



(51) International Patent Classification:
A61F 13/496 (2006.01)

(21) International Application Number:
PCT/CN2019/075102

(22) International Filing Date:
14 February 2019 (14.02.2019)

(25) Filing Language: English

(26) Publication Language: English

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP,
KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,

(54) Title: PANT-TYPE WEARABLE ARTICLE

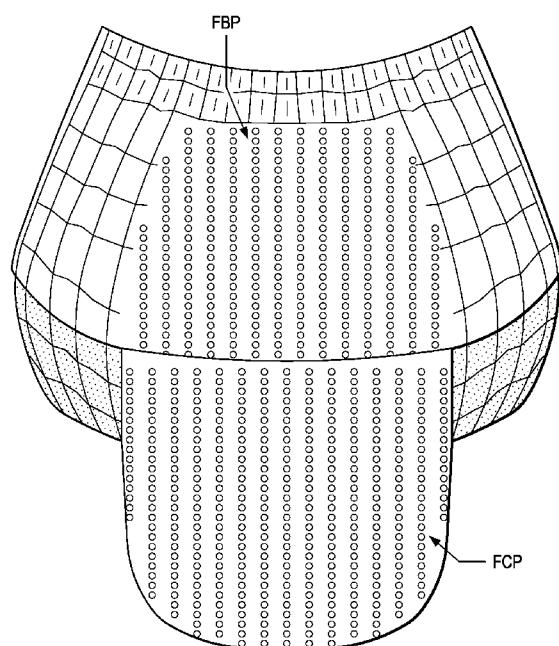


FIG. 6A

(57) Abstract: Disclosed is a wearable article (20) continuous in a longitudinal direction and a transverse direction comprising a front elastic belt (84), a back elastic belt (86), a crotch region (30), a waist opening, and a pair of leg openings; the crotch region (30) extending longitudinally between the front elastic belt (84) and the back elastic belt (86); the front elastic belt (84) and back elastic belt (86) having a transverse dimension of LW, the smaller longitudinal dimension of the front elastic belt (84) or the back elastic belt (86) having a dimension of LS, wherein from about 10% to about 40% of LW, and from about 15% to about 75% of LS, preferably from about 30% to about 70% of LS, is removed of its elastic activity, wherein the region of the front elastic belt (84) and the back elastic belt (86) removed of its elastic activity is a non-elastic region (221); the front and back non-elastic regions (221) have a First Belt Pattern FBP and the crotch region (30) has a First Crotch Pattern FCP; wherein the First Belt Pattern FBP is a Geometric Pattern, the First Crotch Pattern FCP is an Aesthetic Pattern, wherein both the First Belt Pattern FBP and the First Crotch Pattern FCP have a Longitudinal Orientation, according to the measurements herein.

GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

PANT-TYPE WEARABLE ARTICLE

FIELD OF THE INVENTION

5 The present invention relates to pant-type wearable articles having a favorable tactile and aesthetic sense.

BACKGROUND OF THE INVENTION

10 Infants and other incontinent individuals wear absorbent articles such as diapers to receive and contain urine and other body exudates. Pull-on absorbent articles, or pant-type absorbent articles, are those which are donned by inserting the wearer's legs into the leg openings and sliding the article up into position about the lower torso. Pant-type absorbent articles have become popular for use on children who are able to walk and often who are toilet training, as well as for younger children who become more active in movement such that
15 application of taped-type absorbent articles tends to be more difficult, and also for younger babies requiring a soft fit around the waist opening and leg openings.

 Pant-type articles may take various structures wherein the circumference of the waist opening and vicinity thereof is made elastic enough to facilitate the wearer or the caregiver to expand the article and insert the wearer's legs into the leg openings for wearing the article. The
20 region of the waist circumference and vicinity thereof is often referred to as the elastic belt. One type of structure for the pant-type article is the belt-type pant having a central chassis to cover the crotch region of the wearer and a separate elastic belt defining the waist opening and leg opening, such as described in PCT Publication WO 2006/17718A. Another type of structure for the pant-type article is the uni-body type pant configured such that the outer cover
25 of the article completely covers the entirety of the garment-facing surface of the article, wherein the portion configured to stretch about the torso is considered the elastic belt region.

 Whatever the structure of the article may be, the outer surface, or garment-facing surface of the article may be the portion which is most touched and observed by the wearer or the caregiver upon use, and thus its properties most associated with the quality and function of the
30 article. By quality, what may be desired is an undergarment like appearance, and pleasant tactile sense such as softness and cushiony touch. Undergarment like appearance may be enhanced by providing the garment-facing surface with certain aesthetic sense such that the belt

region and crotch region are not easily distinguished. By function, what may be desired are secure wearability, breathability and comfort, or intuitive signals of such attributes.

Meanwhile, from a manufacturer's point of view, there is desire to provide a high quality absorbent article while controlling cost for making the article; by selecting materials and assembling them in a manner that may provide the best user experience per cost of material.

Based on the foregoing, there is a need for a wearable article providing improved stretchability for ease of application, improved fit for preventing sagging, improved comfort and softness, and improved breathability for skin health. There is also a need for a wearable article having improved aesthetics which intuitively communicates the functional benefits described above. There is also a need for providing such a wearable article which can be economically made.

SUMMARY OF THE INVENTION

The present invention is directed to a wearable article continuous in a longitudinal direction and a transverse direction comprising a front elastic belt, a back elastic belt, a crotch region, a waist opening, and a pair of leg openings; the crotch region extending longitudinally between the front elastic belt and the back elastic belt;

the front elastic belt and back elastic belt having a transverse dimension of LW, the smaller longitudinal dimension of the front elastic belt or the back elastic belt having a dimension of LS, wherein from about 10% to about 40% of LW, and from about 15% to about 75% of LS, preferably from about 30% to about 70% of LS, is removed of its elastic activity, wherein the region of the front elastic belt and the back elastic belt removed of its elastic activity is a non-elastic region 221; the front and back non-elastic regions 221 have a First Belt Pattern FBP and the crotch region has a First Crotch Pattern FCP;

wherein the First Belt Pattern FBP is a Geometric Pattern, the First Crotch Pattern FCP is an Aesthetic Pattern, wherein both the First Belt Pattern FBP and the First Crotch Pattern FCP have a Longitudinal Orientation, according to the measurements herein.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as forming the present invention, it is believed that the invention will be better understood from the following description which is taken in

conjunction with the accompanying drawings and which like designations are used to designate substantially identical elements, and in which:

Figure 1A is a perspective view of one embodiment of a wearable article of the present invention.

5 Figure 1B is a schematic view of one embodiment of a wearable article of the present invention in a contracted state showing the front side of the article.

Figure 2 is a schematic plan view of one embodiment of a wearable article of the present invention with the seams unjoined and in a flat uncontracted condition showing the garment facing surface.

10 Figure 3A is a schematic plan view of the embodiment of Figure 2 showing the elastic member positioning, elastic bondings and vertical bondings.

Figure 3B is an expanded schematic plan view of Figure 3A.

Figure 4A is a schematic cross section view of the elastic belt of the present invention in a stretched state.

15 Figure 4B is a schematic cross section view of 4A in a contracted state.

Figure 5A is a schematic plan view of the elastic belt of the present invention.

Figure 5B is a plan view of the elastic belt of the present invention in a stretched state.

Figure 5C is a plan view of the elastic belt of Figure 5B in a contracted state.

20 Figure 6A is a schematic plan view of one embodiment of a wearable article of the present invention in a contracted state.

Figure 6B is a schematic plan view of another embodiment of a wearable article of the present invention in a contracted state.

Figure 7 is a schematic plan view of another embodiment of a wearable article of the present invention in a contracted state.

25 Figure 8 is a schematic plan view of another embodiment of a wearable article of the present invention in a contracted state.

Figure 9 is a schematic plan view of another embodiment of a wearable article of the present invention in a contracted state.

30 Figure 10 is a schematic view of an example of a hanger-type sample holding fixture according to the “Whole Article Force Measurement”.

Figures 11A-11D are related to the Longitudinal Orientation measurement herein.

Figures 12A – 12C are images of Example 1 FBP in its original and processed forms related to the “Longitudinal/Transverse Distribution” measurements herein.

Figures 13A – 13C are images of Example 1 FCP in its original and processed forms related to the “Longitudinal/Transverse Distribution” measurements herein.

Figures 14A – 14C are images of Example 2 FBP in its original and processed forms related to the “Longitudinal/Transverse Distribution” measurements herein.

5 Figures 15A – 15C are images of Example 2 FCP in its original and processed forms related to the “Longitudinal/Transverse Distribution” measurements herein.

DEFINITIONS

As used herein, the following terms shall have the meaning specified thereafter:

10 “Wearable article” refers to articles of wear which may be in the form of pants, taped diapers, incontinent briefs, feminine hygiene garments, and the like. The “wearable article” may be so configured to also absorb and contain various exudates such as urine, feces, and menses discharged from the body. The “wearable article” may serve as an outer cover adaptable to be joined with a separable disposable absorbent insert for providing absorbent and
15 containment function, such as those disclosed in PCT publication WO 2011/087503A.

“Pant” refers to disposable absorbent articles having a pre-formed waist and leg openings. A pant may be donned by inserting a wearer's legs into the leg openings and sliding the pant into position about the wearer's lower torso. Pants are also commonly referred to as “closed diapers”, “prefastened diapers”, “pull-on diapers”, “training pants” and “diaper-pants”.

20 “Longitudinal” refers to a direction running substantially perpendicular from a waist edge to an opposing waist edge of the article and generally parallel to the maximum linear dimension of the article.

“Transverse” refers to a direction perpendicular to the longitudinal direction.

25 “Proximal” and “distal” refer respectively to the position closer or farther relative to the longitudinal center of the article.

“Body-facing” and “garment-facing” refer respectively to the relative location of an element or a surface of an element or group of elements. “Body-facing” implies the element or surface is nearer to the wearer during wear than some other element or surface. “Garment-facing” implies the element or surface is more remote from the wearer during wear than some
30 other element or surface (i.e., element or surface is proximate to the wearer's garments that may be worn over the disposable absorbent article).

“Disposed” refers to an element being located in a particular place or position.

“Joined” refers to configurations whereby an element is directly secured to another element by affixing the element directly to the other element and to configurations whereby an element is indirectly secured to another element by affixing the element to intermediate member(s) which in turn are affixed to the other element.

5 “Film” refers to a sheet-like material wherein the length and width of the material far exceed the thickness of the material. Typically, films have a thickness of about 0.5 mm or less.

“Water-permeable” and “water-impermeable” refer to the penetrability of materials in the context of the intended usage of disposable absorbent articles. Specifically, the term “water-permeable” refers to a layer or a layered structure having pores, openings, and/or
10 interconnected void spaces that permit liquid water, urine, or synthetic urine to pass through its thickness in the absence of a forcing pressure. Conversely, the term “water-impermeable” refers to a layer or a layered structure through the thickness of which liquid water, urine, or synthetic urine cannot pass in the absence of a forcing pressure (aside from natural forces such as gravity). A layer or a layered structure that is water-impermeable according to this definition
15 may be permeable to water vapor, i.e., may be “vapor-permeable”.

“Extendibility” and “extensible” mean that the width or length of the component in a relaxed state can be extended or increased.

“Elasticated” and “elasticized” mean that a component comprises at least a portion made of elastic material.

20 “Elongatable material”, “extensible material”, or “stretchable material” are used interchangeably and refer to a material that, upon application of a biasing force, can stretch to an elongated length of at least about 110% of its relaxed, original length (i.e. can stretch to 10 percent more than its original length), without rupture or breakage, and upon release of the applied force, shows little recovery, less than about 20% of its elongation without complete
25 rupture or breakage as measured by EDANA method 20.2-89. In the event such an elongatable material recovers at least 40% of its elongation upon release of the applied force, the elongatable material will be considered to be “elastic” or “elastomeric.” For example, an elastic material that has an initial length of 100mm can extend at least to 150mm, and upon removal of the force retracts to a length of at least 130mm (i.e., exhibiting a 40% recovery). In the event the
30 material recovers less than 40% of its elongation upon release of the applied force, the elongatable material will be considered to be “substantially non-elastic” or “substantially non-elastomeric”. For example, an elongatable material that has an initial length of 100mm can

extend at least to 150mm, and upon removal of the force retracts to a length of at least 145mm (i.e., exhibiting a 10% recovery).

“Dimension”, “Length”, “Width”, “Pitch”, “Diameter”, “Aspect Ratio”, “Angle”, and “Area” of the article are all measured in a state wherein the article is extended to the Full Stretch Circumference W1 according to the “Whole Article Force Measurement” herein, and utilizing a ruler or a loupe, unless specified otherwise.

“Artwork” refers to a visual presentation to the naked eye, which is provided by printing or otherwise, and having a color. Printing includes various methods and apparatus well known to those skilled in the art such as lithographic, screen printing, flexographic, and gravure ink jet printing techniques.

“Color” or “Colored” as referred to herein includes any primary color except color white, i.e., black, red, blue, violet, orange, yellow, green, and indigo as well as any declination thereof or mixture thereof. The color white is defined as those colors having a L* value of at least 94, an a* value equal to 0 ± 2 , and a b* value equal to 0 ± 2 according to the CIE L* a* b* color system.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1A is a perspective view of a wearable article 20 of the present invention, Figure 1B is a schematic view of a wearable article of the present invention in a contracted state showing the front side, and Figure 2 is a schematic plan view of a wearable article with the seams unjoined and in its flat uncontracted condition showing the garment-facing surface. The wearable article 20 has a longitudinal centerline LX which also serves as the longitudinal axis, and a transverse centerline TX which also serves as the transverse axis. The wearable article 20 has a body facing surface, a garment facing surface, a front elastic belt 84, a back elastic belt 86, a crotch region 30, and side seams 32 which join the front elastic belt 84 and the back elastic belt 86, to form two leg openings and a waist opening.

The wearable article 20 may be a belt-type pant as in Figures 1A, 1B, and 2 comprising a central chassis 38 to cover the crotch region 30 of the wearer, a front elastic belt 84 and a back elastic belt 86 (hereinafter may be referred to as “front and back elastic belts”), the front and back elastic belts 84, 86 forming a discrete ring-like elastic belt 40 extending transversely defining the waist opening. For the belt-type pant, the discrete ring-like elastic belt 40 may also be referred to as the elastic belt 40. For the belt-type pant as in Figures 1A, 1B, and 2, the front and back elastic belts 84, 86 and the central chassis 38 jointly define the leg openings. For the

belt-type pant, the front elastic belt 84 is the front region 26, and the back elastic belt 86 is the back region 28, and the remainder is the crotch region 30. While not shown, the wearable article 20 may be a uni-body type pant configured such that the outer cover of the central chassis 38 and the elastic belt 40 are common. For the uni-body type pant, the portion extending in the transverse direction between the side seams 32, respectively, are considered the front region 26 and the back region 28, and the remainder is the crotch region 30. For the uni-body type pant, the front region 26 is considered the front elastic belt 84, and the back region 28 is considered the back elastic belt 86.

The central chassis 38 may comprise a topsheet, a backsheet and an absorbent core 62 disposed between the topsheet and the backsheet, and further an outer cover layer 42 for covering the garment-facing side of the backsheet. The topsheet may be a water permeable substrate. The backsheet may be a water impermeable film. The outer cover layer 42 may be a nonwoven sheet. The central chassis 38 may contain an absorbent core 62 for absorbing and containing body exudates disposed on the central chassis 38, and an absorbent material non-existing region 61 surrounding the periphery of the absorbent core 62. The absorbent material non-existing region 61 may be made of the topsheet and/or the backsheet and/or the outer cover layer 42 and/or other parts configuring the central chassis 38. In the embodiment shown in Figure 2, the central chassis 38 has a generally rectangular shape, left and right longitudinally extending side edges 48 and front and back transversely extending end edges 50. The absorbent core 62 may exist through the entire longitudinal dimension of the crotch region and extending at least partly in the front region 26; or at least partly in both the front and back regions 26, 28. The central chassis 38 may have a front waist panel 52 positioned in the front region 26 of the absorbent article 20, a back waist panel 54 positioned in the back region 28, and a crotch panel 56 between the front and back waist panels 52, 54 in the crotch region 30. The center of the front elastic belt 84 is joined to a front waist panel 52 of the central chassis 38, the center of the back elastic belt 86 is joined to a back waist panel 54 of the central chassis 38, the front and back elastic belts 84, 86 each having a left side panel and a right side panel 82 where the central chassis 38 does not overlap. The central chassis has a crotch panel 56 positioned between the front waist panel 52 and the back waist panel 54.

The absorbent core 62 may include an absorbent layer and an acquisition layer. The absorbent layer is the region wherein absorbent materials having a high retention capacity, such as superabsorbent polymers, are present. The absorbent layer may be substantially cellulose free. Superabsorbent polymers of the absorbent layer may be disposed between first and

second layers of material immobilized by a fibrous layer of thermoplastic adhesive material. The first and second layers of materials may be nonwoven fibrous webs including synthetic fibers, such as mono-constituent fibers of PE, PET and PP, multiconstituent fibers such as side by side, core/sheath or island in the sea type fibers. Such synthetic fibers may be formed via a spunbonding process or a meltblowing process. The acquisition layer facilitates the acquisition and the distribution of body exudates and may be placed between the topsheet and the absorbent layer. The acquisition layer may include cellulosic fibers.

The absorbent layers may be disposed in plurality in the absorbent core 62. Some portions of the absorbent layers may be configured to have substantially no absorbent material to form a channel or a plurality of channels. Channels may be useful for allowing the absorbent core 62 to bend upon swelling with fluids, such that the absorbent article conforms to the wearer's body after swelling and prevent sagging of the article. The channels may also be formed in the acquisition layer, and may be configured to at least partly match the channels of the absorbent layer in the thickness direction.

The elastic belt 40 of the article of the present invention acts to dynamically create fitment forces and to distribute the forces dynamically generated during wear. The front and back elastic belts 84, 86 may be joined with each other only at the side edges 89 to form side seams 32, a waist opening and two leg openings. Each leg opening may be provided with elasticity around the perimeter of the leg opening. The elasticity around the leg opening may be provided by the combination of elasticity from the front belt 84, the back belt 86, and the central chassis 38.

The longitudinal length of the backsheet and the outer cover layer 42 may be the same, or may be varied. For example, the outer cover layer 42 may have a shorter length compared to that of the backsheet, such that the outer cover layer 42 is devoid where the central chassis 38 overlaps the elastic belt 40. By such configuration, the elastic belt may have better breathability. Further, such configuration may provide cost saving. The transverse width of the backsheet and the outer cover layer 42 may be the same, or may be varied. For example, the backsheet may have a shorter transverse width compared to that of the outer cover layer 42. By such configuration, the longitudinal side edges 48 of the crotch panel 56, which make part of the leg openings, may have better breathability. Further, such configuration may provide cost saving.

The front elastic belt 84 and back elastic belt 86 are configured to impart elasticity to the belt 40. Referring to Figures 1B and 2, the front belt 84 and the back belt 86 may each be

formed by a laminate comprising a plurality of elastic bodies 96 running in the transverse direction, an inner sheet 94, an outer sheet 92, and an outer sheet fold over (not shown) wherein the outer sheet fold over is an extension of the outer sheet material formed by folding the outer sheet material at the distal edge 88 of the front and back belts; wherein the belt elastic bodies 96 are sandwiched between two of these sheets. The front elastic belt 84 and the back elastic belt 86 may each be made only by elastic bodies 96, the inner sheet 94, the outer sheet 92, and the outer sheet fold over. The various patterns, discussed below, may be provided on the outer sheet 92. The belt elastic bodies 96 may extend in the transverse direction to provide a ring like elastic belt 40 when the front elastic belt 84 and the back elastic belt 86 are joined. At least some of the elastic bodies 96 extend in the transverse direction substantially parallel to each other. All of the elastic bodies 96 may extend in the transverse direction substantially parallel to each other. Such an article may be economically made. The front and back elastic belt 84, 86 each may have transversely continuous proximal and distal edges, the proximal edge 90 being located closer than the distal edge 88 relative to the longitudinal center of the article. The elastic bodies 96 may be disposed in the same or different denier, interval, and force between the front and back, as well as in different longitudinal positions of the belt.

Referring to Figure 2, the transverse width LW of the back belt 86 in the uncontracted condition is the same as the transverse width of the front belt 84 of the same condition. Along its entire width LW, the back elastic belt 86 between the back distal edge 88 and the back proximal edge 90 has a longitudinal dimension LB, and the front elastic belt 84 between the front distal edge 88 and the front proximal edge 90 has a longitudinal dimension LF. LB and LF may be the same or different. The shorter of LB and LF is defined as LS.

Referring to Figure 2, LB may be greater than LF. In such configuration, when the wearable article is assembled to form the waist opening and the leg openings, the wearable article 20 is folded along the transverse centerline TX such that the front distal edge 88 is aligned with the back distal edge 88. The front side edge 89 is also aligned with a portion of the back side edge 89. Then the front elastic belt 84 and the back elastic belt 86 are joined at the front and back side edges 89 at the seams 32. The front and back proximal edges 90, however, may not be aligned to one another. The back proximal edge 90 may be disposed longitudinally closer than the front proximal edge 90 relative to the transverse center line TX such that the proximal portion of the back side panel 82 extends toward the crotch panel 56 of the central chassis 38 beyond the front proximal edge 90. The side edge of the proximal portion of the

back side panel 82 may not be joined to anywhere and free from attachment. Thus, the proximal portion of the back side panel 82 provides a buttock cover 95, as in Figure 1B.

Referring to Figure 1B and 2, the front and back elastic belts 84, 86 are treated such that certain regions are removed of its elastic activity to form a non-elastic region 221. For each front and back elastic belt 84, 86, from about 10% to about 40% of LW, and from about 15% to about 75% of LS, preferably from about 30% to about 70% of LS, is removed of its elastic activity. The non-elastic region 221 may overlap the front and/or back waist panel 52, 54 of the central chassis 38. Removal of elasticity from a certain area superposing the front and/or back waist panel 52, 54 may be advantageous when the central chassis 38 comprises an absorbent core 62, in that elasticity in the front and/or back area overlapping the absorbent core 62 may cause bunching of the absorbent layer or any of the layers in the absorbent core 62 and interfere with close fit of the central chassis 38 to the wearer.

The remainder of the front elastic belt 84 and the back elastic belt 86 each comprise an elastic region, the elastic regions at least extending along the waist opening in the transverse direction to provide a circumferential elastic region. The circumferential elastic region along the waist opening defines the Upper Gather Region 220.

Referring to Figure 3A, the laminate may be made by bonding the elastic members 96 to at least one of the inner sheet 94 and the outer sheet 92, via a combination of an elastic bonding 230 and a vertical bonding 234. In Figure 3A, the front elastic belt 84 is shown with the elastic members 96, elastic bonding 230, and vertical bonding 234 expressed in solid lines. In Figure 3A, the vertical bonding 234 is only expressed in the right side of the front elastic belt 84, and the side seams 32 are shown in an unjoined state.

What is meant by elastic bonding 230 herein is a bonding that bonds the elastic member 96 along the side edges 89 of the front and back elastic belts 84, 86. The elastic bonding 230 may be continuously applied to each elastic member 96 for a length of at least about 10mm, or from about 10mm to about 60 mm in the direction of stretch adjacent the side edges 89 of the front and back elastic belts 84, 86, including the length planned for side seaming. The elastic bonding 230 is to provide relatively strong bonding for the elastic member 96 and thus securely anchor the elastic member 96 within the laminate. The anchoring may be assisted by the side seaming. A certain percentage, or a greater percentage, of the dimension of the elastic bonding 230 along the side edges 89 may be seamed. The elastic bonding 230 may also be utilized for an effective process of inactivating some length of the elastic member 96. Referring to Figures 2 and 3A, the elastic member 96 may be inactivated in portions overlapping the absorbent core

62. The elastic bonding 230 may be provided on both sides of the transverse dimension of the elastic member 96 to be inactivated, wherein the region between the elastic bondings 230 are severed and deactivated.

What is meant by vertical bonding 234 herein is a bonding applied to at least one of the inner sheet 94 and the outer sheet 92 with intervals in the transverse direction for intermittently bonding the inner sheet 94 and the outer sheet 92. The vertical bonding 234 may also bond the elastic member 96 to at least one of the inner sheet 94 and the outer sheet 92. The vertical bonding 234 may only be provided to the outer sheet 92. Referring to Figure 3A, vertical bonding 234 may be provided in a pattern for the entire area of the laminate. By providing vertical bonding 234 in a pattern for the entire area of the laminate, the vertical bonding 234 may serve as a bonding for the inner and outer sheets 92, 94 in regions where the elastic members 96 are severed. Vertical bonding 234 may be provided in regions adjacent the side edges 89 and thus overlapping regions where the elastic bondings 230 are provided. Alternatively, vertical bonding 234 may be provided only in regions where the elastic bondings 230 are not provided. Vertical bonding 234 may be provided at least in regions where the elastic member 96 is in active elasticity, wherein the elastic bondings 230 are devoid.

Referring to Figure 4A, the vertical bonding 234 is observed in the thickness direction of the laminate along a single elastic member 96 in an extended state in the transverse direction, wherein Figure 4A only expresses the outer sheet 92, vertical bonding 234, and the elastic member 96, wherein the outer sheet 92 is bonded to the elastic member 96 with vertical bonding 234. The vertical bonding 234 may have a transverse dimension VG2 and provided as a continuous pattern aligned in the longitudinal direction, each longitudinal pattern of vertical bonding 234 spaced apart from each other with a transverse pitch VG1, wherein VG1 may be from about 2mm to about 15 mm, and VG2 may be from about 0.2 mm to about 7 mm. When focusing on one elastic member 96, the vertical bonding 234 may provide intermittent bonding between the elastic member 96 and one of the inner sheet 94 and the outer sheet 92, or between the elastic member 96 and the outer sheet 92. This is in contrast with the elastic bonding 230 which is provided continuously along a certain length of the elastic member 96 in the direction of stretch. As such, in the region where the elastic member 96 is only intermittently bonded to one of the inner sheet 94 and the outer sheet 92, as in Figure 4A, the portion of the elastic member 96 between the vertical bonding 234 in the transverse direction is unattached to any other part of the laminate. Referring to Figure 4B, when the elastic member 96 is allowed to contract, this causes the unattached portion of the outer sheet 92 to fold away from the elastic

member 96 and form gathers. As such, compared to areas where the elastic bonding 230 is applied, the outer sheet 92 has less restriction in creating gathers.

Without being bound by theory, it is believed that by having less restriction for the inner sheet 94 and outer sheet 92 materials against the elastic members 96, this contributes in creating
5 gathers of improved regularity, in that a significant amount of the inner and outer sheet materials 92, 94 existing between the vertical bondings 234 are available for creating gathers continuous in the longitudinal direction. Without being bound by theory, it is also believed that, by having less restriction for the inner and outer sheet materials 92, 94 against the elastic members 96, this allows improved stretchability of the elastic members 96, which may provide ease of application.
10 Compared to elastic belts made only by continuously bonded elastic members 96, the elastic belt 40 of the present invention may have a lower Stretch Circumference Force, according to the measurements herein. Further, despite such relatively low Stretch Circumference Force, the elastic belt 40 of the present invention may maintain a suitable Fit Circumference Force, according to the measurements herein. Without being bound by theory, it is also believed that,
15 by having less restriction for the inner and outer sheet materials 92, 94 against the elastic members 96, this improves the breathability of the overall laminate, which may enhance skin health. Without being bound by theory, it is also believed that vertical bonding 234 provides a configuration wherein a greater percentage of the inner and outer sheet materials 92, 94 are available for forming the outer surfaces of the laminate when the elastic belt 40 is contracted,
20 while the elastic members 96 remain positioned inside the thickness of the laminate. As such, the laminate is provided improved loft and thickness, thus imparting improved comfort and softness when worn. Further, without being bound by theory, in that there is a great percentage of the inner and outer sheet materials 92, 94 available for forming the outer surfaces of the laminate in high regularity when the elastic belt 40 is contracted, this provides the body facing
25 surface of the elastic belt 40 having higher stiffness in the longitudinal direction, thus contributing in improved fit for preventing sagging. Still further, in that the elastic members are less visible when the elastic belt 40 is contracted, this further enhances the aesthetically pleasing regularity of gathers.

In order to make available for gathering a significant amount of the inner and outer sheet
30 materials 92, 94 between the vertical bondings 234 in the transverse direction, VG1 may be from about 2 times to about 20 times, or from about 3.5 times to about 10 times of VG2.

By bonding, what may be utilized are any methods known in the art, such as use of hot melt adhesive, thermal energy, and ultrasonic energy. Bonding strength may be adjusted by the

area of bonding, or by different adhesion or energy level provided by the bonding, for example, adjusting the amount and strength of an adhesive agent. The bonding strength of the elastic bonding 230 and the vertical bonding 234 may be the same or may be varied. The elastic bonding 230 and the vertical bonding 234 may be provided by the same hot melt adhesive.

5 The vertical bonding 234 may be a continuous line extending in the longitudinal direction. Referring to Figure 3B, the vertical bonding 234 may be an array of discrete bondings aligned in the longitudinal direction. Each discrete vertical bonding 234 may have a longitudinal dimension of from about 0.5mm to about 10mm, and a longitudinal pitch of from about 1mm to about 10mm, or from about 0.8mm to about 5mm. By providing the vertical
10 bonding 234 in an array of discrete bondings, the overall area of bonding may be decreased. This is advantageous for maintaining the laminate in a soft tactile sense, in that bonding may provide the inner and outer sheet material 92, 94 stiffer. Further, this may save material or energy for the bonding. Each discrete vertical bonding 234 may be provided in appropriate longitudinal pitch such that there is at least one discrete bonding for each elastic member 96,
15 however, this is not essential. For an individual elastic member 96, some portions may be bonded by the intersecting vertical bonding 234 along the length of the elastic member 96. For an individual elastic member 96, some portions may be left unbonded by the vertical bonding 234 along the length of the elastic member 96, which is acceptable. In that the elastic bonding 230 provides secure bonding of the elastic member 96 along the side seams, so long as there is at
20 least one discrete vertical bonding 234 between each elastic member 96, this prevents the elastic member 96 from moving away from its intended position.

Referring to Figure 2, for the belt-type pant, the proximal edges 90 of the front and back belt 84, 86 may be provided with an end seal in order to keep the inner and outer sheets 92, 94 closed at the proximal edges 90 and thus prevent elastic members 96 from being accessible.
25 Such unaccessibility of elastic members 96 may be particularly advantageous when the article is for a young wearer. Alternatively or additionally, the elastic member 96 which is positioned closest to the proximal edge 90 may be provided with a bonding along the transverse dimension of the elastic member 96 in state of active elasticity.

Referring to Figure 2, the elastic member 96 may be made by a plurality of elastic strands
30 96 running parallel to each other in the transverse direction, wherein the laminate has at least a region wherein the elastic strands 96 have a longitudinal pitch of from about 2mm to about 20mm, or from about 3mm to about 12mm, or from about 3mm to about 7mm. At least some of the Upper Gather Region 220 may have the elastic strands 96 disposed in a longitudinal pitch

of from about 3mm to about 7mm. Without being bound by theory, it is believed that such longitudinal pitch of the elastic strands 96, combined with the transverse pitch of the vertical bonding 234 as described above, contributes in creating gathers of improved regularity by providing the appropriate longitudinal continuity of material provided by the stiffness of the inner and outer sheet materials 92, 94. At least some of the Upper Gather Region 220 may have the elastic strands 96 disposed in a constant longitudinal pitch, the constant pitch being from about 2mm to about 20mm, or from about 3mm to about 12mm, or from about 3mm to about 7mm, with a deviation of no more than about 1.5mm. Without being bound by theory, it is believed that such constant pitch of the elastic strands 96 contributes in creating gathers of improved regularity and continuity.

The front and back elastic belts 84, 86 may be made by running the continuous inner and outer sheet materials as well as the continuous elastic strands along the transverse axis of the article, and bonding them via the elastic bondings 230 and vertical bondings 234. During manufacture, the continuous inner and outer sheet materials and continuous elastic strands may be transferred in the machine direction, wherein the machine direction of manufacture matches the transverse axis TX of the article. In such manufacturing process, the vertical bondings 234 are provided continuous or discretely aligned in the cross machine direction and intermittently spaced apart by a pitch of VG1 in the machine direction of manufacture. The longitudinal pattern of vertical bondings 234 may match the cross machine direction of manufacture, namely the longitudinal axis LX of the article, or may be slightly tilted for better control of the process, particularly when the vertical bonding 234 is provided by applying bonding on a rotating roller. The vertical bonding 234 may be tilted with an angle from the cross machine direction of manufacture, namely the longitudinal axis LX of the article, by from about 0.1 to about 30 degrees, or from about 0.1 to about 15 degrees.

The tensile stress (N/m) of the entirety of the front and back elastic belts 84, 86, respectively, may be profiled in order to provide the functional benefits of the present invention, such as ease of stretch and application, while also maintaining certain force during wear to prevent the article from sagging after loading. When the elasticity of the front and back elastic belts 84, 86 are provided by a plurality of elastic members 96 running in the transverse direction, the tensile stress may be adjusted by one or more of the following methods; 1) elongation rate of the elastic member 96; 2) density (dtex) of the elastic member 96; 3) longitudinal interval of multiple elastic members 96; and 4) effective length of elasticity of the elastic member 96 in the transverse direction. By elongation, "0% elongation" is meant the original length of the elastic

member. When a portion of an elastic member 96 is removed of its elasticity, the remainder of the intact elastic member capable of imparting elasticity is defined as the “effective length of elasticity of an elastic member”.

5 The front and back elastic belts 26, 28 may each be divided into 4 zones spanning in the transverse direction and defined of its position from the distal edge 88 to the proximal edge 90 relative to the percentage of the seam length LS. In the example of Figure 2, the entirety of the length of the belt side edge 89 of the front region 26 is the front belt 84, and is seamed with a certain length of the belt side edge 89 of the back region 28 which is the back belt 86 to define a seam length LS. When seam length LS is considered 0% at the distal edge 88 and 100% at the
10 proximal edge 90 of the side seam 32, the zones are defined as such: 0-25% is the waist zone 102, 25-50% is the distal tummy zone 104, 50-85% is the proximal tummy zone 106, and 85-100% is the leg zone 108 (zones 102, 104, 106, and 108 are not shown in Figures). When there is an elastic member disposed at 25% from the distal edge 88, such elastic member is considered to be included in the waist zone 102. When there is an elastic member disposed at 50% from
15 the distal edge 88, or 85% from the distal edge 88, such elastic member is considered to be included in the proximal tummy zone 106.

In the article of the present invention, the tensile stress of the front proximal tummy zone 106 may be provided higher than the tensile stress of any of the front waist zone 102, the front distal tummy zone 104, or the front leg zone 108. The tensile stress of the front proximal
20 tummy zone 106 may be higher than the tensile stress of any other zone, either in the front or the back. The tensile stress of the back distal tummy zone 104 may be provided higher than any of the tensile stress of the back waist zone 102, the back proximal tummy zone 106, or the back leg zone 108. When comparing the 4 zones each of the front belt and the back belt, the tensile stress may be provided greatest in the order of: the front proximal tummy zone 106, followed by
25 the back distal tummy zone 104. Without being bound by theory, such profiling of the tensile stress per zone is believed to provide the article of the present invention with a shaped elastic belt 40 that conforms well to a human body, particularly to a lower torso of a child of less than 36 months of age, and therefore provide good fit and comfort to the wearer, without compromise of sagging prevention or leakage prevention. Namely, the front proximal tummy zone 106 is
30 subject to high tensile stress such that the article may be anchored against the wearer's trochanter, while leaving more area for the back proximal tummy zone 106 to accommodate the wearer's buttock. As long as the article is anchored securely at the trochanter, the Upper Gather Region 220 may be provided in relatively lower tensile stress. Without being bound by theory,

it is believed that such relatively lower tensile stress contributes in providing the Upper Gather Region 220 with improved regularity of gathering, as well as soft fit.

In the present invention, at least one of the inner sheet 92 and the outer sheet 94 of the present laminate may further comprise a plurality of deformations wherein the deformations are aligned in the longitudinal direction. Deformations may be apertures, slits, engravings, embossings, projections, or any other permanent deformation to the nonwoven material for making the inner sheet 92 and/or the outer sheet 94, so long as they are aligned in the longitudinal direction. For example, referring to Figure 5A, deformations on the outer sheet 92 in the form of apertures are expressed. Each longitudinal deformation pattern may be spaced apart from each other with a transverse pitch of DF1, wherein VG1 is greater than DF1, or wherein VG1 is at least about 1.5 times, or at least about 2 times, of DF1. Without being bound by theory, such deformation provided in relationship with the vertical bonding 234 assists the nonwoven material for making the inner sheet 92 and/or the outer sheet 94 to be folded within dimension VG1, the folding being continuous in the longitudinal direction. As such, the regularity of gathering is enhanced. The longitudinal deformation pattern may or may not be registered with the longitudinal pattern of the vertical bonding 234. In fact, it is the finding of the present invention that, even when the longitudinal deformation pattern is not registered with the longitudinal pattern of the vertical bonding 234, this still enhances the regularity of gathering. In that registering the longitudinal deformation pattern and the longitudinal pattern of the vertical bonding 234 may require precision of process, such registration may be omitted. Even when the longitudinal deformation pattern is not registered with the longitudinal pattern of the vertical bonding 234, by providing DF1 and VG1 in a relationship other than multiple number of integers, a majority of the longitudinal deformation patterns fit within the longitudinal patterns of the vertical bonding 234 and assists gather forming.

The deformation may be a continuous line extending in the longitudinal direction, or an array of discrete deformations aligned in the longitudinal direction and spaced apart from each other with a longitudinal pitch of DF2, wherein DF2 is not greater than DF1, as in Figure 5A. By providing the deformations in an array of discrete deformations, the overall area weakened or stiffened by the deformation may be decreased. By providing DF2 the same or smaller than DF1, this facilitates the folding of the inner and outer sheet material 92, 94 in the longitudinal direction as described above.

The deformation may be an aperture on the outer sheet, wherein the aperture is in the shape of a circle, oval, or polyhedron, and having have a minor radius of at least about 0.1mm, or

from about 0.1mm to about 0.8mm. What is meant by minor radius herein is the radius of a circle, minor radius of an oval, or one half the shortest dimension of a polyhedron. Apertures of such size may be visible to the naked eye on the garment-facing surface, and thus connote breathability and high quality of the gather, as well as the entire laminate. Thus, apertures may
5 be provided on the outer sheet 92. The apertures may be provided on both the inner and outer sheets 92, 94 for enhancing breathability. Further, by providing VG1 greater than DF1, the apertures are positioned on the folding as described above, thus the visibility of the apertures are enhanced, even when the gathers are in contracted state. Figure 5B is a plan view of the elastic belt of the present invention in a stretched state, whereas Figure 5C is the same elastic belt in a
10 contracted state. In the elastic belt of Figures 5B-5C, VG1 is about 1.5 times that of DF1. As can be seen in Figure 5C, by providing the VG1 and DF1 relationship as such, at least one longitudinal row of apertures are continuously folded in the longitudinal manner to provide a longitudinal continuous gather, while the apertures are situated nearby the mountain of each gather. As such, visibility of the apertures are enhanced. This may further enhance
15 breathability, as well as the breathability perception.

The front and back non-elastic regions 221 are removed of elasticity and have less or no gathering, thus the material forming the garment facing side of the non-elastic regions 221 have high visibility. Further, the front and back non-elastic regions 221 are adjacent the Upper Gather Region 220 as well as the crotch region 30, and positioned more or less in the
20 longitudinal and transverse center of the article when worn. Thus, the aesthetic effect of the non-elastic regions 221 in coordination with the remainder of the article provide certain perception of quality for the entire article. The aesthetic effect of the non-elastic regions 221 may be coordinated with the elastic region to enhance the directionality of the longitudinally continuing gathers of the elastic region. Additionally or alternatively, the aesthetic effect of the
25 non-elastic regions 221 may be coordinated with the crotch region 30 to enhance the integral undergarment like appearance of the article. Such aesthetic effects are expected to provide the perception of a high quality article.

The non-elastic regions 221 and crotch region 30 are provided with an Aesthetic Pattern or a Geometric Pattern. In the present invention, by Aesthetic Pattern, what is meant is a
30 repeating visual presentation which may be a Geometric Pattern, or a printed pattern, so long as the repeating visual presentation is visible from the garment-facing side by the naked eye. In the present invention, by Geometric Pattern, what is meant is a repeating visual presentation which is a permanent deformation to the material forming the garment-facing side of the non-

elastic region 221, and which is visible from the garment-facing side by the naked eye. Permanent deformation may be apertures, embossings, and other textural deformations. Permanent deformations that are not visible to the naked eye are not considered as a Geometric Pattern herein. Permanent deformations not visible to the naked eye include those that are too fine or too subtle for the naked eye to perceive, those which are provided in such uniformity that the deformation may not be perceived, and those which are not disposed on the garment facing surface. Permanent deformations may be the same or different deformations as described above for assisting gather forming. Printed patterns may be those directly printed by color on the garment facing surface of the non-elastic region 221 or crotch region 30, and/or printed on layers superposing the non-elastic region 221 or crotch region 30 and visible through the layers overlapping them. For example, the printed pattern may be provided on the garment facing surface of the inner sheet 94. For example, the printed pattern may be provided on the central chassis overlapping with the non-elastic region 221 or crotch region 30.

The non-elastic region 221 herein is provided with a First Belt Pattern FBP. The First Belt Pattern FBP may be a Geometric Pattern. The First Belt Pattern FBP may have a Longitudinal Orientation, according to the measurements herein. Alternatively or additionally, the First Belt Pattern FBP may have a Longitudinal Distribution of at least about 35%, preferably at least about 50%, more preferably at least about 70%, and a Transverse Distribution of no more than about 35%, preferably no more than about 20%, more preferably no more than about 10%, according to the measurements herein. What is described by the Longitudinal Orientation or required Longitudinal/Transverse Distribution, according to measurements herein, is the longitudinally directed impression that the naked eye perceives when observing the repeating visual presentation of the First Belt Pattern FBP. For example, referring to Figures 6A and 6B, the article of the present invention is shown in a contracted state observed from the front side. The non-elastic region 221 of the front belt is provided with a First Belt Pattern FBP of apertures which are visible from the garment facing side. The apertures are aligned in a more or less straight line extending in the longitudinal direction, and each of such lines are repeated in the transverse direction with spacing. The First Belt Pattern FBP of Figures 6A and 6B have a Longitudinal Orientation. Referring to Figures 11A – 11D, what specifically is meant by Longitudinal Orientation is explained. First, a Basic Unit which is a minimum complete unit of the deformations or printings that repeats to create the pattern is identified. The pattern may be a regularly and continuously repeating pattern of deformation or printing in both the longitudinal and transverse directions, with no specific boundary of the pattern. Such regularly and

continuously repeating patterns are referred to as randomly repeating patterns. Whether a randomly repeating pattern or not, the Basic Unit is defined as a group of at least 3, or at least 4, individual deformation or printing which is capable of surrounding a specific area, which is defined as a Basic Unit Area. For example, Figure 11A is a randomly repeating pattern having a Basic Unit consisting of 4 deformations, each deformation having a circle shape which may be apertures, wherein the Basic Unit Area is an approximate rectangle. In another example, Figure 11B is a randomly repeating pattern having a Basic Unit consisting of 4 deformations, each deformation having a bar shape which may be an embossing, wherein the Basic Unit Area is an approximate diamond. In yet another example, Figure 11C is a randomly repeating pattern having a Basic Unit consisting of 4 deformations, each deformation having an S shape which may be a slit, wherein the Basic Unit Area is an approximate diamond. In yet another example, Figure 11D is a randomly repeating pattern having a Basic Unit consisting of about 50 deformations lined up in 2 sinusoidal waves, each deformation having a circle shape which may be apertures, wherein the Basic Unit Area is an approximate wave having a substantially constant transverse dimension. Within the Basic Unit, the closest adjacent deformation or printing in the longitudinal direction and the transverse direction are identified, and their spacings measured. Those patterns having the X spacing longer than the Y spacing by at least 10% are considered having a Longitudinal Orientation. Those patterns having the X spacing of less than 10% difference from the Y spacing is considered having a Non-directional Orientation. Those patterns having the Y spacing greater than the X spacing by 10% or more are not considered.

While discussed in further detail below, the Longitudinal/Transverse Distribution is for extracting the longitudinally continuous and transverse continuous impressions of a pattern by utilizing image analysis, in order to define the distribution of a particular pattern in the longitudinal and transverse direction.

Without being bound by theory, by providing the First Belt Pattern FBP having a Longitudinal Orientation or the required Longitudinal/Transverse Distribution, the non-elastic region 221 appears coordinated with the Upper Gather Region to enhance the directionality of the longitudinally continuing gathers of the Upper Gather Region.

The crotch region 30 herein is provided with a First Crotch Pattern FCP. The First Crotch Pattern FCP may be an Aesthetic Pattern or a Geometric Pattern. The First Crotch Pattern FCP may have a Longitudinal Orientation, according to the measurements herein. Alternatively or additionally, the First Crotch Pattern FCP may have a Longitudinal Distribution

of at least about 35%, preferably at least about 50%, more preferably at least about 70%, and a Transverse Distribution of no more than about 35%, preferably no more than about 20%, more preferably no more than about 10%, according to the measurements herein. What is described by Longitudinal Orientation or required Longitudinal/Transverse Distribution, according to measurements herein, is the longitudinally directed impression that the naked eye perceives when observing the repeating visual presentation of the First Crotch Pattern FCP, similar to what was discussed for the First Belt Pattern FBP. Referring to Figure 6A, the crotch region 30 is provided with a First Crotch Pattern FCP of apertures which are visible from the garment facing side, and similar to that of the First Belt Pattern FBP. The First Crotch Pattern FCP also has a Longitudinal Orientation. Referring to Figure 6B, 11D and the measurement method below, the crotch region 30 of Figure 6B is provided with a First Crotch Pattern FCP of apertures which are not being similar to that of the First Belt Pattern FBP. Yet, the apertures of the First Crotch Pattern FCP have a Longitudinal Orientation, thus appear aligned with the First Belt Pattern FBP.

By providing both the First Belt Pattern FBP and the First Crotch Pattern FCP to have Longitudinal Orientation or the required Longitudinal/Transverse Distribution, the non-elastic regions 221 appear coordinated with the crotch region 30 to enhance the integral undergarment like appearance of the article. Such combination of the First Belt Pattern FBP and the First Crotch Pattern FCP is particularly useful for belt-type pants wherein the ring like elastic belt 40 and the central chassis 38 are provided as different parts. By providing both the First Belt Pattern FBP and the First Crotch Pattern FCP to have Longitudinal Orientation or the required Longitudinal/Transverse Distribution, the visibility of the border between the different parts may be alleviated. The First Belt Pattern FBP may be a Geometric Pattern. The First Crotch Pattern FCP may be a Geometric Pattern or an Aesthetic Pattern.

The First Belt Pattern FBP and the First Crotch Pattern FCP may have a common element. By having a common element, what is meant is that the Basic Unit, according to the measurements herein, of the First Belt Pattern FBP and the First Crotch Pattern FCP are provided the same or similar. For example, the First Belt Pattern FBP and the First Crotch Pattern FCP of Figure 6A have a common element. The common element may be expressed in different sizes wherein the Basic Unit is geometrically similar. The common element may be disposed in similar orientation of direction, color, and density. For example, referring to Figure 7, the cloud like patterns are provided in similar, yet different sizes of the cloud. The cloud like pattern may serve as the common element.

The common element may be provided in different methods. For example, a particular element provided as a Geometric Pattern for the First Belt Pattern FBP may be provided as a printed pattern for the First Crotch Pattern FCP. In another example, a particular element provided as an embossing for the First Belt Pattern FBP may be provided as an aperture for the First Crotch Pattern FCP.

The non-elastic region 221 may further comprise a Second Belt Pattern SBP. The Second Belt Pattern SBP is a different pattern from the First Belt Pattern FBP in either visual presentation or a similar pattern provided in different methods, as discussed above. By similar pattern provided in different methods, what is meant is, for example a First Belt Pattern FBP provided in embossing, and a Second Belt Pattern SBP provided in color matching the embossing. The Second Belt Pattern SBP may be an Aesthetic Pattern or a Geometric Pattern. The Second Belt Pattern SBP may have a common element with the First Belt Pattern FBP or the First Crotch Pattern FCP. The crotch region 30 may further comprise a Second Crotch Pattern SCP. The Second Crotch Pattern SCP is a different pattern from the First Crotch Pattern FCP in either visual presentation or a similar pattern provided in different methods, as discussed above. The Second Crotch Pattern SCP may be an Aesthetic Pattern or a Geometric Pattern. The Second Crotch Pattern SCP may have a common element with the First Belt Pattern FBP or the First Crotch Pattern FCP. The Second Belt Pattern SBP and the Second Crotch Pattern SCP may have a common element. Referring to Figure 7, the First Belt Pattern FBP and the First Crotch Pattern FCP are apertures having Longitudinal Orientation having common element, while the Second Belt Pattern SBP and the Second Crotch Pattern SCP are arrangement of apertures expressing clouds, wherein the clouds do not necessarily have Longitudinal Orientation. Referring to Figure 8, the First Belt Pattern FBP and the First Crotch Pattern FCP are apertures having Longitudinal Orientation having common element, while the Second Belt Pattern SBP and the Second Crotch Pattern SCP are embossings also having Longitudinal Orientation having common element.

The First Belt Pattern FBP, the First Crotch Pattern FCP, the Second Belt Pattern SBP, and the Second Crotch Pattern SCP may each have a Pattern Density, according to measurements herein. The Pattern Density of a particular pattern may be selected in order to provide a particular aesthetic effect. For example, the Pattern Density of the First Belt Pattern FBP and the First Crotch Pattern FCP may be made to have a less than about 10 points difference, such that the non-elastic region 221 appears coordinated with the crotch region 30 to enhance the integral undergarment like appearance of the article. For the belt-type pant, the visibility of the

border between the different parts may be alleviated. For example, the Pattern Density may be provided in a gradient which gradually decreases from the distal edge 88 towards the proximal edge 90 and further into the crotch region 30.

The First Belt Pattern FBP and the First Crotch Pattern FCP may be Geometric Patterns having a common element, wherein both the First Belt Pattern FBP and the First Crotch Pattern FCP have a High Order Pattern HOP in an area dimension of from about 16mm^2 to about 100mm^2 and having a Non-directional Orientation, according to the measurements herein. What is meant by High Order Pattern HOP is a pattern which is not a randomly repeating unit, but rather provides a presentation of a shape that is of a greater dimension than that of the individual deformations. Referring to Figure 9, the First Belt Pattern FBP as well as the First Crotch Pattern FCP have a Basic Unit consisting of 7 deformations having a circle shape which may be apertures, wherein the Basic Unit Area is an approximate circle, and the Basic Unit provides an impression of a flower like shape, and the shape of the Basic Unit may be identified independently from another Basic Unit. Patterns having such Basic Unit are referred to as a High Order Pattern HOP. The High Order Pattern HOP area is described by a phantom rectangle, or approximate square, of minimum area, drawn using only longitudinally spanning lines and transverse spanning lines, to surround the periphery of the High Order Pattern HOP. The area dimension of the Higher Order Pattern HOP, according to measurements herein, is from about 16mm^2 to about 100mm^2 . Within the High Order Pattern HOP, the individual deformation is provided in similar spacing in the longitudinal direction and the transverse direction, and thus have a Non-directional Orientation. What is described by Non-directional Orientation, according to measurements herein, is the impression the naked eye perceives that the repeating visual presentation does not have a particular orientation in either the longitudinal direction or the transverse direction. By providing both the First Belt Pattern FBP and the First Crotch Pattern FCP to have a Non-directional Orientation, and further having a common element of a High Order Pattern HOP, the non-elastic region 221 appears coordinated with the crotch region 30 to enhance the integral undergarment like appearance of the article. For the belt-type pant, the visibility of the border between the different parts may be alleviated.

Whole Article Force Measurement

Force is measured using an Electronic Tensile Tester with a computer interface such as the MTS Criterion C42 running TestWorks 4 Software (available from MTS SYSTEMS (CHINA) CO., LTD) or equivalent instrument. A load cell is selected so that force results for the samples tested will be between 10 and 90% of capacity of the load cell used. The instrument

is calibrated according to the manufacturer's instructions. All testing is performed in a room maintained at 23 ± 2 °C and 50 ± 5 % relative humidity.

The tensile tester is fitted with hanger-type sample holding fixtures 300 as shown in Figure 10. Each fixture comprises a rigid linear rubber-coated horizontal bar section 302 to prevent sample slippage during testing. The outer bar diameter (including the rubber coating) of the horizontal bar sections is 10.0 mm. The central axes of the horizontal bar sections 302 are configured to remain parallel and in the same vertical plane throughout the test procedure. The gauge circumference is determined by the following equation:

$$\text{Gauge Circumference} = 2 \times (H + D + \pi D/2)$$

where H is the vertical gap between the horizontal bar sections 302, and D is the outer diameter of the bar.

The instrument is set up to go through the following steps:

Crosshead Speed	254.0mm/min
Final Load Point	19.61 N
Hold Time	0
Number of Cycles	1
Data Acquisition Rate	50Hz

An article 20 sample is inserted onto the upper horizontal bar section 302 so that the bar passes through the waist opening and one leg opening of the article. The crosshead is raised until the specimen hangs above the lower bar and does not touch lower bar 302. The load cell is tared and the crosshead is lowered to enable the lower bar 302 to be inserted through the waist opening and other leg opening without stretching the article. The article is adjusted so that the longitudinal centerline LX of the article is in a horizontal plane halfway between the upper and lower bars 302. The center of the side portion in contact with the bar 302 is situated on the same vertical axis as the instrument load cell. The crosshead is raised slowly while the article is held in place by hand as necessary until the force is between 0.05 and 0.1N, while taking care not to add any unnecessary force. The gauge circumference at this point is the Initial Gauge Circumference. The test is initiated and the crosshead moves up at 254 mm/min until a force of 19.6N is attained, then the crosshead immediately returns to the Initial Gauge Circumference at the same speed. The maximum circumference at 19.6N and the force at 70% of the maximum circumference during the loading segment and unloading segment of the test are recorded.

The maximum circumference (mm) at 19.6N is defined as the Full Stretch Circumference W1. The Full Stretch Circumference (mm) $\times 0.7$ is defined as the 70% Stretch Circumference W2. The force (N) during the loading segment of the test at 70% Stretch Circumference is defined as the Stretch Circumference Force. The force (N) during the unloading segment of the test at 70% Stretch Circumference is defined as the Fit Circumference Force. Five samples are analyzed and their average are calculated and reported to the nearest 1mm or 0.01N, respectively.

Longitudinal Orientation / Non-directional Orientation / High Order Pattern

This measurement is provided for a visible pattern, which is defined as a visually recognizable pattern by the naked eye when observed from a distance of 10cm. Referring to Figures 11A – 11D, identify a Basic Unit which is a minimum complete unit of the pattern that repeats to create the pattern and capable of surrounding a specific area. Within the Basic Unit, the closest adjacent deformation or printing in the longitudinal direction and the transverse

direction are identified. The spacing between the closest adjacent deformation/printing in the longitudinal direction (Y) and the same in the transverse direction (X) are measured by a scale (unit: 0.1 mm). The Y spacing and/or X spacing may be negative, as is the case for the Y spacing in Figure 11C.

- 5 Those patterns having the X spacing greater than the Y spacing by at least 10% are considered having a Longitudinal Orientation. Those patterns having the X spacing of less than 10% difference from the Y spacing is considered as having a Non-directional Orientation.

Only for those patterns having a Non-direction Orientation, the repetition of the Basic Unit is examined in order to define if there is a High Order Pattern HOP according to the
10 description above. Next, a phantom rectangle of minimum area is drawn using only longitudinally spanning lines and transverse spanning lines, to surround the periphery of the High Order Pattern HOP. The phantom rectangle is the area dimension of the High Order Pattern HOP.

Five portions of the same pattern are analyzed and their average are calculated and
15 reported to the nearest % or 0.1mm^2 , respectively.

Longitudinal Distribution / Transverse Distribution / Pattern Density

1. Sample preparation

An article 20 sample is mounted on a rigid plastic plate which has an appropriate size which enables mounting the elastic belt 40 of the sample in a state stretched by 65% to 90% of its Full Stretch Circumference W1. For measurement of the article samples of Examples 1-2, a rigid plastic plate having a dimension of 250mm in the transverse direction and a thickness of 4mm was used. Further, a stretching block is inserted in the sample between the front side and the plastic plate. Regardless of the size of the sample, the stretching block has a dimension of 110mm in the transverse direction, 170mm in the longitudinal direction, and thickness of 25mm.
25 The stretching block is inserted to the center of the article such that any elastics on the central chassis 38 are in a substantially stretched state.

2. Image acquisition

The sample prepared above is placed on a non-reflective black background plate horizontally with the front side facing up. A Canon camera (CanonEO2 6D Mark 2) with lens
30 (EF 24-105mm f/4L IS2 USM) or equivalent is placed directly vertically above the sample in a length of 1050mm. Two bar lights (Smart Vision Lights LHF 300 or equivalent) are placed 650mm away from the sample in the transverse direction, 300mm away from the sample in the vertical direction, wherein the surface of the light is faced in an angle of 45 ± 6 degrees from the

horizontal direction, and the longer dimension of the bar light is placed in parallel with the longitudinal axis of the sample. The focal length of the camera is set to 64mm. The image acquisition settings are; ISO: 400, F: 5.0, exposure time: 1/160seconds

3. Image analysis for Pattern Density

- 5 a) The above acquired images are imported into ImageJ software (version. 1.52h, National Institute of Health, USA) or equivalent, and converted into 8 bit.
- b) Set the scale referencing to the rigid plastic plate.
- c) The analyzing region of the first belt pattern and first crotch pattern are cropped out simultaneously as a 50mm x 50mm square each, and side by side, from nearly the transverse
10 center of the article, while avoiding regions which have wrinkles, shadows, or high reflection. The images obtained by this step were as such: Figure 12A for FBP of Example 1, Figure 13A for FCP of Example 1, Figure 14A for FBP of Example 2, and Figure 15A for FCP of Example 2. This order of Figures (12, 13, 14, 15) for the respective patterns will be the same for the remaining images described below.
- 15 d) The cropped images are filtered using the “FFT bandpass filter” in ImageJ with filter large structure down to 10 pixels, filter small structure up to 3 pixels with check marks on the “function of autoscale after filtering” and “surtulation when autoscaling”.
- e) The filtered images obtained in step d) are converted to black & white color using threshold at 70 gray value.
- 20 f) An ImageJ built-in plugin called “particle analysis” is applied to the threshold images obtained in step e) for filtering out particles having a size of less than 0.2mm^2 , set “Show” pull down menu to “Masks” to create cleaned pattern images and check mark on the summary table. The cleaned pattern images obtained by this step for Examples 1 and 2 were Figures 12B – 15B. The pattern density is defined as % Area from the summary table. Five samples are analyzed
25 and their average are calculated and reported to the nearest 0.1 points.

4. Image analysis for Longitudinal Distribution / Transverse Distribution

- g) The cleaned pattern images obtained in step f) are T filtered using the “Gaussian Blur” filter in ImageJ with a Sigma (radius) of 1mm. The images obtained by this step for Examples 1 and 2 were Figures 12C – 15C.
- 30 h) To calculate the orientation distribution, an ImageJ built-in plugin called “directionality” is applied to the blur filtered images obtained in step g) to calculate the orientation distribution. The analysis parameters used are: Method: Fourier components; Nbins: 5, histogram start: -45; histogram end: 135 with check mark at the Display table.

i) Obtain directional distribution from the output table. The output table contains distribution of each angle -45° , 0° , 45° , 90° and 135° . Transversal Distribution is defined as the distribution% at 0° . Longitudinal Distribution is defined as the distribution% at 90° . Five samples are analyzed and their average are calculated and reported to the nearest 0.01 points.

5

EXAMPLES

Examples 1 and 2 were created by having the belt configuration of Figure 2, the planning of First Belt Pattern FBP and First Crotch Pattern FCP as in Figures 6A and 6B respectively, actual images as in Figures 12A – 15A respectively, and elastic/bonding profile as in Table 1.

10 The Longitudinal/Transverse Distribution and Pattern Density of Examples 1 and 2 were obtained, as in Table 2.

Table 1

	Dtex / elongation% / number of elastic members
Front waist zone	470Dtex / 160% / 4 with elastic pitch of 6mm
Front distal tummy zone	470Dtex / 160% / 2 470Dtex / 230% / 2 with tummy cut (*1)
Front proximal tummy zone	940Dtex / 230% / 8 with tummy cut (*1)
Front leg zone	470Dtex / 130% / 2 with tummy cut (*1)
Back waist zone	470Dtex / 160% / 4 with elastic pitch of 6mm
Back distal tummy zone	940Dtex / 160% / 4 with elastic pitch of 6mm
Back proximal tummy zone	470Dtex / 230% / 4 470Dtex / 270% / 4 with elastic pitch of 12mm and tummy cut (*1)
Back leg zone	470Dtex / 270% / 2 with tummy cut (*1)
Outer sheet material	Air-through carded nonwoven made by Beijing Dayuan having basis weight of 20gsm
Outer sheet aperture minus radius	0.45 – 0.55mm
Outer sheet DF1	3.8mm
Outer sheet DF2	2mm
VG1	7mm
VG2	1mm

(*1) “Tummy cut” in Table 1 refers to removal of elasticity at the transverse central area of elastic strands resulting in 68% effective length of elasticity.

Table 2

	Example 1	Example 2
FBP Longitudinal Distribution	0.90	0.55
FBP Transverse Distribution	0.02	0.05
FBP Pattern Density	7.8	4.4
FCP Longitudinal Distribution	0.86	0.51
FCP Transverse Distribution	0.02	0.11
FCP Pattern Density	5.3	5.2

The article of Examples 1 and 2 provide aesthetically pleasing integral appearance. The article of Examples 1 and 2 also have improved stretchability for ease of application, improved fit for preventing sagging, improved comfort and softness, and improved breathability for skin health.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.” Further, every numerical range given throughout this specification includes every narrower numerical range that falls within such broader numerical range.

Every document cited herein, including any cross referenced or related patent or application, is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests or discloses any such invention. Further, to the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

CLAIMS

What is claimed is:

1. A wearable article continuous in a longitudinal direction and a transverse direction comprising a front elastic belt, a back elastic belt, a crotch region, a waist opening, and a pair of leg openings; the crotch region extending longitudinally between the front elastic belt and the back elastic belt;

the front elastic belt and back elastic belt having a transverse dimension of LW, the smaller longitudinal dimension of the front elastic belt or the back elastic belt having a dimension of LS, wherein from about 10% to about 40% of LW, and from about 15% to about 75% of LS, preferably from about 30% to about 70% of LS, is removed of its elastic activity, wherein the region of the front elastic belt and the back elastic belt removed of its elastic activity defines a non-elastic region ; the front and back non-elastic regions have a First Belt Pattern FBP and the crotch region has a First Crotch Pattern FCP;

wherein the First Belt Pattern FBP is a Geometric Pattern, the First Crotch Pattern FCP is an Aesthetic Pattern,

wherein both the First Belt Pattern FBP and the First Crotch Pattern FCP have a Longitudinal Orientation, according to the measurements herein.

2. A wearable article continuous in a longitudinal direction and a transverse direction comprising a front elastic belt, a back elastic belt, a crotch region, a waist opening and a pair of leg openings; the crotch region extending longitudinally between the front elastic belt and the back elastic belt;

the front elastic belt and back elastic belt having a transverse dimension of LW, the smaller longitudinal dimension of the front elastic belt or the back elastic belt having a dimension of LS, wherein from about 10% to about 40% of LW, and from about 15% to about 75% of LS, preferably from about 30% to about 70% of LS, is removed of its elastic activity, wherein the region of the front elastic belt and the back elastic belt removed of its elastic activity defines a non-elastic region; the front and back non-elastic regions have a First Belt Pattern FBP; and the crotch region has a First Crotch Pattern FCP;

wherein the First Belt Pattern FBP is a Geometric Pattern, the First Crotch Pattern FCP is an Aesthetic Pattern,

wherein both the First Belt Pattern FBP and the First Crotch Pattern FCP have a Longitudinal Distribution of at least about 35%, preferably at least about 50%, more preferably

at least about 70%, and a Transverse Distribution of no more than about 35%, preferably no more than about 20%, more preferably no more than about 10%, according to the measurements herein.

5 3. The article of any of the preceding claims wherein the First Belt Pattern FBP and the First Crotch Pattern FCP have a common element.

4. The article of any of the preceding claims wherein the First Crotch Pattern FCP is a Geometric Pattern.

10 5. A wearable article continuous in a longitudinal direction and a transverse direction comprising a front elastic belt, a back elastic belt, a crotch region, a waist opening and a pair of leg openings; the crotch region extending longitudinally between the front elastic belt and the back elastic belt;

15 the front elastic belt and back elastic belt having a transverse dimension of LW, the smaller longitudinal dimension of the front elastic belt or the back elastic belt having a dimension of LS, wherein from about 10% to about 40% of LW, and from about 15% to about 75% of LS, preferably from about 30% to about 70% of LS, is removed of its elastic activity, wherein the region of the front elastic belt and the back elastic belt removed of its elastic activity
20 defines a non-elastic region; the front and back non-elastic regions have a First Belt Pattern FBP and the crotch region has a First Crotch Pattern FCP;

 wherein both the First Belt Pattern FBP and the First Crotch Pattern FCP form a High Order Pattern HOP in an area dimension of from about 16mm² to about 100mm², wherein the First Belt Pattern FBP and the First Crotch Pattern FCP are Geometric Patterns having a
25 common element, and both the First Belt Pattern FBP and the First Crotch Pattern FCP have a Non-directional Orientation, according to the measurements herein.

6. The article of any of Claims 3-5 wherein the non-elastic region further comprises a Second Belt Pattern SBP which is a Geometric Pattern.

30 7. The article of any of Claims 3-5 wherein the crotch region further comprises a Second Crotch Pattern SCP which is a Geometric Pattern.

8. The article of any of Claims 3-5 wherein the non-elastic region further comprises a
35 Second Belt Pattern SBP which is an Aesthetic Pattern, the crotch region further comprises a

Second Crotch Pattern SCP which is an Aesthetic Pattern, wherein the Second Belt Pattern SBP and the Second Crotch Pattern SCP have a common element.

9. The article of any of the preceding claims wherein the First Belt Pattern FBP has a Pattern Density and the First Crotch Pattern FCP has a Pattern Density, wherein the difference between the Pattern Density of the First Belt Pattern FBP and that of the First Crotch Pattern FCP is less than about 10 points according to the measurements herein.

10. The article of any of the preceding claims wherein the First Belt Pattern FBP and the First Crotch Pattern FCP are formed by apertures having a minor radius of at least about 0.1mm.

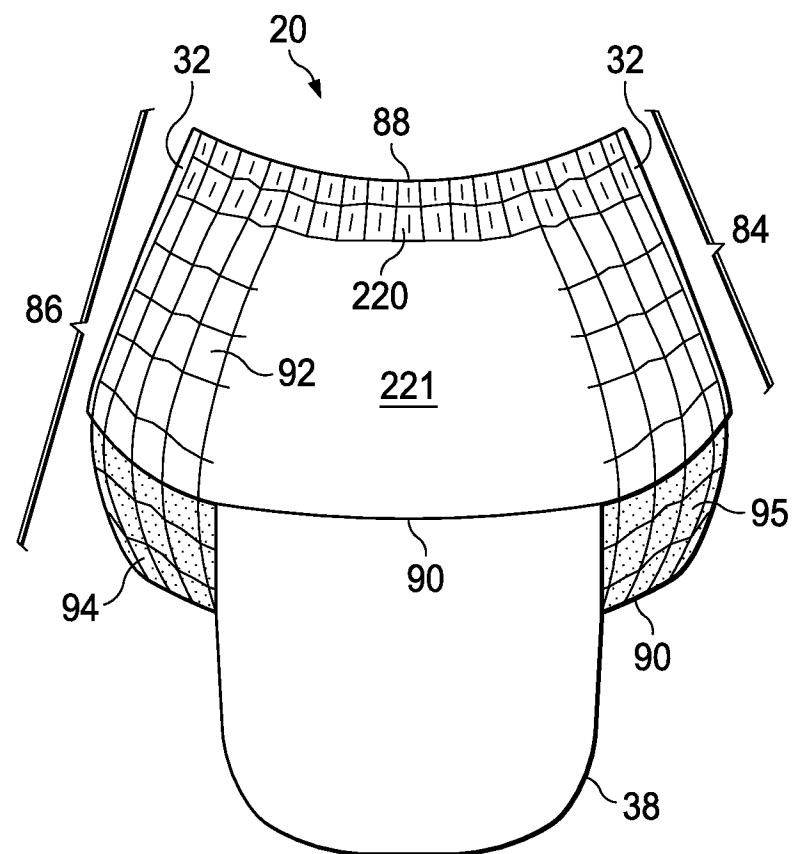
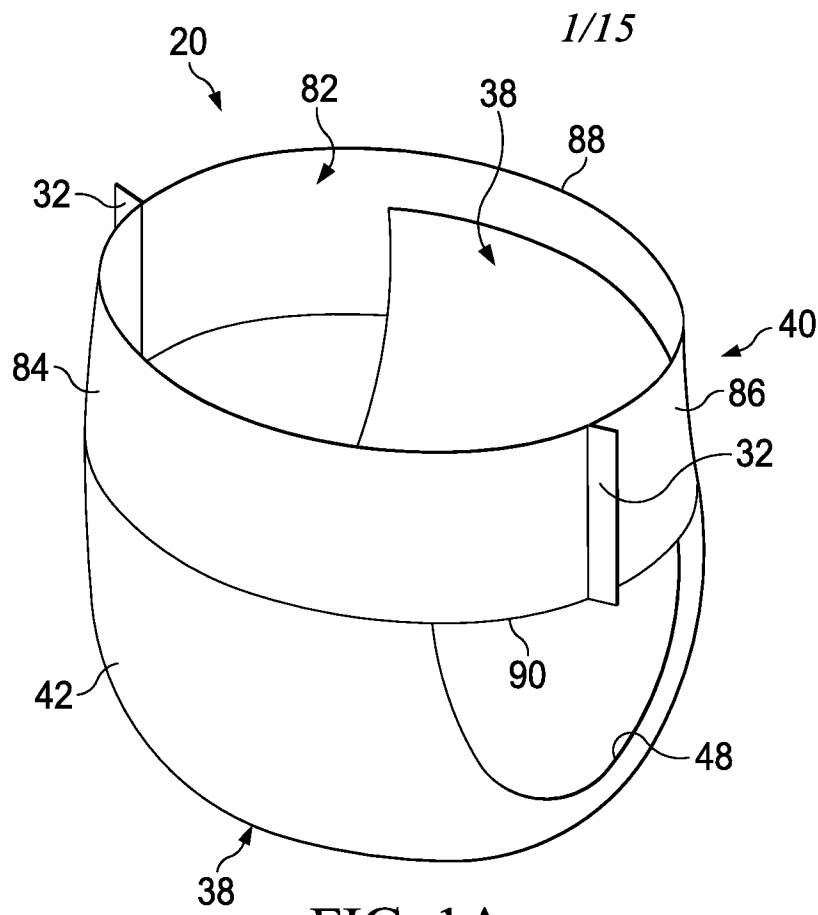
11. The article of Claim 10 wherein the apertures are aligned in a plurality of lines extending in the longitudinal direction, wherein the lines are spaced apart from each other with a transverse pitch DF1 of from about 2 mm to about 15 mm.

12. The article of any of Claims 1-9 wherein the First Belt Pattern FBP and the First Crotch Pattern FCP are embossings.

13. The article of any of the preceding claims wherein the front elastic belt and the back elastic belt each comprise an elastic region, the elastic regions at least extending along the waist opening in the transverse direction to provide a circumferential elastic region, wherein the front elastic belt and the back elastic belt is a laminate comprising an inner sheet, an outer sheet, and an elastic member running in the transverse direction, wherein the outer sheet comprises apertures displayed in the First Belt Pattern FBP.

14. The article of Claim 13 wherein the entire garment facing surface of the front elastic belt and the back elastic belt have the First Belt Pattern FBP.

15. The article of Claim 13 or 14 wherein the laminate comprises an elastic bonding and a vertical bonding, the elastic bonding continuously bonds the elastic member for at least about 10mm in the direction of stretch in a region adjacent the side edges of the front and back elastic belts, and the vertical bonding applied to at least one of the inner sheet and the outer sheet with intervals in the transverse direction for intermittently bonding the elastic member to at least one of the inner sheet and the outer sheet.



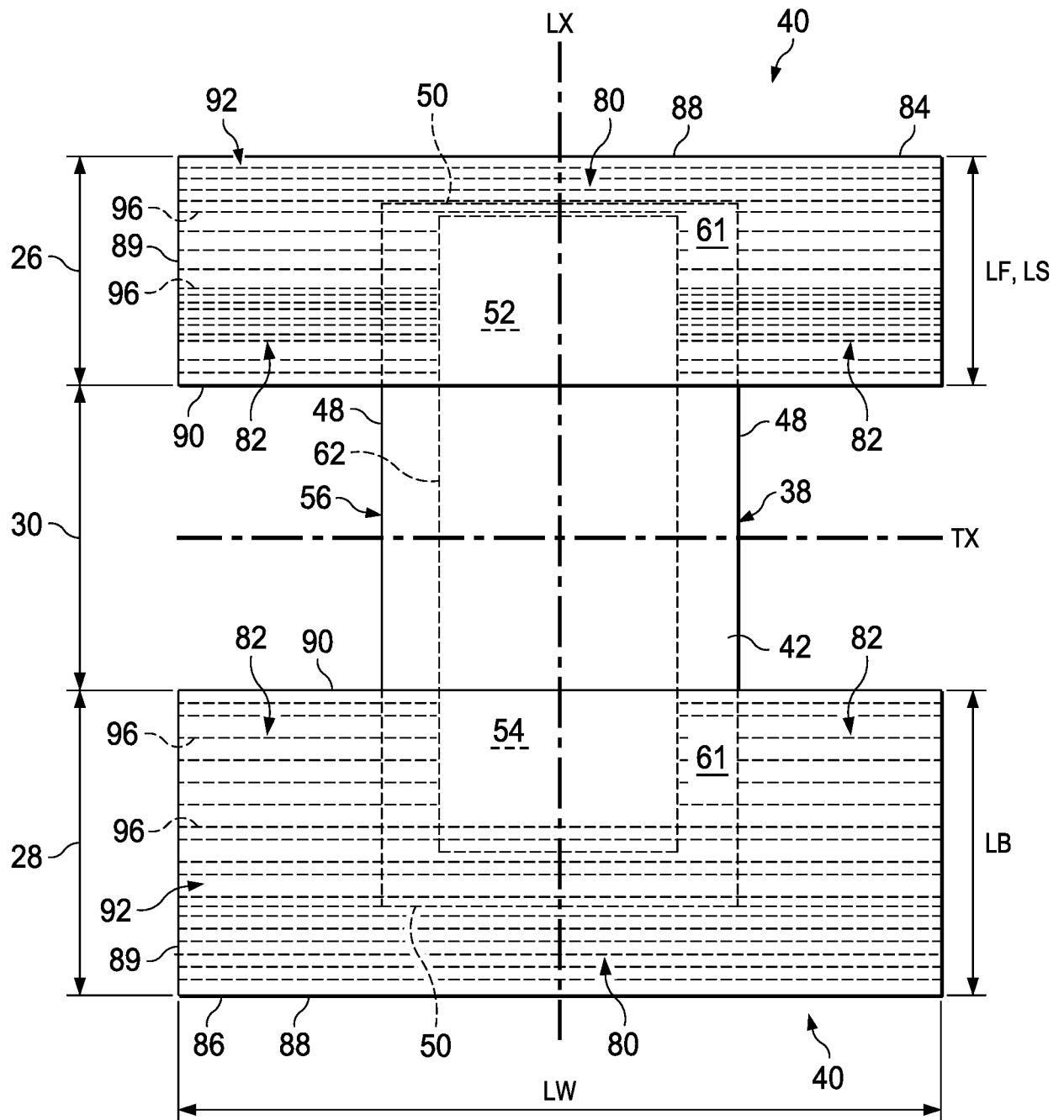
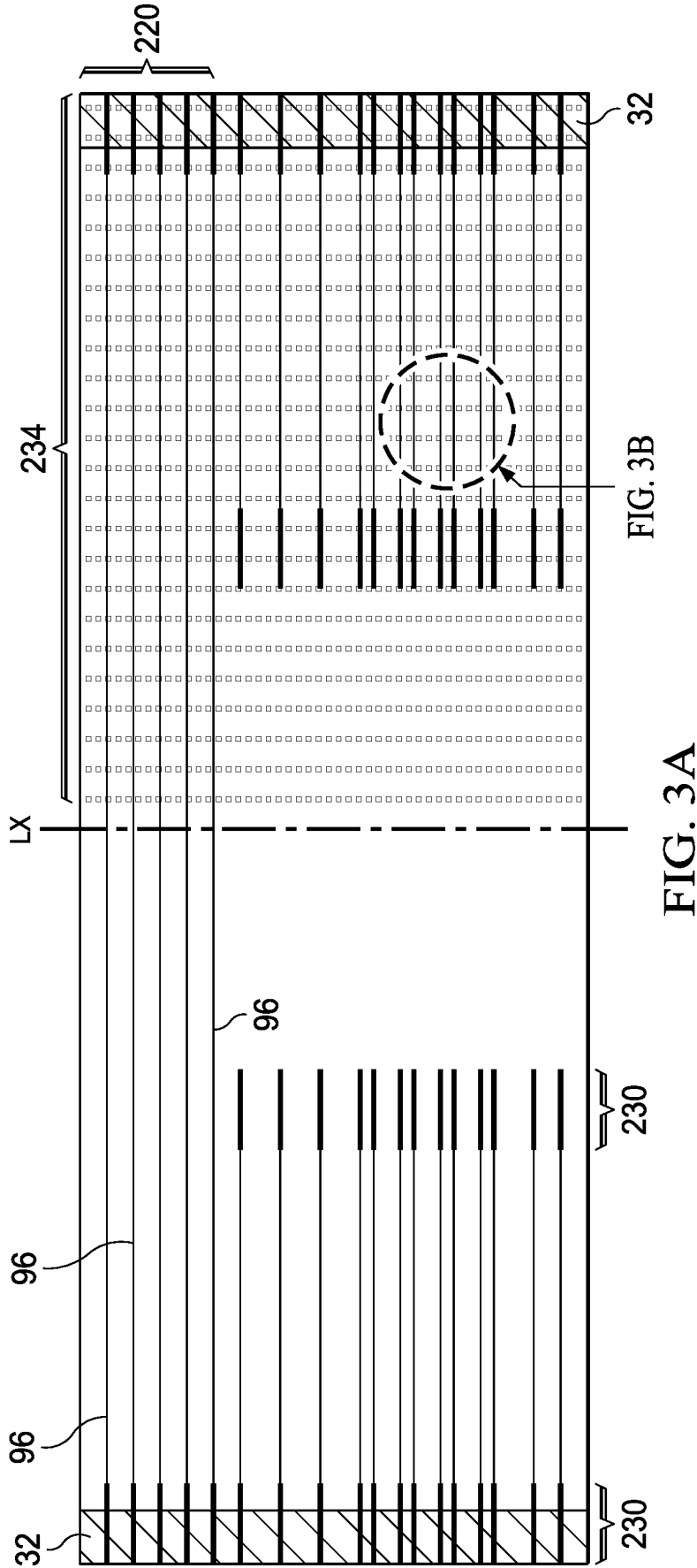


FIG. 2



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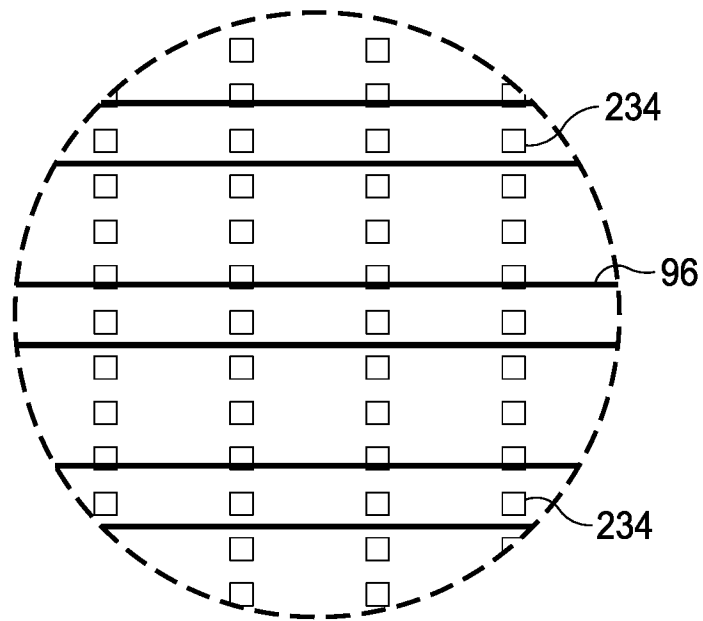


FIG. 3B

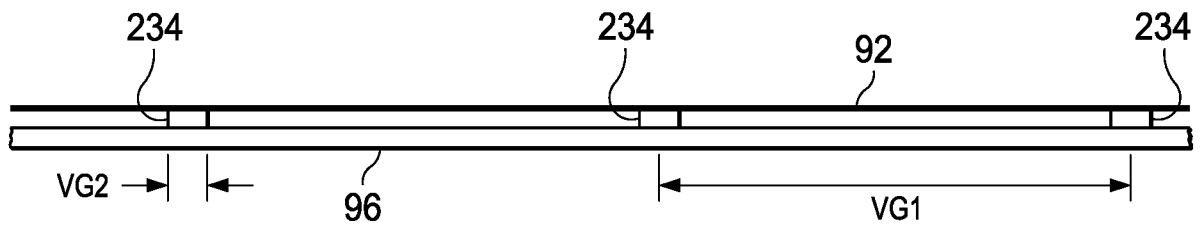


FIG. 4A

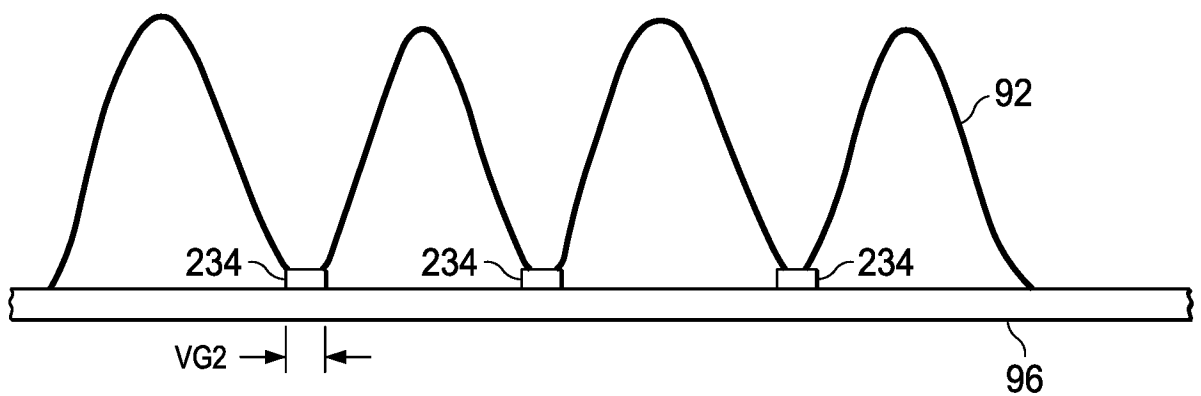


FIG. 4B

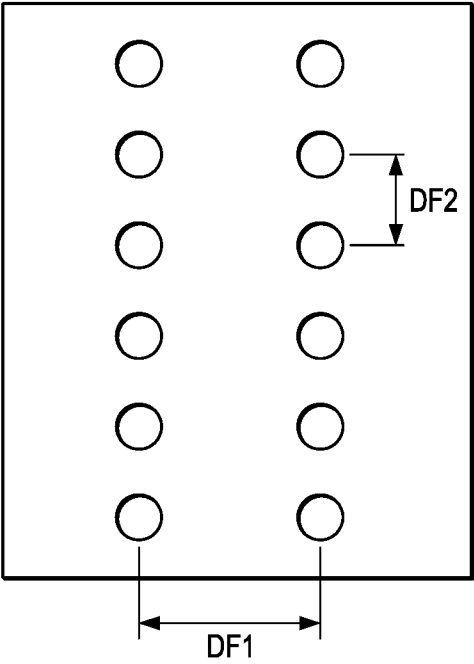


FIG. 5A

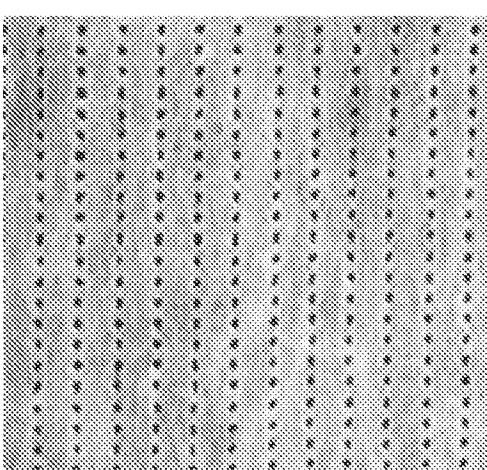


FIG. 5B

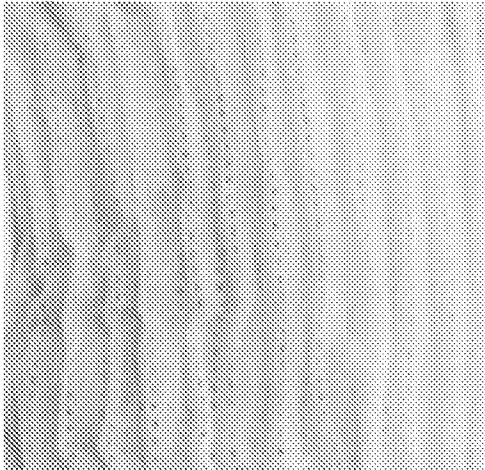


FIG. 5C

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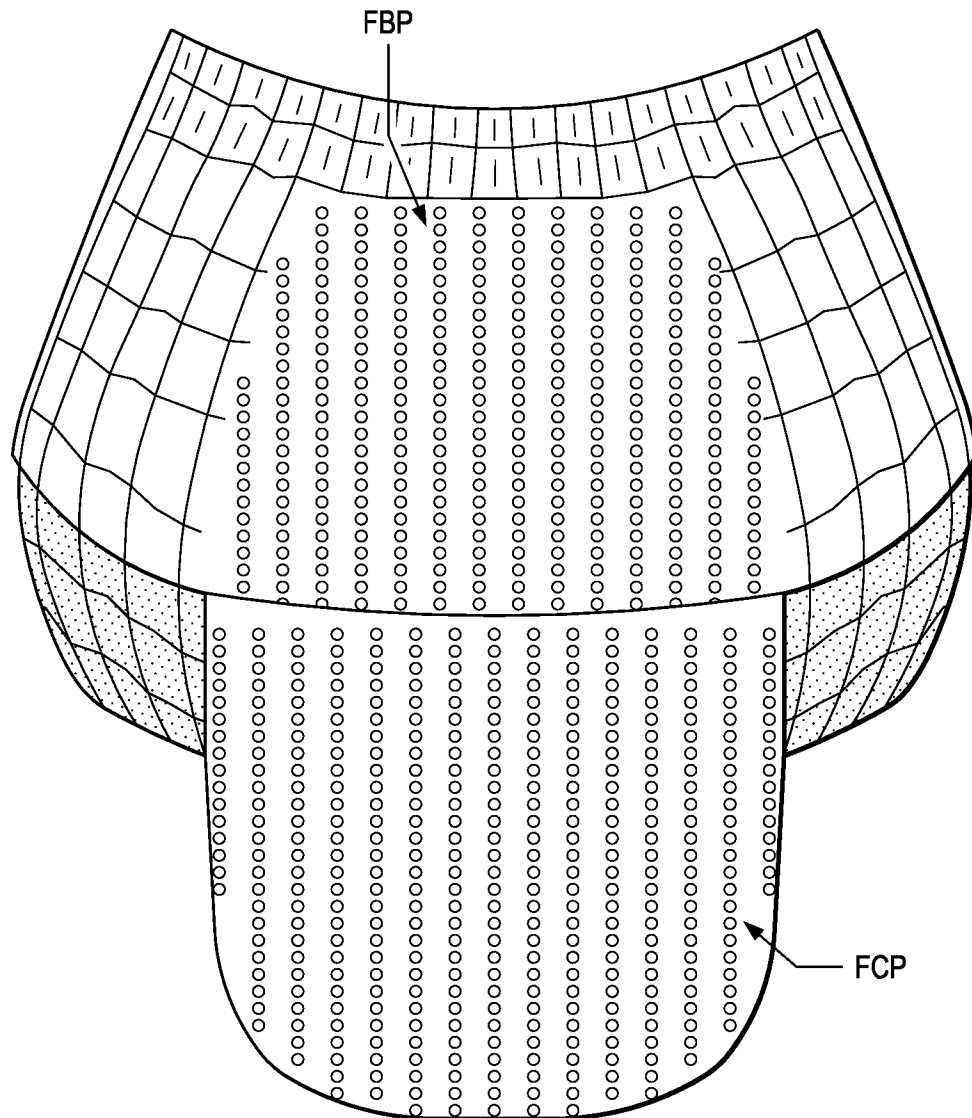


FIG. 6A

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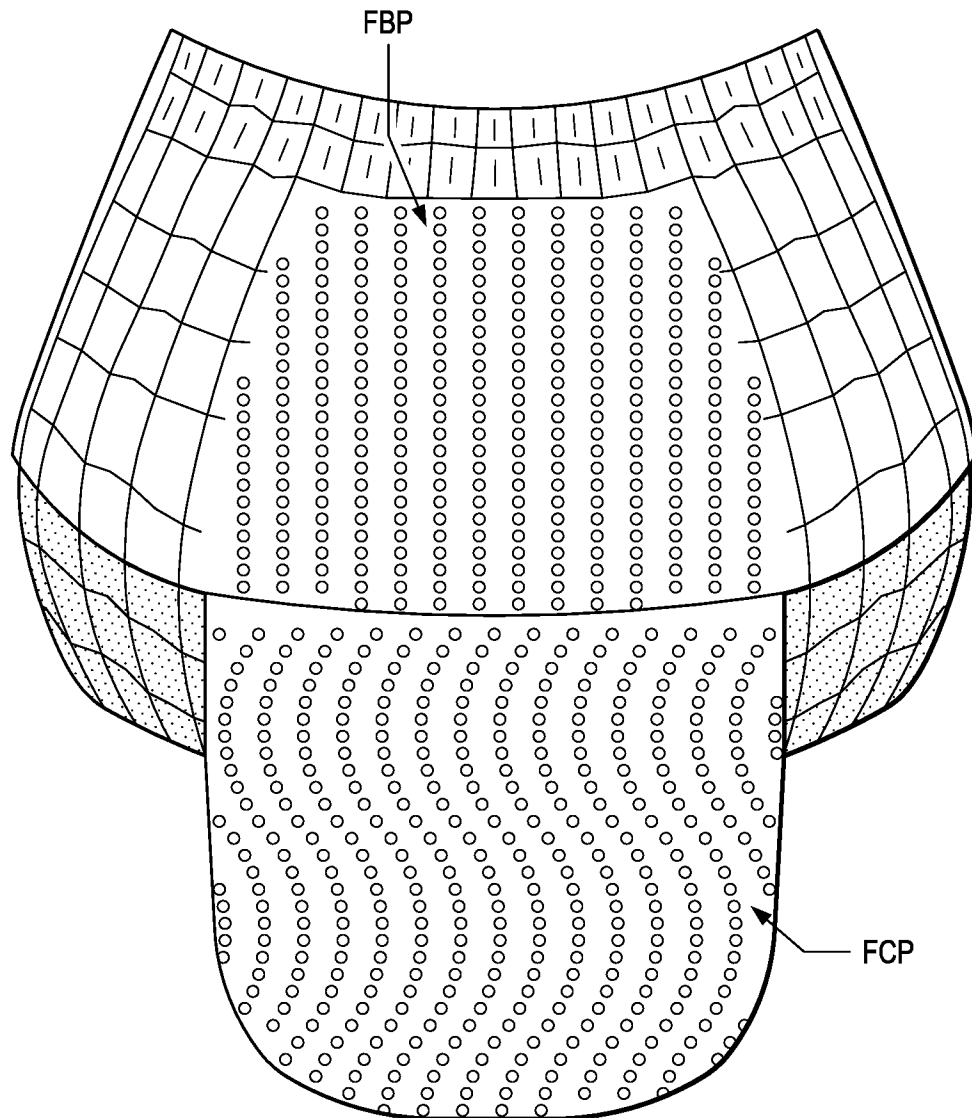


FIG. 6B

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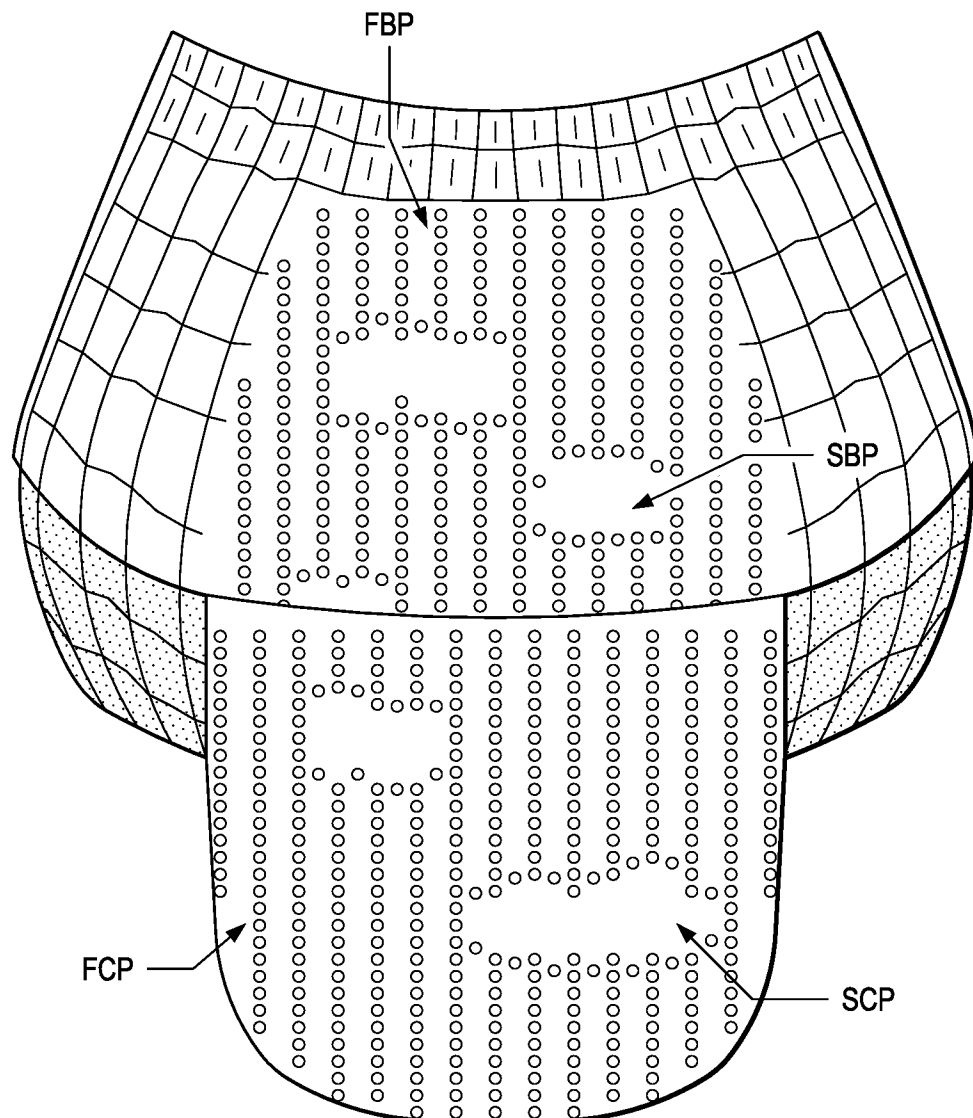


FIG. 7

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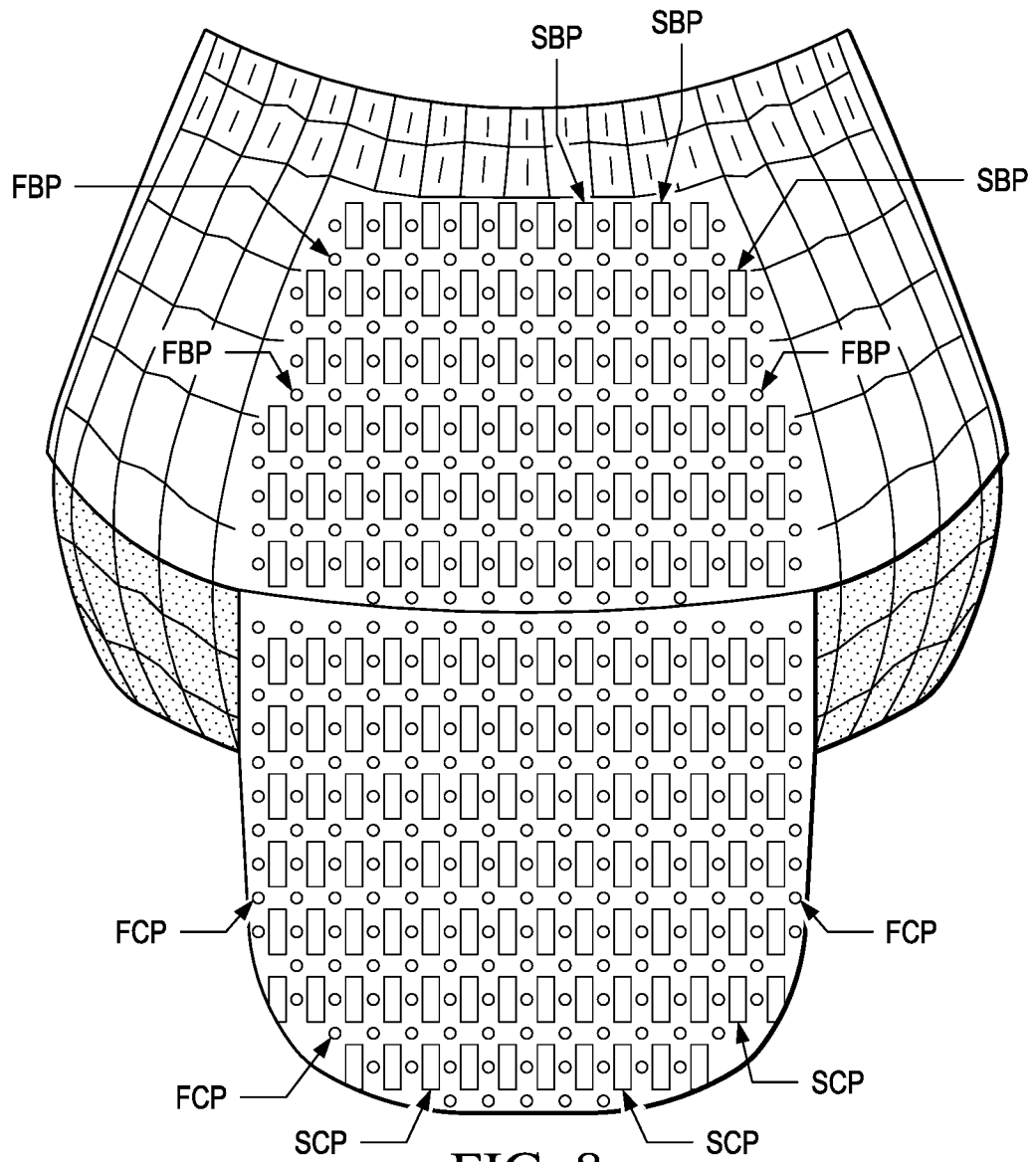


FIG. 8

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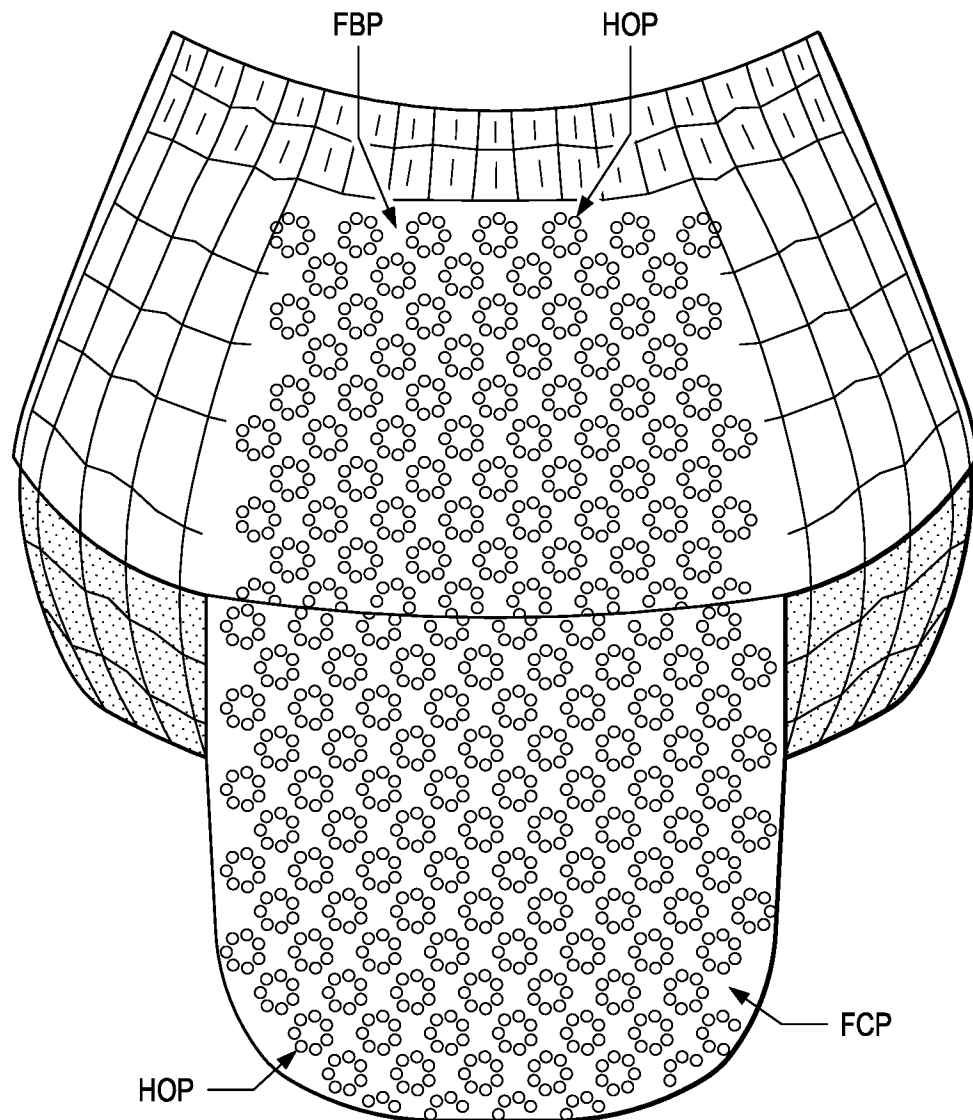


FIG. 9

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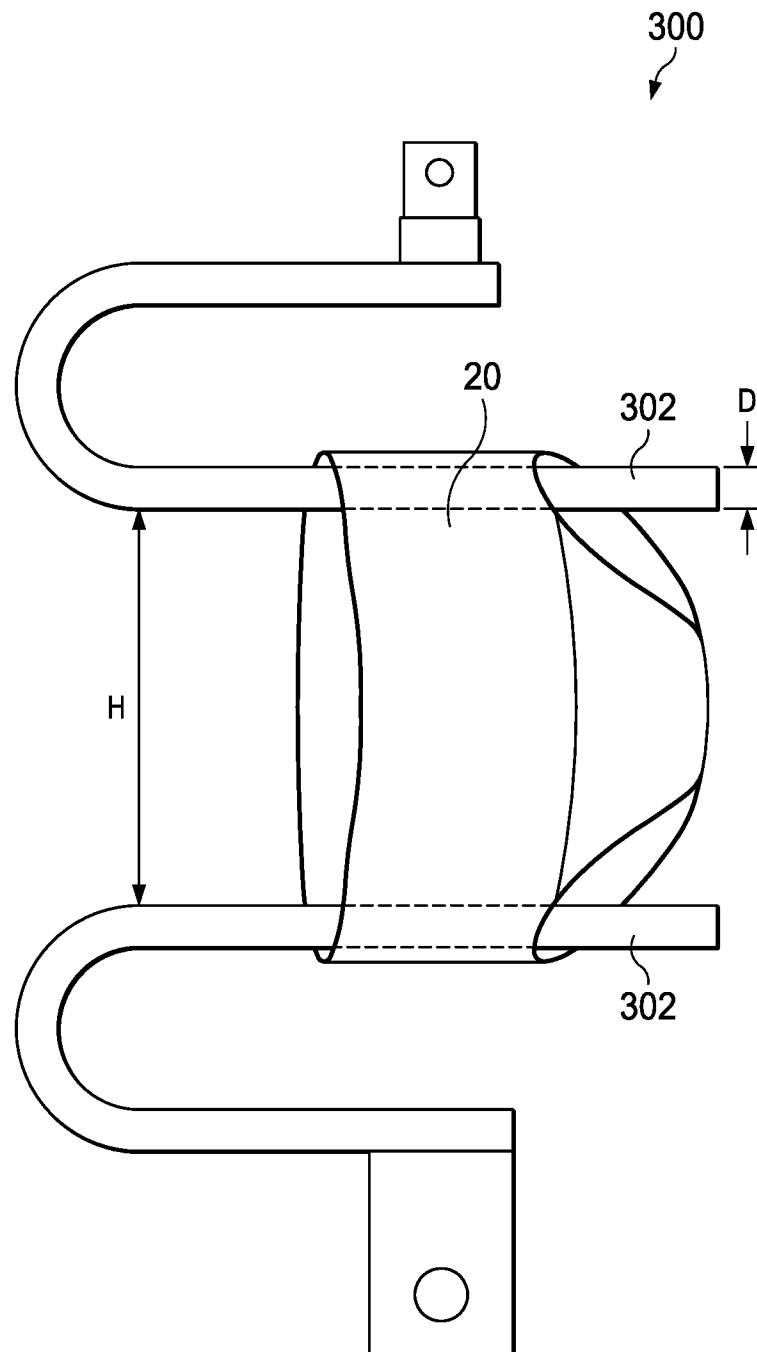


FIG. 10

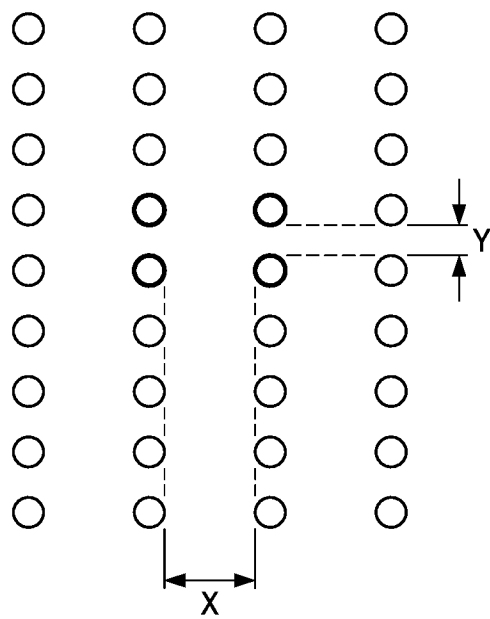


FIG. 11A

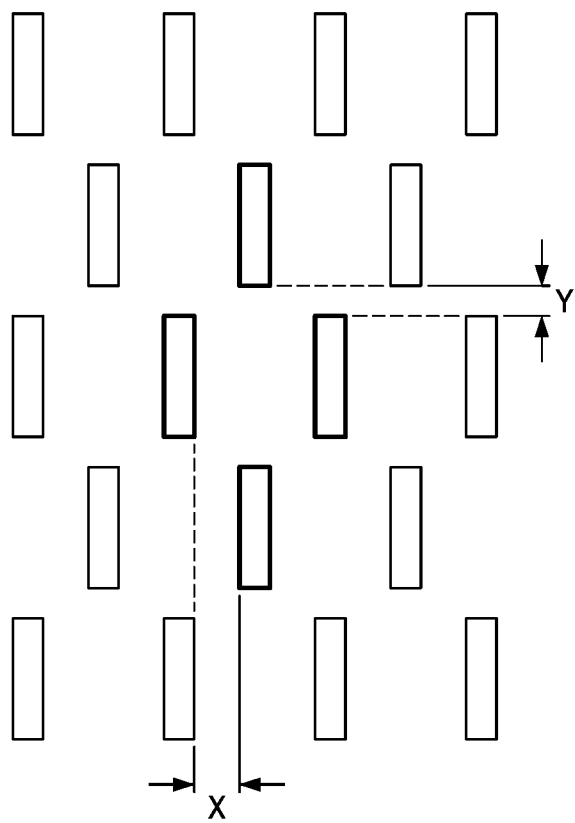


FIG. 11B

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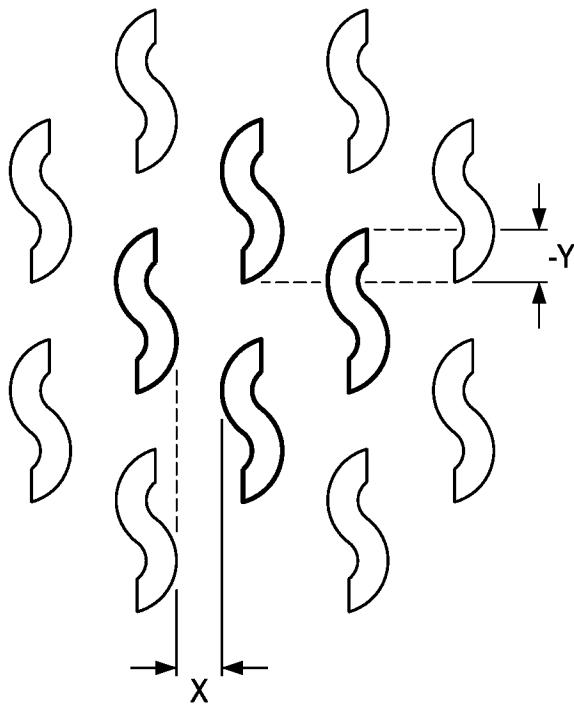


FIG. 11C

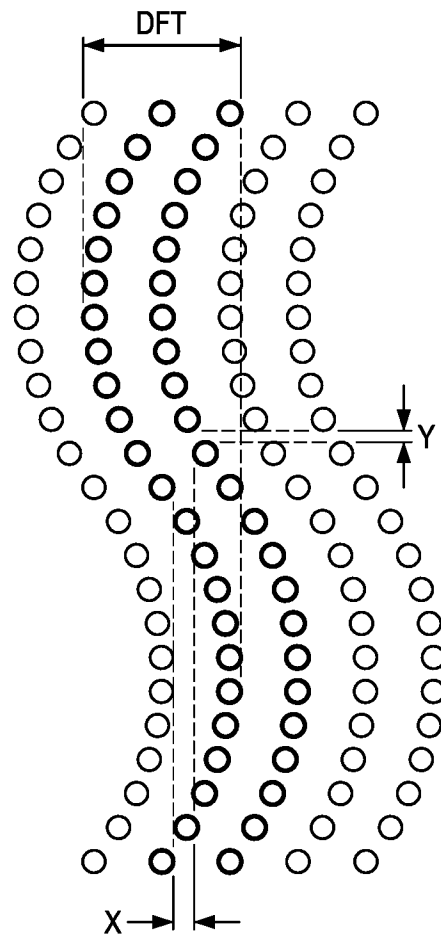


FIG. 11D

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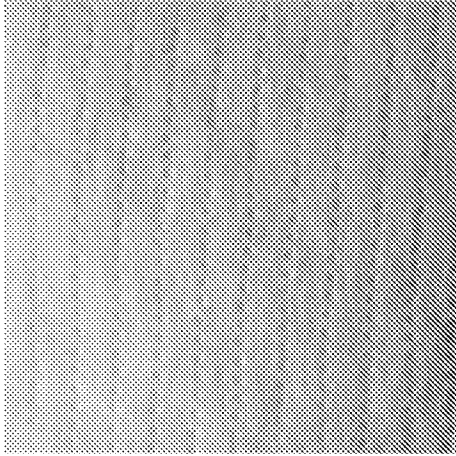


FIG. 12A

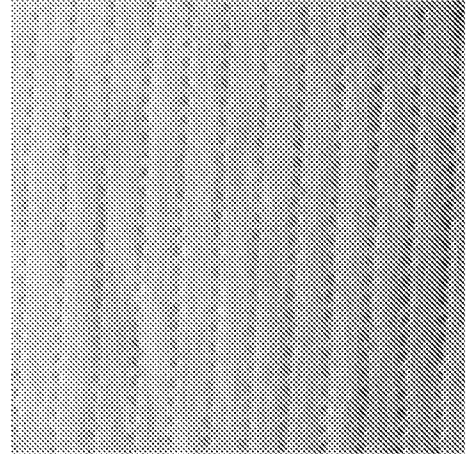


FIG. 13A

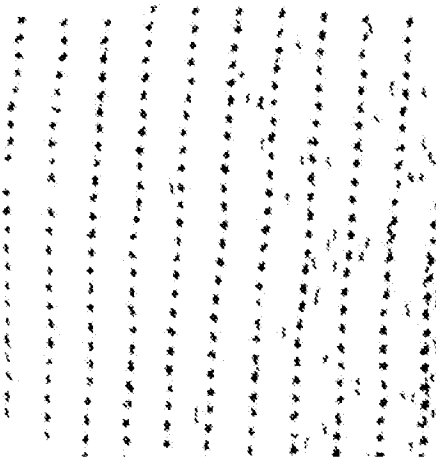


FIG. 12B

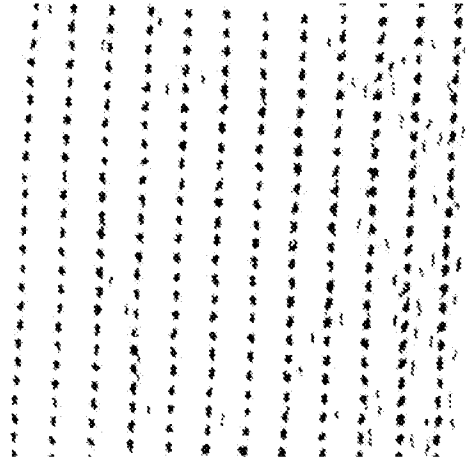


FIG. 13B

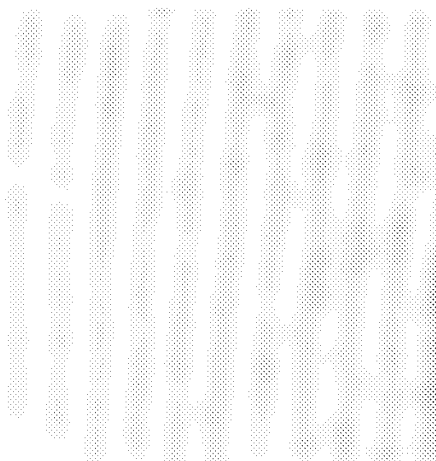


FIG. 12C

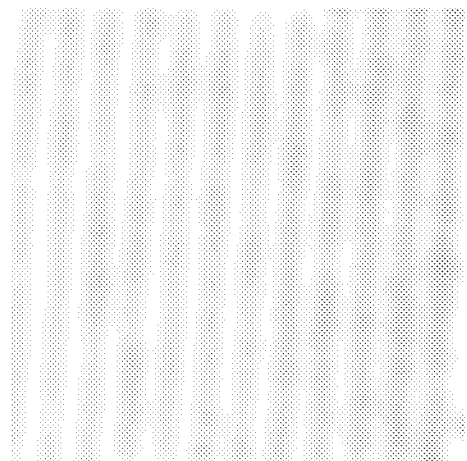


FIG. 13C

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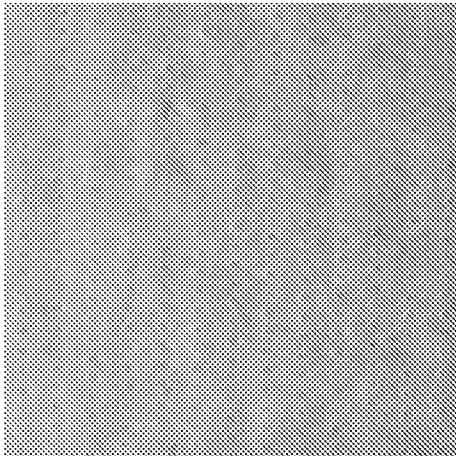


FIG. 14A

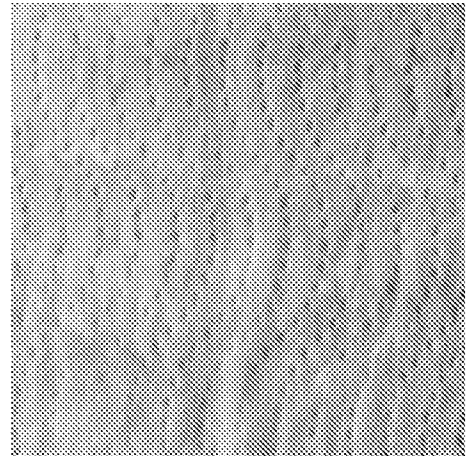


FIG. 15A

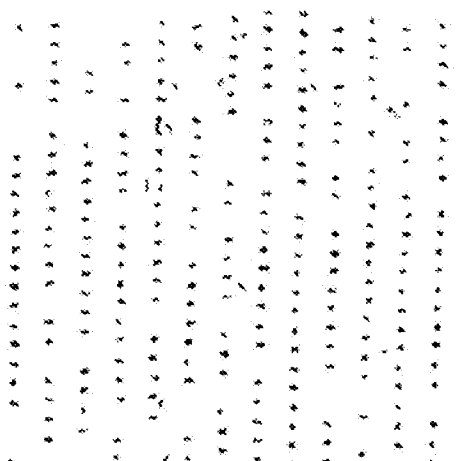


FIG. 14B

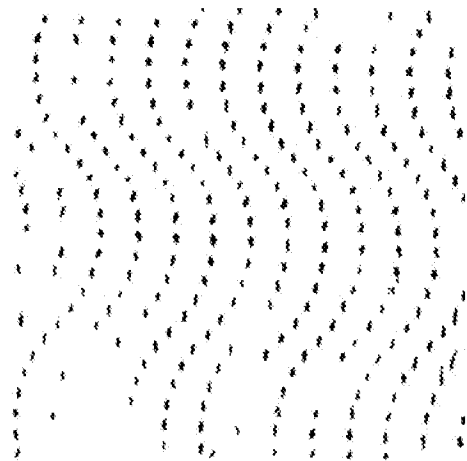


FIG. 15B



FIG. 14C



FIG. 15C

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/075102

A. CLASSIFICATION OF SUBJECT MATTER

A61F 13/496(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61F13/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, WPI, EPODOC, CNKI; PROCTER & GAMBLE, pant, crotch, elastic+, pattern, aperture?, embossing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 107260401 A (DAIO PAPER CORP.) 20 October 2017 (2017-10-20) paragraphs [0114]-[0183] and figures 1-9	1-15
Y	CN 104349761 A (PROCTER & GAMBLE CO.) 11 February 2015 (2015-02-11) paragraphs [0041]-[0054] and figures 1-7f	1-15
A	WO 2019026529 A1 (UNICHARM CORPORATION) 07 February 2019 (2019-02-07) the whole document	1-15
A	CN 108601687 A (UNI-CHARM K.K.) 28 September 2018 (2018-09-28) the whole document	1-15
A	JP 2007068819 A (OJI NEPIA CO., LTD.) 22 March 2007 (2007-03-22) the whole document	1-15
A	CN 204428283 U (KAO CORP.) 01 July 2015 (2015-07-01) the whole document	1-15
A	CN 208160703 U (DAIO PAPER CORP.) 30 November 2018 (2018-11-30) the whole document	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

14 October 2019

Date of mailing of the international search report

13 November 2019

Name and mailing address of the ISA/CN

National Intellectual Property Administration, PRC
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Facsimile No. (86-10)62019451

Telephone No. 86-(10)-53962497

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2019/075102

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	107260401	A	20 October 2017	JP	6298093	B2	20 March 2018
				TW	201733546	A	01 October 2017
				CN	208160703	U	30 November 2018
				EP	3437602	A1	06 February 2019
				WO	2017169338	A1	05 October 2017
				BR	112018069373	A2	22 January 2019
				JP	2017176503	A	05 October 2017
CN	104349761	A	11 February 2015	EP	2849710	A2	25 March 2015
				US	10166155	B2	01 January 2019
				JP	2017099942	A	08 June 2017
				JP	2015519951	A	16 July 2015
				US	2019076306	A1	14 March 2019
				US	9339421	B2	17 May 2016
				CN	104349761	B	16 November 2018
				US	2013310798	A1	21 November 2013
				BR	112014028359	A2	27 June 2017
				JP	6096286	B2	15 March 2017
				WO	2013173290	A2	21 November 2013
				US	2017027770	A1	02 February 2017
WO	2019026529	A1	07 February 2019	JP	2019025065	A	21 February 2019
				TW	201909860	A	16 March 2019
CN	108601687	A	28 September 2018	JP	6427511	B2	21 November 2018
				US	2019060142	A1	28 February 2019
				EP	3395310	A1	31 October 2018
				TW	201735884	A	16 October 2017
				JP	2017136110	A	10 August 2017
				WO	2017134889	A1	10 August 2017
JP	2007068819	A	22 March 2007	None			
CN	204428283	U	01 July 2015	None			
CN	208160703	U	30 November 2018	JP	6298093	B2	20 March 2018
				TW	201733546	A	01 October 2017
				EP	3437602	A1	06 February 2019
				CN	107260401	A	20 October 2017
				WO	2017169338	A1	05 October 2017
				BR	112018069373	A2	22 January 2019
				JP	2017176503	A	05 October 2017