(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 4 209 142 A1

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**12.07.2023 Bulletin 2023/28**

(21) Application number: **23150371.5**

(22) Date of filing: **04.01.2023**

(51) International Patent Classification (IPC):
***A41D 31/18*** *(2019.01)* ***A41F 9/00*** *(2006.01)*
***A41D 1/21*** *(2018.01)*

(52) Cooperative Patent Classification (CPC):
**A41D 31/185; A41D 1/21; A41F 9/00**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA**
Designated Validation States:
**KH MA MD TN**

(30) Priority: **07.01.2022 US 202263297308 P**
**02.01.2023 US 202318149119**

(71) Applicant: **Mast Industries (Far East) Limited**
**Kowloon (HK)**

(72) Inventors:
- **TODARO, Ursula Giovanna**
  **Glendale, NY 11385 (US)**
- **BARATTA, Jennifer**
  **Brooklyn, NY 11225 (US)**

(74) Representative: **Gill Jennings & Every LLP**
**The Broadgate Tower**
**20 Primrose Street**
**London EC2A 2ES (GB)**

## (54) LOWER BODY GARMENT FOR MATERNITY

(57) A lower body garment (10, 110, 210) has a pair of legs (12) having an upper edge (14) located below a wearer's pregnant belly and a waistband (16) connected to the upper edge (14). The waistband (16) has a front waistband portion (16a) that substantially covers the wearer's pregnant belly and a rear waistband portion (16b) that covers the wearer's sacroiliac joints, and which, together with the front waistband portion (16a), encircles the wearer's torso. The rear waistband portion (16b) has a rear three-layer section having an inner layer of fabric (20) contacting the wearer's skin, an outer layer of fabric (24) facing outwardly from the wearer, and a middle layer of material (22) between the inner and outer layers of fabric (20, 24). The front waistband portion (16a) has a front three-layer section (26, 126, 226) and a front section (28, 128, 228) having no middle layer of material (22). Stretch, recovery, and/or modulus of the three-layer sections (18, 118, 218, 26, 126, 226) may be greater than the same properties of the section (28, 128, 228) having no middle layer of material (22).

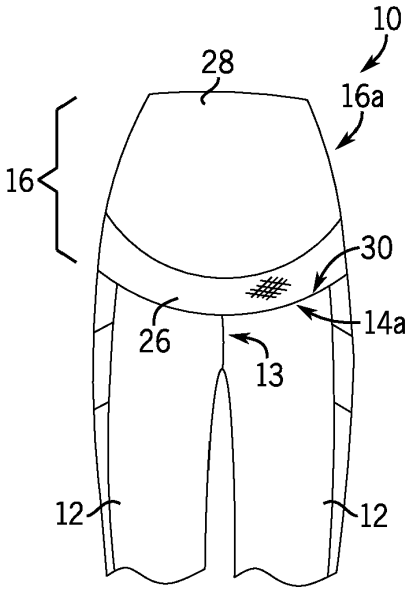


FIG. 1

EP 4 209 142 A1

## Description

FIELD

**[0001]** The present disclosure relates to maternity wear for a pregnant woman's lower body.

BACKGROUND

**[0002]** U.S. Patent No. 8,968,051 discloses a crossover maternity panel that may be attached to any lower garment worn throughout pregnancy and post-partum body changes. The crossover maternity panel may be a belly panel comprised of a single piece of fabric or multiple pieces connected with seams, and wrap around from the front to the back of the wearer. The portions may overlap in the back of the wearer as they decrease in height to create a crossover triangular section that provides support to the lumbar region of the wearer. The crossover maternity panel may be attached to any lower garment such as a pant, short, skirt, skort, or the like. The flexible and stretchable material of the crossover maternity panel allows the wearer to have support for the enlarged belly, support for increased pressure and laxity on the wearer's sacroiliac joints and lower back, as well as comfort and mobility.

**[0003]** U.S. Patent No. 9,730,476 discloses maternity garments intended for use by pregnant women throughout the entirety of their pregnancy. In one exemplary arrangement, the maternity garments include a built-in support belt and a belly bump portion. The maternity garment may further include leggings. In some arrangements, the maternity garment is formed of light compression weaves in areas such as the baby bump area and the leggings area of the garment, while the areas around the periphery of the baby bump, as well as the back area of the garment are formed of slightly stronger compression weave so as to provide needed support and lift in these areas. Finally, the area associated with the middle of the back of the pregnant woman may be formed of an even stronger compression weave so as to provide even greater support in this area to deal with the troublesome soreness and pain often had by pregnant woman as the pregnancy progresses.

**[0004]** U.S. Patent Application Publication No. 2012/0122372 discloses garments to support a distended abdomen. For example the garment comprises an abdominal panel displaced beneath and in a position to support a distended abdomen, said panel being formed from an anisotropic elastomeric fabric that stretches in a latitudinal direction; side panels secured to a side of said abdominal panel, each side panel extending upwards and to a rear of said abdominal panel and being formed from an isotropic elastomeric fabric having a modulus of elasticity at least 1.5 times greater than said abdominal panel; and a back panel positioned over a lumbar region attached to said side panel.

**[0005]** U.S. Patent Application Publication No. 2012/0309265 discloses a garment having specific supportive panels for providing adequate back and belly support; in a preferred embodiment the garment is an exercise garment. The supportive panels of the garment are made of composites of expandable materials giving structural support to the garment such that the wearer's back is stabilized and the belly is supported to prevent drastic pitch, roll or yaw movements during exercise. The expandable materials are designed to yield such that excessive pressure against the belly is not caused as such pressure, found in garments of the prior art, can inflict pain to the musculature and skin surface of the wearer. The expandable materials provide support and allow for the natural growth of the body during pregnancy, providing a desirable combination of a supportive exercise garment that can be used throughout the gestation period.

**[0006]** U.S. Patent Application Publication No. 2016/0015087 discloses garments that can be worn during early stages of pregnancy and postpartum. The garments shape or contour the stomach or abdomen regions of the wearer to give the abdomen a smoother and slimmer appearance. The garments comprise at least one shaper stitch region that is adapted to apply a compressive force to the wearer's abdomen to shape the stomach or abdomen regions of the wearer.

**[0007]** U.S. Patent Application Publication No. 2019/0320737 discloses a garment, which includes a belly panel, a back panel, a front portion, and a contoured front seamwork positioned between the belly panel and the front portion. The contoured front seamwork attaches the belly panel and the front portion and extends substantially in a U-shape to provide support to a protruding belly.

SUMMARY

**[0008]** 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 the claimed subject matter, nor is it intended to be used as an aid in limiting the scope of the claimed subject matter.

**[0009]** According to one example of the present disclosure, a lower body garment comprises a pair of legs having an upper edge configured to be located below a wearer's pregnant belly and a waistband connected to the upper edge of the pair of legs. The waistband comprises a front waistband portion configured to substantially cover the wearer's pregnant belly and a rear waistband portion configured to cover the wearer's sacroiliac joints, and which, together with the front waistband portion, is configured to encircle the wearer's torso. The rear waistband portion comprises a rear three-layer section having an inner layer of fabric configured to contact the wearer's skin, an outer layer of fabric configured to face outwardly from the wearer, and a middle layer of material between the inner and outer layers of fabric. The front waistband portion comprises a front three-layer section

having the inner layer of fabric, the middle layer of material, and the outer layer of fabric, and a front section having no middle layer of material. Recovery of the front and rear three-layer sections is greater than recovery of the inner and outer layers of fabric together without the middle layer of material.

**[0010]** According to one aspect, the middle layer of material is a plastic film that is self-bonded to at least one of the inner and outer layers of fabric in each of the front and rear three-layer sections.

**[0011]** According to another example of the present disclosure, a lower body garment comprises a pair of legs joined at front and rear rise portions and together defining a front upper edge configured to be located on the underside of a wearer's pregnant belly and together defining a rear upper edge configured to be located proximate the wearer's lower back. A waistband is coupled to the front and rear upper edges of the pair of legs. The waistband comprises a front waistband portion coupled to the front upper edge and configured to substantially cover the wearer's pregnant belly and a rear waistband portion coupled to the rear upper edge and configured to cover the wearer's lumbar region, and which, together with the front waistband portion, is configured to encircle the wearer's torso. The rear waistband portion comprises a rear reinforced section having at least three layers, including a rear inner layer of fabric configured to contact the wearer's skin, a rear outer layer of fabric configured to face outwardly from the wearer, and a rear middle layer of material between the rear inner and outer layers of fabric. The front waistband portion comprises a front reinforced section having at least three layers, including a front inner layer of fabric configured to contact the wearer's skin, a front outer layer of fabric configured to face outwardly from the wearer, and a front middle layer of material between the front inner and outer layers of fabric. The front waistband portion also comprises a front unreinforced section comprising at least one of the front inner and outer layers of fabric, but lacking the front middle layer of material. An elastic modulus of the rear reinforced section is greater than an elastic modulus of the rear inner and outer layers of fabric together without the rear middle layer of material. An elastic modulus of the front reinforced section is greater than an elastic modulus of the front inner and outer layers of fabric together without the front middle layer of material.

**[0012]** According to one aspect, the front and rear middle layers of material are non-textile mesh. Optionally, the non-textile mesh is a polystyrene mesh that is 130 microns thick, has a weight of 50 grams per square meter, and has apertures having a diameter of less than 3 millimeters.

**[0013]** According to one aspect, the front middle layer of material is self-bonded to at least one of the front inner and outer layers of fabric and the rear middle layer of material is self-bonded to at least one of the rear inner and outer layers of fabric.

**[0014]** According to another example of the present disclosure, a lower body garment comprises a pair of legs joined at front and rear rise portions and together defining a front upper edge configured to be located on the underside of a wearer's pregnant belly and together defining a rear upper edge configured to be located proximate the wearer's lower back. A waistband is coupled to the front and rear upper edges of the pair of legs. The waistband comprises a front waistband portion coupled to the front upper edge and configured to substantially cover the wearer's pregnant belly and a rear waistband portion coupled to the rear upper edge and configured to cover the wearer's lumbar region, and which, together with the front waistband portion, is configured to encircle the wearer's torso. The rear waistband portion comprises a reinforced section having a rear inner layer configured to contact the wearer's skin, a rear outer layer configured to face outwardly from the wearer, and a rear middle layer of high-modulus film self-bonded between the rear inner and outer layers. The front waistband portion comprises a front reinforced section having a front inner layer configured to contact the wearer's skin, a front outer layer configured to face outwardly from the wearer, and a front middle layer of high-modulus film self-bonded between the front inner and outer layers. The front waistband portion also comprises a front unreinforced section that does not include the front middle layer of high-modulus film. An elastic modulus of the front and rear reinforced sections is greater than an elastic modulus of portions of the waistband that do not include the front or rear middle layers of high-modulus film.

**[0015]** According to one aspect, the front and rear middle layers of high-modulus film are mesh film. Optionally, the front and rear middle layers of high-modulus film are a polystyrene mesh film that is 130 microns thick, has a weight of 50 grams per square meter, and has apertures having a diameter of less than 3 millimeters.

**[0016]** According to one aspect of any of the above examples, the front reinforced section is located at least along a lower edge of the front waistband portion. Optionally, the front reinforced section makes up at least a lower quarter of the front waistband portion and the front unreinforced section makes up at least an upper third of the front waistband portion.

**[0017]** According to one aspect of any of the above examples, the front reinforced section is also located along an upper edge of the front waistband portion and the front unreinforced section is located vertically between the front reinforced sections along the lower and upper edges of the front waistband portion.

**[0018]** According to one aspect of any of the above examples, the rear upper edge is configured to be located proximate the wearer's sacroiliac joints.

**[0019]** According to one aspect of any of the above examples, the front and rear middle layers of high-modulus film are made of a plastic. Optionally, the plastic is polystyrene.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0020]** The present disclosure is described with reference to the following Figures. The same numbers are used throughout the Figures to reference like features and like components.

FIGURE 1 illustrates a front view of a first example of a lower body garment.

FIGURE 2 illustrates a right side view of the lower body garment FIGURE 1.

FIGURE 3 illustrates a rear view of the lower body garment of FIGURE 1.

FIGURE 4 illustrates a front view of a second example of a lower body garment.

FIGURE 5 illustrates a rear view of the lower body garment of FIGURE 4.

FIGURE 6 illustrates a front view of a third example of a lower body garment.

FIGURE 7 illustrates a rear view of the lower body garment of FIGURE 6.

FIGURE 8 illustrates one example of a reinforced section of the lower body garment.

FIGURE 9 illustrates another example of a reinforced section of the lower body garment.

## DETAILED DESCRIPTION

**[0021]** According to one example of the present disclosure, as shown in FIGURES 1-3, a lower body garment 10 comprises a pair of legs 12 having an upper edge 14 configured to be located below a wearer's pregnant belly when the lower body garment 10 is worn and a waistband 16 connected to the upper edge 14 of the pair of legs 12. Specifically, the pair of legs 12 are joined at front and rear rise portions 13, 15 and together define a front upper edge 14a configured to be located on the underside of a wearer's pregnant belly and together define a rear upper edge 14b configured to be located proximate the wearer's lower back. The waistband 16 comprises a front waistband portion 16a coupled to the front upper edge 14a and configured to substantially cover the wearer's pregnant belly. By "substantially cover the wearer's pregnant belly," it is meant that the front waistband portion 16a is of a height that is configured to reach above the wearer's navel, and optionally to extend onto the top side (fundus) of her protruding belly. In some examples, the front waistband portion 16a is dimensioned to be able to touch or nearly touch the wearer's ribcage after covering the top of her belly. The waistband 16 also comprises a rear waistband portion 16b coupled to the rear upper edge 14b and configured to cover the wearer's lumbar region. In some examples, the rear upper edge 14b of the pair of legs 12 is configured to be located proximate the wearer's sacroiliac joints. In some examples, the rear waistband portion 16b is configured to cover the wearer's sacroiliac joints, while in other examples, the rear waistband portion 16b is configured to begin just above the wearer's sacroiliac joints. The rear waistband portion 16b, together with the front waistband portion 16a, is configured to encircle the wearer's torso. The front waistband portion 16a and the rear waistband portion 16b may each be made of a single panel of material or may be made of multiple panels of material stitched together along generally vertically extending seams. In another example, the front waistband portion 16a and the rear waistband portion 16b are both made from the same seamless knit tube.

**[0022]** The rear waistband portion 16b comprises a rear reinforced section 18, the extent of which is outlined and provided with partial hatching. Referring also to FIGURE 9, the rear reinforced section 18 has at least three layers, including a rear inner layer of fabric 20 configured to contact the wearer's skin, a rear outer layer of fabric 24 configured to face outwardly from the wearer, and a rear middle layer of material 22 between the rear inner and outer layers of fabric 20, 24. In one example, the rear reinforced section 18 is a three-layer section having the inner layer of fabric 20, the outer layer of fabric 24, and the middle layer of material 22 between the inner and outer layers of fabric 20, 24. The front waistband portion 16a comprises a front reinforced section 26, the extent of which is outlined and provided with partial hatching, also having at least three layers, including a front inner layer of fabric 20 configured to contact the wearer's skin, a front outer layer of fabric 24 configured to face outwardly from the wearer, and a front middle layer of material 22 between the front inner and outer layers of fabric 20, 24. In one example, the front reinforced section 26 is a three-layer section having the inner layer of fabric 20, the middle layer of material 22, and the outer layer of fabric 24. The front waistband portion 16a also comprises a front section 28 having no middle layer of material 22. The front section 28 therefore has only one or both of the inner layer of fabric 20 or/and the outer layer of fabric 24. In other words, the front section 28 comprises at least one of the front inner and outer layers of fabric 20, 24, but lacks the front middle layer of material 22 and therefore is unreinforced.

**[0023]** In some examples, the front reinforced section 26 (e.g., three-layer section) is located at least along a lower edge 30 of the front waistband portion 16a. According to one alternative, as shown in FIGURES 1 and 2, the front reinforced section 26 makes up at least a lower quarter of the front waistband portion 16a, and the front unreinforced section 28 having no middle layer of material 22 makes up at least an upper third of the front waistband portion 16a. The front reinforced section 26 extends laterally across the entire front waistband portion 16a and connects to the rear reinforced section 18 just behind each of the wearer's hips. The front reinforced section 26 may be narrowest (in a vertical direction) near the front of each of the wearer's hip bones, and may widen toward the center front of the front reinforced section 26 and toward the rearmost ends of the front reinforced section 26, where the front reinforced section 26 connects to the rear reinforced section 18. The rear reinforced sec-

tion 18 has a bottom edge 32 adjacent the rear upper edge 14b of the pair of legs 12 and extends to the upper edge 34 of the rear waistband portion 16b.

**[0024]** The front and rear reinforced sections 26, 18 are composite panels having different properties than areas of the waistband 16 that do not include the middle layer of material 22. The middle layer of material 22 may have a higher elastic modulus, recovery, and/or stretch than the inner or outer layers of fabric 20, 24, which affects the elastic modulus, recovery, and/or stretch of the reinforced sections 26, 18 overall. According to one example, the middle layer of material 22 is made of a polymer, and more particularly, the front and rear middle layers of material 22 are made of a plastic. Preferably, the plastic is polystyrene. In other examples, the middle layer of material 22 is polyolefin or a shape memory polymer. In some examples, the middle layer of material 22 is a non-woven material, and in a more particular example, the front and rear middle layers of material 22 are a non-textile mesh. The mesh may be formed by gravure printing, extruding, screen printing, or additive printing polymer onto a release sheet, from which the polymer can be removed once set. In other examples, the polymer could be directly applied onto the inner or outer layer of fabric 20, 24 in a mesh pattern. In other examples, the middle layer of material 22 is netting. The netting may be a woven fabric netting. For example, the netting may comprise polyethylene and thermoplastic elastomer threads.

**[0025]** The mesh or netting may have any shape of apertures, such as square, diamond, circular, ovular, parallelogram, or rectangular apertures. The size of the apertures will generally be on the order of 1 to 3 millimeters or less. The thickness of the mesh or netting may be 100-160 microns, more particularly 130 microns. The mesh or netting may have a weight of 30gsm-70gsm, more particularly 50gsm. The porosity (fraction of open area to total area) of the mesh or netting may be 30 to 50%, more particularly 35 to 40%.

**[0026]** One example of a particularly appropriate mesh is a 100% polystyrene mesh that is 130 microns thick and has a weight of 50gsm, with apertures of 1-3 millimeters or less. A preferred mesh is a 100% polystyrene film that is 130 microns thick, has a weight of 50gsm, has apertures measuring less than 3 millimeters in diameter (preferably 0.9 to 1.1 millimeters major diameter and 0.8 to 0.95 millimeters minor diameter), has an average porosity of 40%, has an elongation of about 120% from 0.1kg to 1kg, has a modulus in the machine direction of about 1.2 N/50mm and in the transverse direction of about 0.8 N/50mm, and has a recovery of about 88%. Some appropriate meshes are available from Meiwa Gravure Co., Ltd. of Higashi-Osaka City, Japan. The modulus, elongation, and recovery of such a mesh do not change significantly with temperature, such as when the mesh is on-body as part of the lower body garment 10. Thus, incorporating the mesh into the lower body garment 10 can provide increased modulus, high stretch, and fast recovery to the fabric laminates of the front and rear reinforced sections 26, 18.

**[0027]** Some other types of appropriate mesh and/or netting are sold under the trademark CONWED™ from Schweitzer-Mauduit International, Inc. of Alpharetta, Georgia.

**[0028]** Note that the overall modulus, stretch, and recovery of the laminated panels will depend on the fabrics with which the mesh or netting is laminated. In one example, the inner and outer layers 20, 24 on either side of the middle layer 22 are weft-knitted interlock nylon-spandex fabric. In further examples, the inner and outer layers of fabric 20, 24 can be woven or knit and can be made of natural or synthetic yarns or blends thereof. The outer layer used in the front reinforced section 26 can be the same as or different from the outer layer used in the rear reinforced section 18. Likewise, the inner layer used in the front reinforced section 26 can be the same as or different from the inner layer used in the rear reinforced section 18, and the middle layer used in the front reinforced section 26 can be the same as or different from the middle layer used in the rear reinforced section 18. In other examples, the inner and outer layers of fabric 20, 24 can be made of the same fabric.

**[0029]** Although the front and rear reinforced sections 26, 18 are shown and described as including three layers, it is possible that the front and rear reinforced sections 26, 18 could include more than three layers. In one example, two or more layers of the middle layer of material 22 could be provided. In another example, two or more layers of material (e.g., fabric) can be provided between the middle layer of material 22 and the wearer. In another example, two or more layers of material (e.g., fabric) can be provided externally of the middle layer of material 22. Further, the front unreinforced section 28 of the front waistband portion 16a could include both the inner and outer layers of fabric 20, 24, only the inner or outer layer of fabric 20 or 24, or could include an inner and/or outer layer of fabric that is different from those used in the front reinforced section 26.

**[0030]** According to some examples, the middle layer of material 22 is bonded to at least one of the inner and outer layers of fabric 20, 24. As shown in FIGURE 9, the middle layer of material 22 is bonded to both the inner and outer layers of fabric 20, 24, such that it is sandwiched therebetween to form a three-layer laminate. In one particular example, the bonding is self-bonding (i.e., no adhesive is required) accomplished by application of heat and pressure to the three layers. That is, the front middle layer of material 22 is self-bonded to at least one of the front inner and outer layers of fabric 20, 24, and the rear middle layer of material 22 is self-bonded to at least one of the rear inner and outer layers of fabric 20, 24. This can be accomplished by selection of a middle layer of material 22 that softens enough during heat pressing to permanently bond to a layer with which it is heat-pressed. In particular, the preferred 100% polystyrene mesh provided from Meiwa Gravure Co., Ltd. noted

hereinabove self-bonds to nylon-spandex fabric upon application of heat (e.g., 150-180 degrees C) and pressure (e.g., 3-5 bar) for 10-20 seconds. In another example, adhesive may be applied between the layers 20, 22, 24 to bond them together. As shown in FIGURE 8, the inner layer of fabric 20 and middle layer of material 22 may be bonded together, and the outer layer of fabric 24 may float with respect to the middle layer of material 22. The outer layer of fabric 24 can be connected to the middle layer of material 22 and inner layer of fabric 20 along the edges of the panel of layers, such as by stitching or bonding. This may make the reinforced sections 26, 18 more aesthetically appealing from the outside of the lower body garment 10, in cases where the bonding of the middle layer of material 22 to the inner and outer layers of fabric 20, 24 causes the fabric to have a dimpled or otherwise less smooth appearance.

**[0031]** As noted, inclusion of the middle layer of material 22 into a composite fabric panel changes the properties of the reinforced sections 26, 18 as compared to non-reinforced sections of the waistband 16. In some examples, recovery of the front and rear reinforced sections 26, 18 is greater than recovery (the tendency of a material to return to its original dimensions once a load is removed) of the inner and outer layers of fabric 20, 24 together without the middle layer of material 22. Additionally, the elastic modulus of the rear reinforced section 18 as a composite panel is greater than the elastic modulus of the rear inner and outer layers of fabric 20, 24 together (e.g., sewn or bonded into a two-layer panel) without the rear middle layer of material 22, and the elastic modulus of the front reinforced section 26 as a composite panel is greater than the elastic modulus of the front inner and outer layers of fabric 20, 24 together (e.g., sewn or bonded into a two-layer panel) without the front middle layer of material 22. This is due to the elastic modulus of the middle layer of material 22, which is greater than the moduli of the inner and outer layers of fabric 20, 24 alone (i.e., as a single layer of fabric) or together (e.g., sewn or bonded into a two-layer panel). Further, stretch of the front and rear reinforced sections 26, 18 may also be greater than stretch of the inner and outer layers of fabric 20, 24 alone or together, but without the middle layer of material 22. This is due to the middle layer of material 22 holding the knit of the inner and outer layers of fabric 20, 24 together closer than they might otherwise be held were the middle layer of material 22 not included in the composite panel, thereby allowing the knit of the inner and outer layers of fabric 20, 24 to be stretched more upon application of tensile force. Recovery, elastic modulus, and stretch may be determined using the ASTM testing standards for same or their equivalents. In one example, elastic modulus can be approximated by measuring the load on a test specimen of the material at a given elongation. Given the measured load, original length of the specimen, change in length of the specimen at the given elongation, and the negligible cross sectional area of the specimen, the elastic modulus can be determined.

**[0032]** In one example, the loads at 50% elongation of two test specimens were measured in order to determine the effect of the middle layer of material on a composite panel. The first test specimen included two nylon-spandex weft knit interlock fabrics layered one on top of the other. The second test specimen included two layers of the same nylon-spandex weft knit interlock fabric, but with the preferred 100% polystyrene mesh provided from Meiwa Gravure Co., Ltd. sandwiched between and self-bonded to the two layers of fabric. Both test specimens had the same dimensions. The load at 50% elongation of the first test specimen was 1.66 lbf, while the load at 50% elongation of the second test specimen was 2.46 lbf. Thus, the load at 50% elongation (and correspondingly the elastic modulus) of the three-layer composite panel including the middle layer of material 22 increased by 48% in comparison to a panel with the same two fabric layers but no middle layer of high-modulus material.

**[0033]** The high stretch, recovery, and elastic modulus of the front and rear reinforced sections 26, 18 provide a supportive, very slight compressive feel to the wearer. The front reinforced section 26 applies upward lifting force to the bottom of her belly, while the rear reinforced section 18 applies an inward compressive force on her sacroiliac joints and/or lower back. In some examples, the rear waistband portion 16b and rear reinforced section 18 thereof are configured to extend up along the wearer's entire lumbar region, providing support to that area as well.

**[0034]** FIGURES 4 and 5 show another example of a lower body garment 110 in which the front reinforced section 126 is located at least along a lower edge 30 of the front waistband portion 16a and makes up at least a lower quarter of the front waistband portion 16a. Here, a lower edge 36 of the front reinforced section 126 is slightly offset from the shared front upper edge 14a of the pair of legs and the lower edge 30 of the front waistband portion 16a. This may provide a bit less compression just below the front reinforced section 126, allowing for the front waistband portion 16a to stretch with less recovery as the wearer's belly grows larger in this gap. The upper edge 38 of the front reinforced section 126 can be configured to be located at or above the wearer's navel, to provide the feel of extra support under the entirety of the wearer's belly. The rear waistband portion 16b (FIGURE 5) is entirely comprised of the rear reinforced section 118. The front and rear reinforced sections 126, 118 can be as described hereinabove.

**[0035]** According to another alternative of the lower body garment 210 as shown in FIGURES 6 and 7, besides the front reinforced section 226 being located at least along a lower edge 30 of the front waistband portion 16a, the front reinforced section 226 is also located along an upper edge 40 of the front waistband portion 16a. The front unreinforced section 228 having no middle layer of material 22 is located vertically between the lower and upper parts of the front reinforced section 226 along the respective lower and upper edges 30, 40 of the front

waistband portion 16a. This shape and positioning of the front reinforced section 226 provides support under the wearer's belly, but also provides a lifting force above her belly, to take strain off her joints and back, especially in the case where the front reinforced section 226 extends downwardly along the sides of her belly, connecting the upper and lower parts of the front reinforced section 226 as shown here. The front unreinforced section 228 can have a height chosen for a desired end result or on-body feel. Three exemplary outlines of the unreinforced section 228 with no middle layer of material 22 are shown at a, b, and c. For example, the outline "a" may be preferred for a pair of leggings for high impact sports, the outline "b" may be preferred for moderate intensity sports, and the outline "c" may be preferred for an everyday pair of leggings. The front section 228 with no middle layer of material 22 will stretch with less recovery and thus allows the front waistband portion 16a to change in dimension with the wearer as her belly grows throughout pregnancy. As with the second example, the rear waistband portion 16b (FIGURE 7) is entirely comprised of the rear reinforced section 218. The front and rear reinforced sections 226, 218 can be as described hereinabove.

**[0036]** In any of the above examples, the front unreinforced section 28, 128, 228 having no middle layer of material 22 may include only the inner layer of fabric 20 or only the outer layer of fabric 24 or may include one or more layers of material different from the inner and outer layers of fabric 20, 24. This may allow the front unreinforced section 28, 128, 228 to cover her belly even more, with less compression than the front reinforced section 26, 126, 226, as her belly grows.

**[0037]** Thus, the present disclosure is of a lower body garment 10, 110, 210 comprising a pair of legs 12 joined at front and rear rise portions 13, 15 and together defining a front upper edge 14a configured to be located on the underside of a wearer's pregnant belly and together defining a rear upper edge 14b configured to be located proximate the wearer's lower back. A waistband 16 is coupled to the front and rear upper edges 14a, 14b of the pair of legs 12. The waistband 16 comprises a front waistband portion 16a coupled to the front upper edge 14a and configured to substantially cover the wearer's pregnant belly and a rear waistband portion 16b coupled to the rear upper edge 14b and configured to cover the wearer's lumbar region, and which, together with the front waistband portion 16a, is configured to encircle the wearer's torso. The rear waistband portion 16b comprises a reinforced section 18, 118, 218 having a rear inner layer 20 configured to contact the wearer's skin, a rear outer layer 24 configured to face outwardly from the wearer, and a rear middle layer 22 of high-modulus film self-bonded between the rear inner and outer layers 20, 24. The front waistband portion 16a comprises a front reinforced section 26, 126, 226 having a front inner layer 20 configured to contact the wearer's skin, a front outer layer 24 configured to face outwardly from the wearer, and a front middle layer 22 of high-modulus film self-bonded between the front inner and outer layers 20, 24. The front waistband portion 16a also comprises a front unreinforced section 28, 128, 228 that does not include the front middle layer 22 of high-modulus film. The elastic modulus of the front and rear reinforced sections 26, 126, 226, 18, 118, 218 is greater than the elastic modulus of portions of the waistband 16 that do not include the front or rear middle layers 22 of high-modulus film.

**[0038]** In one example, the front and rear middle layers 22 of high-modulus film are made of a plastic. In one example, the front and rear middle layers of high-modulus film are mesh film. While the above-noted alternatives apply, preferably, the front and rear middle layers of high-modulus film are a polystyrene mesh film that is 130 microns thick, has a weight of 50 grams per square meter, and has apertures having a diameter of less than 3 millimeters.

**[0039]** Although the lower body garments 10, 110, 210 shown herein are leggings, the lower body garments could instead be bike shorts, panties, or swim bottoms. The lower body garment could alternatively be a pair of looser shorts or pants including the above-noted waistband 16 stitched to the upper edge 14 of the pair of legs.

**[0040]** In the present 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 assemblies described herein may be used alone or in combination with other systems. Various equivalents, alternatives, and modifications are possible within the scope of the appended claims.

## Claims

**1.** A lower body garment (10, 110, 210) comprising:

a pair of legs (12) joined at front and rear rise portions (13, 15) and together defining a front upper edge (14a) configured to be located on the underside of a wearer's pregnant belly and together defining a rear upper edge (14b) configured to be located proximate the wearer's lower back; and

a waistband (16) coupled to the front and rear upper edges (14a, 14b) of the pair of legs (12), the waistband (16) comprising:

a front waistband portion (16a) coupled to the front upper edge (14a) and configured to substantially cover the wearer's pregnant belly; and

a rear waistband portion (16b) coupled to the rear upper edge (14b) and configured to cover the wearer's lumbar region, and which, together with the front waistband

portion (16a), is configured to encircle the wearer's torso;

wherein the rear waistband portion (16b) comprises a rear reinforced section (18, 118, 218) having at least three layers, including a rear inner layer of fabric (20) configured to contact the wearer's skin, a rear outer layer of fabric (24) configured to face outwardly from the wearer, and a rear middle layer of material (22) between the rear inner and outer layers of fabric (20, 24);
wherein the front waistband portion (16a) comprises:

a front reinforced section (26, 126, 226) having at least three layers, including a front inner layer of fabric (20) configured to contact the wearer's skin, a front outer layer of fabric (24) configured to face outwardly from the wearer, and a front middle layer of material (22) between the front inner and outer layers of fabric (20, 24); and
a front unreinforced section (28, 128, 228) comprising at least one of the front inner and outer layers of fabric (20, 24), but lacking the front middle layer of material (22);

wherein an elastic modulus of the rear reinforced section (18, 118, 218) is greater than an elastic modulus of the rear inner and outer layers of fabric (20, 24) together without the rear middle layer of material (22); and
wherein an elastic modulus of the front reinforced (26, 126, 226) section is greater than an elastic modulus of the front inner and outer layers of fabric (20, 24) together without the front middle layer of material (22).

**2.** The lower body garment of claim 1, wherein the front reinforced section (26, 126, 226) is located at least along a lower edge (30) of the front waistband portion (16a).

**3.** The lower body garment of claim 2, wherein the front reinforced section (26) makes up at least a lower quarter of the front waistband portion (16a), and the front unreinforced section (28) makes up at least an upper third of the front waistband portion (16a).

**4.** The lower body garment of claim 2, wherein the front reinforced section (226) is also located along an upper edge (40) of the front waistband portion (16a), and the front unreinforced section (228) is located vertically between the front reinforced sections (226) along the lower and upper edges (30, 40) of the front waistband portion (16a).

**5.** The lower body garment of any one of claims 1-4, wherein the front and rear middle layers of material (22) are made of a plastic.

**6.** The lower body garment of claim 5, wherein the plastic is polystyrene.

**7.** The lower body garment of any one of claims 1-6, wherein the front and rear middle layers of material (22) are non-textile mesh.

**8.** The lower body garment of claim 7, wherein the non-textile mesh is a polystyrene mesh that is 130 microns thick, has a weight of 50 grams per square meter, and has apertures having a diameter of less than 3 millimeters.

**9.** The lower body garment of any one of claims 1-8, wherein the rear upper edge (14b) is configured to be located proximate the wearer's sacroiliac joints.

**10.** The lower body garment of any one of claims 1-9, wherein the front middle layer of material (22) is self-bonded to at least one of the front inner and outer layers of fabric (20, 24), and the rear middle layer of material (22) is self-bonded to at least one of the rear inner and outer layers of fabric (20, 24).

**11.** A lower body garment (10, 110, 210) comprising:

a pair of legs (12) joined at front and rear rise portions (13, 15) and together defining a front upper edge (14a) configured to be located on the underside of a wearer's pregnant belly and together defining a rear upper edge (14b) configured to be located proximate the wearer's lower back; and
a waistband (16) coupled to the front and rear upper edges (14a, 14b) of the pair of legs (12), the waistband (16) comprising:

a front waistband portion (16a) coupled to the front upper edge (14a) and configured to substantially cover the wearer's pregnant belly; and
a rear waistband portion (16b) coupled to the rear upper edge (14b) and configured to cover the wearer's lumbar region, and which, together with the front waistband portion (16a), is configured to encircle the wearer's torso;

wherein the rear waistband portion (16b) comprises a reinforced section (18, 118, 218) having a rear inner layer (20) configured to contact the wearer's skin, a rear outer layer (24) configured to face outwardly from the wearer, and a rear middle layer (22) of high-modulus film self-bonded between the rear inner and outer layers (20,

24);
wherein the front waistband portion (16a) comprises:

a front reinforced section (26, 126, 226) having a front inner layer (20) configured to contact the wearer's skin, a front outer layer (24) configured to face outwardly from the wearer, and a front middle layer (22) of high-modulus film self-bonded between the front inner and outer layers (20, 24); and
a front unreinforced section (28, 128, 228) that does not include the front middle layer (22) of high-modulus film; and

wherein an elastic modulus of the front and rear reinforced sections (26, 126, 226, 18, 118, 218) is greater than an elastic modulus of portions of the waistband (16) that do not include the front or rear middle layers (22) of high-modulus film.

**12.** The lower body garment of claim 11, wherein the front and rear middle layers (22) of high-modulus film are made of a plastic.

**13.** The lower body garment of claim 12, wherein the plastic is polystyrene.

**14.** The lower body garment of any one of claims 11-13, wherein the front and rear middle layers (22) of high-modulus film are mesh film.

**15.** The lower body garment of claim 14, wherein the front and rear middle layers (22) of high-modulus film are a polystyrene mesh film that is 130 microns thick, has a weight of 50 grams per square meter, and has apertures having a diameter of less than 3 millimeters.

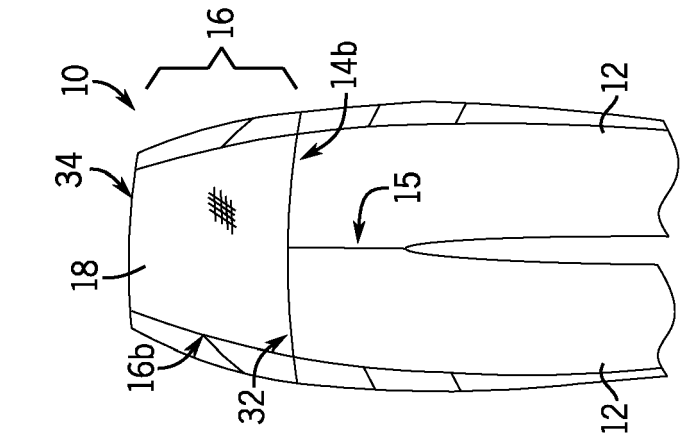


FIG. 3

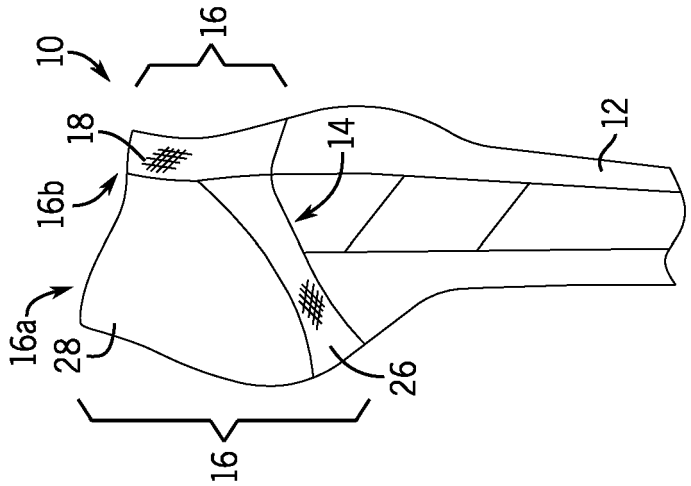


FIG. 2

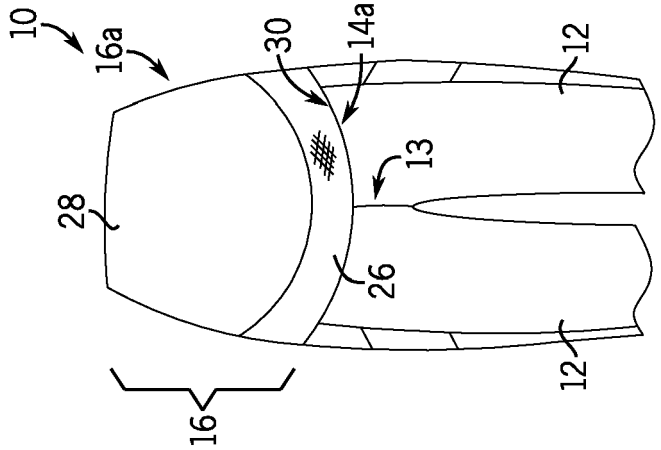


FIG. 1

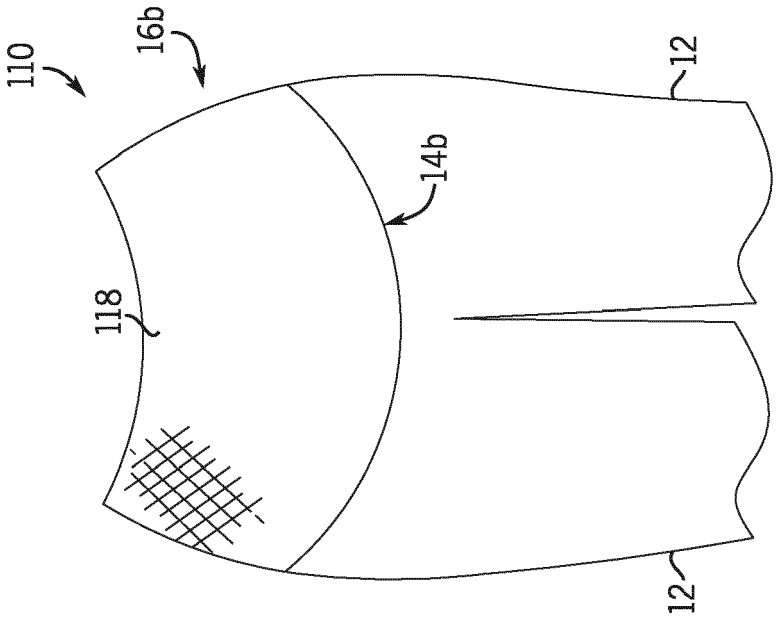


FIG. 5

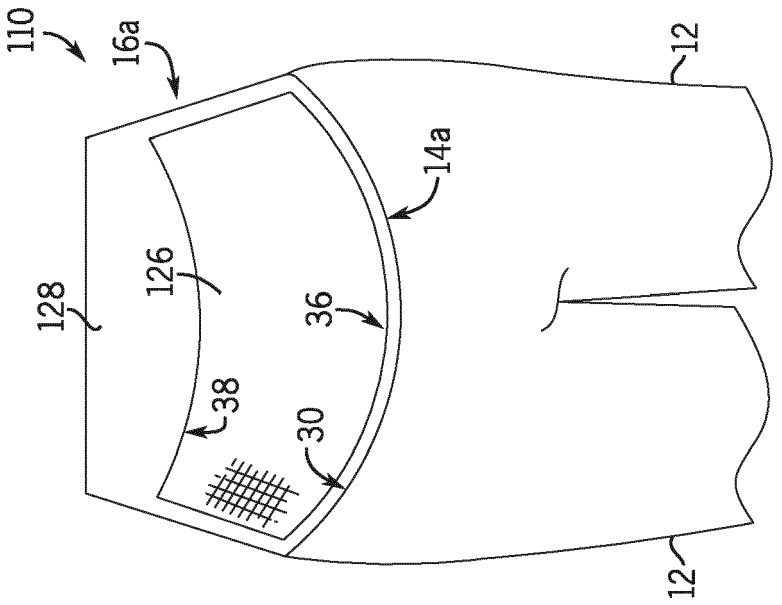


FIG. 4

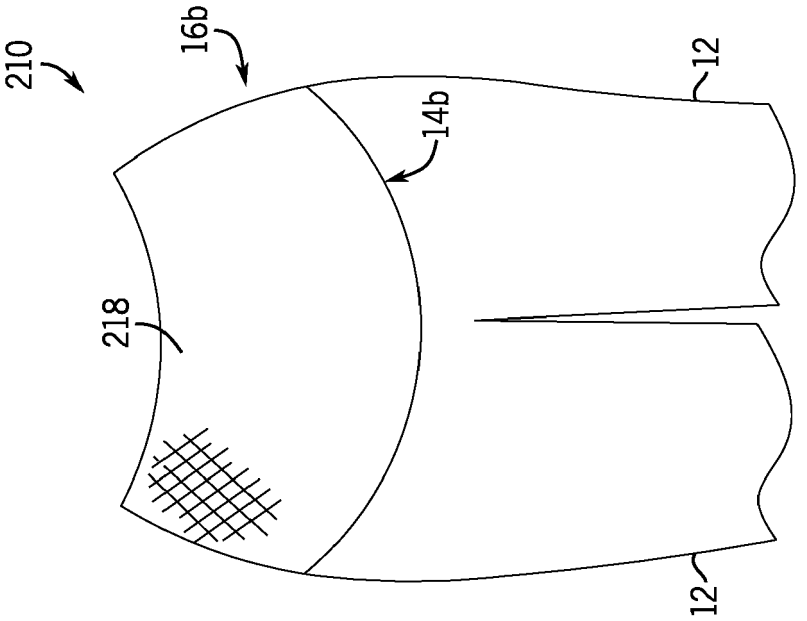


FIG. 7

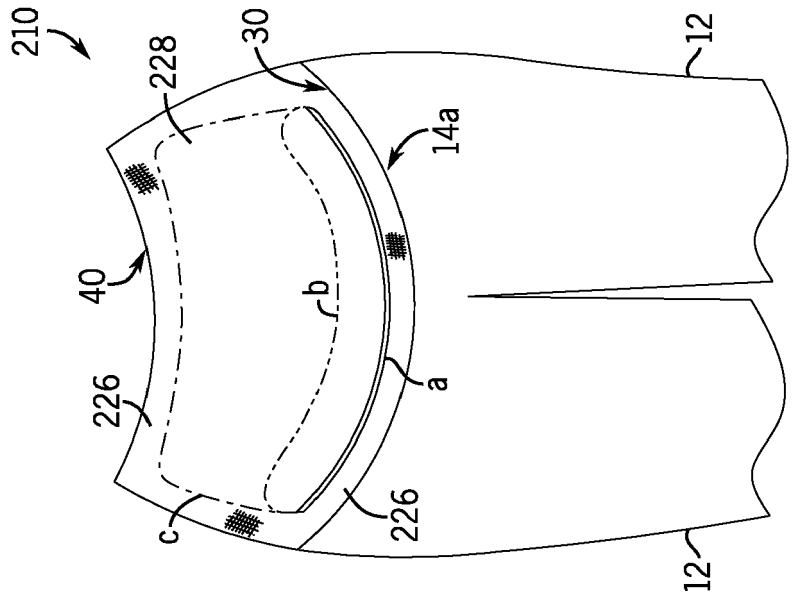


FIG. 6

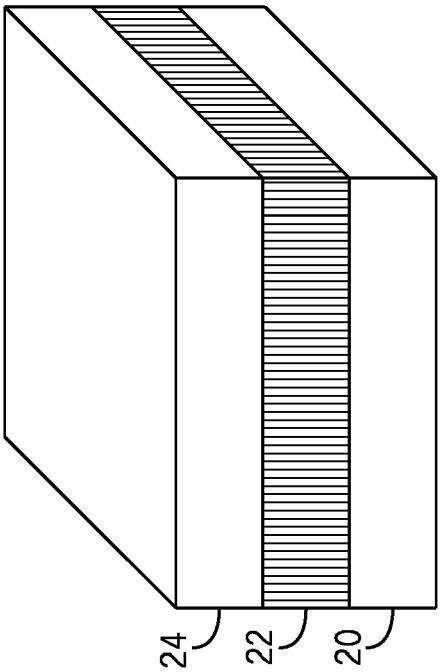


FIG. 9

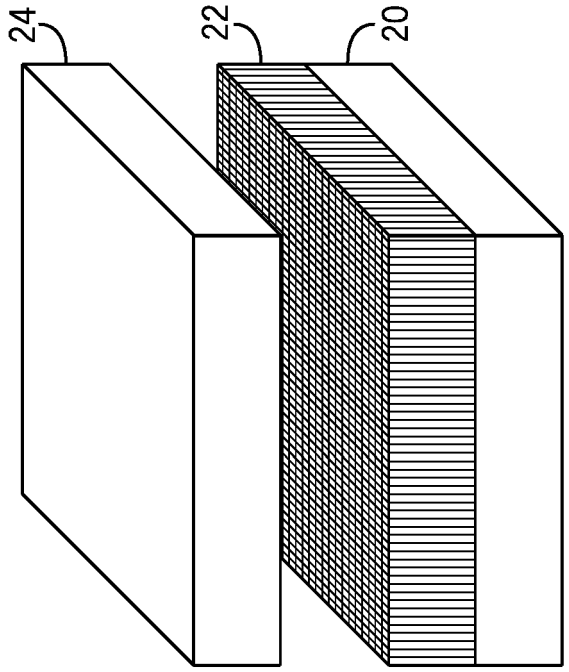


FIG. 8

Europäisches Patentamt
European Patent Office
Office européen des brevets

# EUROPEAN SEARCH REPORT

Application Number
EP 23 15 0371

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| Y | US 2016/015089 A1 (PALESE JILL ELIZABETH [US] ET AL) 21 January 2016 (2016-01-21) * figures 1, 3, 4A, 7 * | 1-15 | INV. A41D31/18 A41F9/00 A41D1/21 |
| Y,D | US 2019/320737 A1 (KIUCHI YUANFANG GU [US] ET AL) 24 October 2019 (2019-10-24) * figure 1 * | 1-15 | |
| Y | WO 2021/063184 A1 (ALL SAFE REHAB SHENZHEN CO LTD [CN]) 8 April 2021 (2021-04-08) * figures 1-5 * | 1-15 | |
| Y | WO 2020/073163 A1 (REGINA MIRACLE INTERNATIONAL GROUP LTD [CN]) 16 April 2020 (2020-04-16) * figures 3A, 3B, 7, 8 * | 1-15 | |

TECHNICAL FIELDS SEARCHED (IPC)

A41D
A41F

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 28 April 2023 | Krüger, Sophia |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 15 0371

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-04-2023

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 2016015089 A1 | 21-01-2016 | NONE | |
| US 2019320737 A1 | 24-10-2019 | NONE | |
| WO 2021063184 A1 | 08-04-2021 | CN 112571896 A | 30-03-2021 |
| | | WO 2021063184 A1 | 08-04-2021 |
| WO 2020073163 A1 | 16-04-2020 | CN 112888558 A | 01-06-2021 |
| | | EP 3863847 A1 | 18-08-2021 |
| | | GB 2592497 A | 01-09-2021 |
| | | JP 2022504460 A | 13-01-2022 |
| | | US 2021401069 A1 | 30-12-2021 |
| | | WO 2020073163 A1 | 16-04-2020 |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## REFERENCES CITED IN THE DESCRIPTION

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

### Patent documents cited in the description


- US 8968051 B **[0002]**
- US 9730476 B **[0003]**
- US 20120122372 **[0004]**
- US 20120309265 **[0005]**
- US 20160015087 **[0006]**
- US 20190320737 **[0007]**