclosure, the spacer fabric outer layer **52** may be pre-molded into the desired cup shapes. Prior to such pre-molding, the spacer fabric outer layer **52** may be laminated

to the shaping foam layer **54** using, for example, one or all of heat, pressure, and spray adhesive. The support component **62** may also be pre-molded into the undulating W-shaped body. The liner fabric **50***a* and the foam **50***b* of the inner layer **50** are also pre-laminated together. Next, referring to FIG. **8**, the pre-molded spacer fabric outer layer **52**, the shaping foam layer **54**, the first supportive foam layer **66**, the pre-molded support component **62**, the second supportive foam layer **68**, the stabilizer fabric layer **64**, the covering foam layer pieces **58***a*, **58***b*, and the laminated inner layer **50** are placed together in the mold **60***a*, **60***b*. The layers are molded to the desired shape while being heated to a desired temperature. During the molding process, the plastic support component **62** is directly fused to the first and second supportive foam layers **66**, **68**, or to the stabilizer fabric layer **64** if no second supportive foam layer **68** is provided. Thus, the support component **62** does not shift within the cups, but rather is embedded in place in the cups. In effect, the support component **62** acts as a relatively stiffer area of the cups, and poke through, breakage, or other negative occurrences associated with normal underwires are thereby avoided because the support component **62** is an integral part of the molded bra cups **12***a*, **12***b*. Because the support component **62** is molded directly to cushioning, padded materials, this provides extra comfort for the wearer.

In the example shown in FIG. **8**, the mold **60***a*, **60***b* is shaped to form both of the bra cups **12***a*, **12***b* and the center gore **16** at once, thereby forming the entire front panel **11** of the bra **10**. After the bra cups **12***a*, **12***b* are molded, other fabric layers can be stitched to the molded bra cups **12***a*, **12***b*, for example after being molded separately themselves. Next, the molded front panel **11** is cut to size and provided with trim, which can be sewn or laminated around the edges **13***a*, **13***b*, **15***a*, **15***b*, **17***a*, **17***b* of the bra cups **12***a*, **12***b*. As described herein above, the torso band **24** can be sewn and/or laminated to the lower edges **17***a*, **17***b* of the bra cups **12***a*, **12***b* to provide a finished edge. The wings **22***a*, **22***b* can be later sewn or otherwise connected to the outer edges **13***a*, **13***b* of the bra cups **12***a*, **12***b*. The fabric pieces **19***a*, **19***b* can be used to connect the upper edges **15***a*, **15***b* to the straps **20***a*, **20***b*. In another embodiment, the front panel **11** can be cut apart at the center gore **16** to form two separate bra cups **12***a*, **12***b*, which can then be re-connected with a zipper or other closure, as will be described further herein below with respect to FIG. **11**.

FIG. **4** shows an alternative example of a cross section of a bra cup **110** according to the present disclosure. Starting at the outer side **28**, the bra cup **110** includes a outer layer comprising a spacer fabric **132**. The inner face layer of the spacer fabric **132** is directly molded to a shaping foam layer **136**. Similar to the first embodiment, the shaping foam layer **136** reaches to the same height as the spacer fabric **132**, but its thickness tapers off drastically toward the upper edge **15***a* of the bra cup **110**. The thickness of the shaping foam layer **136** also tapers off dramatically toward the lower edge **17***a* of the bra cup **110**, so as not to add bulk or weight in this area. An inner face of the shaping foam layer **136** can be directly molded to a plastic support component **138**. The thickness of the shaping foam layer **136**, even before it is molded as part of the cup **120**, ranges from about 8 mm to about 1 mm, depending on what part of the bra cup **110** it forms. In one example, the shaping foam layer **136** is 8 mm thick where it contacts the support component **138** in order to provide extra support in this area. The inner side **30** of the bra cup **110** includes an inner layer comprising a liner fabric **140** laminated to foam **142**. In one example, prior to molding the bra cup **110**, the foam **142** has a uniform thickness along the height of the bra cup **110** and is about 1 mm thick. Again, similar to the first embodiment, the thickness of the liner fabric **140** is roughly the same along the entire height of the cup **120**, while the foams **136**, **142** and the spacer fabric **132** are relatively thicker in some areas as opposed to others. For instance, near the neckline at the upper edge **15***a*, the spacer fabric **132** and the foam layers **136**, **142** become thinner. A supportive foam layer **144** is sandwiched between the foam **142** and the support component **138**. The supportive foam layer **144** provides extra padding and extra support to the underside of the wearer's breasts. A stabilizer fabric layer **146** is provided between the supportive foam layer **144** and the support component **138**. The stabilizer fabric layer **146** provides the support component **138** with extra support and with a more stable bond to the supportive foam layer **144**.

FIG. **9** shows the layers of the second embodiment of the bra cup **110** as they would be placed in between the halves **60***a*, **60***b* of a mold. Note that in this example, the support component **138** includes two separate halves **138***a*, **138***b*. More specifically, the support component **138** comprises two lateral halves **138***a*, **138***b*, each half of the support component being a U-shaped molded body configured to support an underside of a respective one of the wearer's breasts. This type of support component **138** might be desirable if the bra cups are to be used in a front-close bra such as a bra with a zipper up the front connecting the two bra cups at the center gore **16**. (See FIG. **11**.) Note that together, the two support components **138***a*, **138***b*, the stabilizer fabric layer **146**, and the supportive foam layer **144** make up a support shelf assembly.

FIG. **5** illustrates a cross section of another alternative embodiment of a bra cup **220** according to the present disclosure. In this example, the layers of the bra cup **220** will be referred to generically, as the layers may be either fabric or foam in different examples. An outer layer of the bra cup **220**, denoted as **248**, may be a spacer fabric. A layer **250** laminated to the inner surface of the spacer fabric outer layer **248** may be a fabric layer or a foam layer. If a fabric layer, the fabric may be made of polyester. Another layer **252**, laminated to the inside surface of the layer **250**, can be a foam layer or a stabilizer layer. If a stabilizer layer, the layer **252** is made of fabric. A layer **254** just next to the layer **252** can be a supportive foam layer. The support component is shown at **256**. Another supportive foam layer **258** can be provided on the opposite side of the support component **256**. Together, the layers **252**, **254**, **256**, and **258** make up a support shelf assembly. As the inner layer, a foam layer can be provided at **260**, which can be laminated to a liner fabric layer **262**, which serves as the inner face of the bra cup **220**. The outer layer **248** comprises the exposed outer side **28** of the bra cup **220**, while the layer **262** comprises the entire inner side **30** of the bra cup **220** that contacts the wearer's skin. The foam or fabric layer shown at **250** extends almost for the entire height of the bra cup **220**, but ends just before the upper edge **15***a* and the lower edge **17***a*. The foam layer shown at **260** extends for the entire height of the bra cup **220**, but tapers in thickness at both the upper and lower edges **15***a*, **17***a* of the bra cup **220**. The foam layers shown at **254** and **258** extend vertically only in the general area of the support component **256**. The stabilizer fabric layer **252** extends only on one side of the support component **256**, and generally only for the height of the support component **256**.

FIG. **6** shows a cross section of yet another example of a bra cup **330** according to the present disclosure. The bra cup **330** includes an outer layer **302** comprising a spacer fabric. A shaping foam layer **304** is situated on an inner face of the spacer fabric outer layer **302**. An inner layer of the bra cup

330 includes a fabric liner 314 laminated to foam 312. A support shelf assembly is made of a support component 306, a stabilizer fabric layer 308, and a supportive foam layer 310. In one example, the stabilizer fabric layer 308 comprises one layer of stabilizer fabric. In another example, two layers of stabilizer fabric may be provided for extra support, such as for use in a bra having a large cup size. The two layers of stabilizer fabric can be provided face-to-face, or one layer of stabilizer fabric can be provided on each side of the support component 306. Together, the support component 306 and layers 308 and 310 make up a support shelf assembly.

FIG. 7 shows a cross section of yet another alternative embodiment of a bra cup 440. In this example, an outer layer 402 comprises a spacer fabric. A stabilizer fabric, which can be provided in one or multiple layers, is shown at 404. The inner layer of the bra cup 440 comprises foam 406 laminated to a liner fabric layer 408. The bra cup 440 is also provided with a covering foam layer 410 near the apex 39, which provides padding to prevent nipple show-through. This bra cup 440 may be used in a bra having a small cup size, as it lacks a plastic support component.

FIG. 10 shows one example of the sports bra 10 of the present disclosure as worn on a wearer, wherein one bra cup 12*a*, 12*b* supports each of her breasts. FIG. 11 shows an alternative example of a sports bra 100. The front panel of the bra 100 comprises two lateral halves 102*a*, 102*b*, each half of the front panel comprising one of the bra cups 12*a* or 12*b*. In this example, the sports bra 100 includes a front closure, which here is a zipper 101. The zipper 101 on the center gore 16 couples the two halves 102*a*, 102*b* of the front panel together. A back connector 26 (see FIG. 2) may or may not be provided in addition to the front zipper 101. Other types of front closures, such as hook and eye closures, Velcro, snaps, etc. could be provided. Both of the sports bras 10, 100 may have front panels 11 with bra cups 12*a*, 12*b* as described with respect to FIGS. 1, 3, and 8, or front panels with bra cups like those described with respect to FIGS. 4-7 and 9. If the bra cups 12*a*, 12*b* are formed as described with respect to FIGS. 1, 3, and 8 (the first embodiment), note that each bra cup 12*a*, 12*b* includes an inner layer 50, outer layer 52, and shaping foam layer 54 and a stabilizer fabric layer 64 and first supportive foam layer 66 of a support shelf assembly 56 that span across a center gore 16 that connects the bra cups 12*a*, 12*b* and together form a front panel 11 of the bra 10, 100. In other words, the front-close sports bra 100 of FIG. 11 could be made by molding layers of single, continuous pieces of fabric and foam that span across both bra cups 12*a*, 12*b*, and later cutting those foam and fabric layers into halves 102*a*, 102*b* after the front panel of the bra 100 has been molded. In an alternative embodiment, the sports bra 100 can be formed by molding previously-cut layers of foam and fabric according to the above-described cross-sections into separate lateral halves 102*a*, 102*b* of the front panel.

In either of the bras of FIG. 10 or 11, the support component could be the undulating, W-shaped molded body 62 shown in FIG. 8, which because it is plastic, is easily cut to form the lateral halves 102*a*, 102*b* of the sports bra 100. Alternatively, the support component could be the separate, U-shaped components 138*a*, 138*b* shown in FIG. 9, which would obviate the need to cut the support component when cutting the center gore 16 to create the two lateral halves 102*a*, 102*b* of the front panel. Note that the separate support component halves 138*a*, 138*b* might be used even in the sports bra 10, which is not separable at the center gore 16. Both of the sports bras 10, 100 allow for a plunging neckline while still providing good support that controls and contains the wearer's breasts. The bras 10, 100 deliver on maximum support with less construction, and yet remain lightweight due to inclusion of a plastic support shelf and a spacer fabric.

FIG. 12 shows an example of a lingerie-type bra 70 according to the present disclosure. The bra 70 also includes two bra cups 72*a*, 72*b*, which are connected by a center gore 74. The cross section of both of the bra cups 72*a*, 72*b* can be that shown and described with respect to any of FIGS. 3-7, it being understood that the relative height and thickness of the support shelf assemblies shown therein might not be as high or as thick as those shown for purposes of the sports bras 10, 100. A center gore 74 corresponding to the exemplary bra cup 110 of FIGS. 4 and 9 is shown in cross section in FIG. 13 Similar to the bra cups 72*a*, 72*b*, the outer side 76 of the center gore 74 comprises a spacer fabric, as shown at 78. The spacer fabric 78 may be coextensive (integral) with the spacer fabric of the bra cups 72*a*, 72*b*. A stabilizer fabric layer, which provides relative stiffness to the center gore 74, is shown at 80. The stabilizer fabric layer 80 can be, for example, 100% polyester weft knit interlock with a weight of 100 g/m^2 and 48 courses per inch and 48 wales per inch (28 gauge) and can be coextensive (integral) with stabilizer fabric layer 146 shown in FIGS. 4 and 9. A foam layer is shown at 82. This foam layer 82 can be coextensive (integral) with corresponding supportive foam layer 144. Another foam layer is shown at 84, which can be coextensive (integral) with corresponding foam 142. At an inner side 88 of the center gore 74, a fabric liner 86 is provided, which can be coextensive (integral) with the liner fabric 140. It should be understood that if the cup cross sections of FIG. 3 or 5-7 are instead used, the center gore 74 would have corresponding layers integral with the cup layers shown in those figures.

In the above description, certain terms have been used for brevity, clarity, and understanding. No unnecessary limitations are to be implied therefrom beyond the requirement of the prior art because such terms are used for descriptive purposes only and are intended to be broadly construed. The different articles and methods described herein above may be used in alone or in combination with other articles and methods. Various equivalents, alternatives and modifications are possible within the scope of the appended claims. Each limitation in the appended claims is intended to invoke interpretation under 35 USC § 112(f) only the terms "means for" or "step for" are explicitly recited in the respective limitation. The scope of this disclosure is not intended to be bound by the literal order or literal content of method steps described herein, and non-substantial differences or changes still fall within the scope of the disclosure.

What is claimed is:

1. A front panel for a brassiere, the front panel comprising:

a pair of bra cups, each bra cup in the pair of bra cups configured to hold one of a wearer's breasts;

an inner layer of each bra cup configured to contact the wearer's skin;

an outer layer of each bra cup opposing the inner layer; and

a support shelf assembly between the inner and outer layers and spanning across at least a lower portion of each bra cup, the support shelf assembly comprising:

a plastic support component located proximate a lower edge of each respective bra cup;

a non-stretch stabilizer fabric layer spanning between both bra cups and along a full length of the support component; and

a first supportive foam layer spanning between both bra cups and along the support component; and

a shaping foam layer sandwiched between the outer layer and the inner layer of each bra cup, wherein the shaping foam layer extends from the lower edge of each bra cup to an upper edge of each bra cup;

wherein the inner layer, the outer layer, the support shelf assembly, and the shaping foam layer are molded together such that the support shelf assembly is an embedded, integral part of the front panel, and during the molding process, the support component is directly fused to at least one of the stabilizer fabric layer and the first supportive foam layer on either side of the support component; and

wherein the inner and outer layers and the shaping foam layer of each bra cup and the first supportive foam layer and the stabilizer fabric layer of the support shelf assembly all extend below a lower edge of the support component.

2. The front panel of claim **1**, further comprising a covering foam layer sandwiched between the shaping foam layer and the inner layer of each bra cup, wherein the covering foam layer is centered at an apex of each bra cup.

3. The front panel of claim **1**, wherein the support shelf assembly further comprises a second supportive foam layer spanning between both bra cups and along the support component, the second supportive foam layer being located on an opposite side of the support component than the first supportive foam layer.

4. The front panel of claim **1**, wherein the stabilizer fabric layer and the first supportive foam layer of the support shelf assembly both have an undulating shape configured to mimic a curvature of an underside of the wearer's breasts.

5. The front panel of claim **4**, wherein the stabilizer fabric layer is a single, continuous layer of material spanning both of the bra cups.

6. The front panel of claim **5**, wherein the first supportive foam layer is a single, continuous layer of material spanning both of the bra cups and extending along the full length of the support component.

7. The front panel of claim **1**, wherein the support component is an undulating, W-shaped molded body configured to support an underside of the wearer's breasts.

8. The front panel of claim **1**, wherein:

the inner layer of each bra cup comprises an inner liner fabric laminated to an inner foam layer, and the inner liner fabric is configured to contact the wearer's skin; and

the outer layer of each bra cup comprises a spacer fabric.

9. The front panel of claim **1**, wherein the stabilizer fabric layer of the support shelf assembly comprises 100% polyester.

10. The front panel of claim **1**, wherein the front panel comprises two lateral halves, each half of the front panel comprising a respective one of the pair of bra cups, and further comprising a zipper that couples the two halves of the front panel together.

11. The front panel of claim **10**, wherein the support component comprises two lateral halves, each half of the support component being a U-shaped molded body configured to support an underside of a respective one of the wearer's breasts.

12. The front panel of claim **1**, wherein the inner and outer layers and the shaping foam layer of each bra cup and at least the first supportive foam layer and the stabilizer fabric layer of the support shelf assembly all extend to the lower edge of each bra cup.

13. The front panel of claim **1**, wherein the stabilizer fabric layer is made of 100% polyester weft knit interlock.

14. A brassiere comprising the front panel of claim **1**.

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