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updated as appropriate

Additional Fields
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GB 2610963 B

Fig. 1

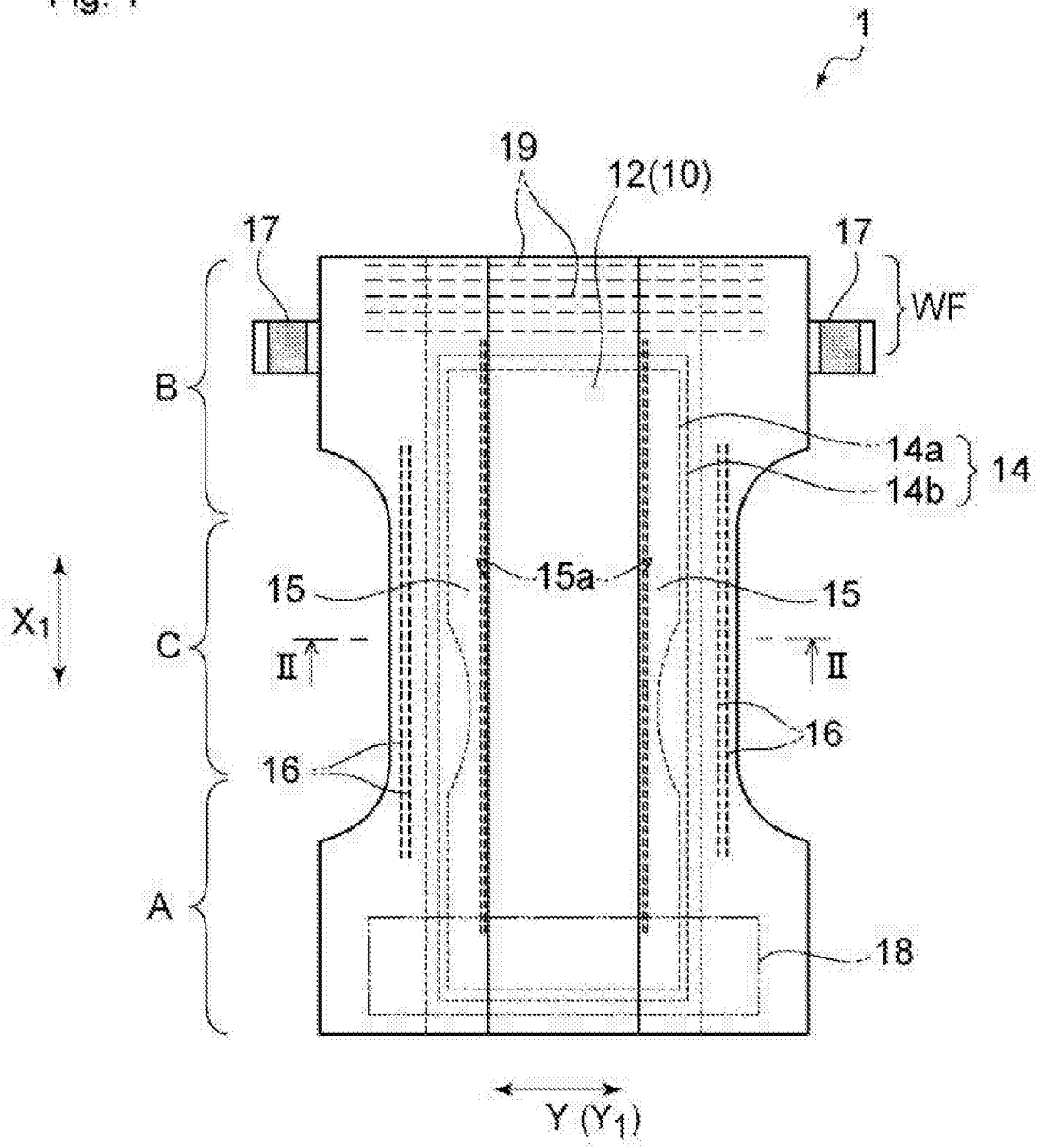


Fig. 2

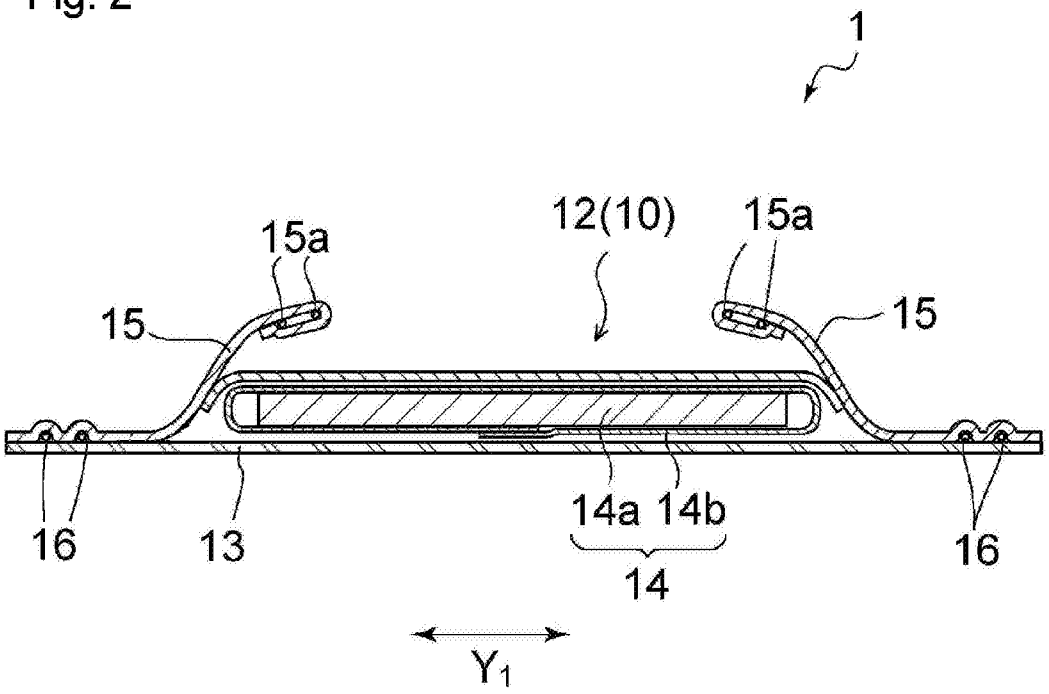
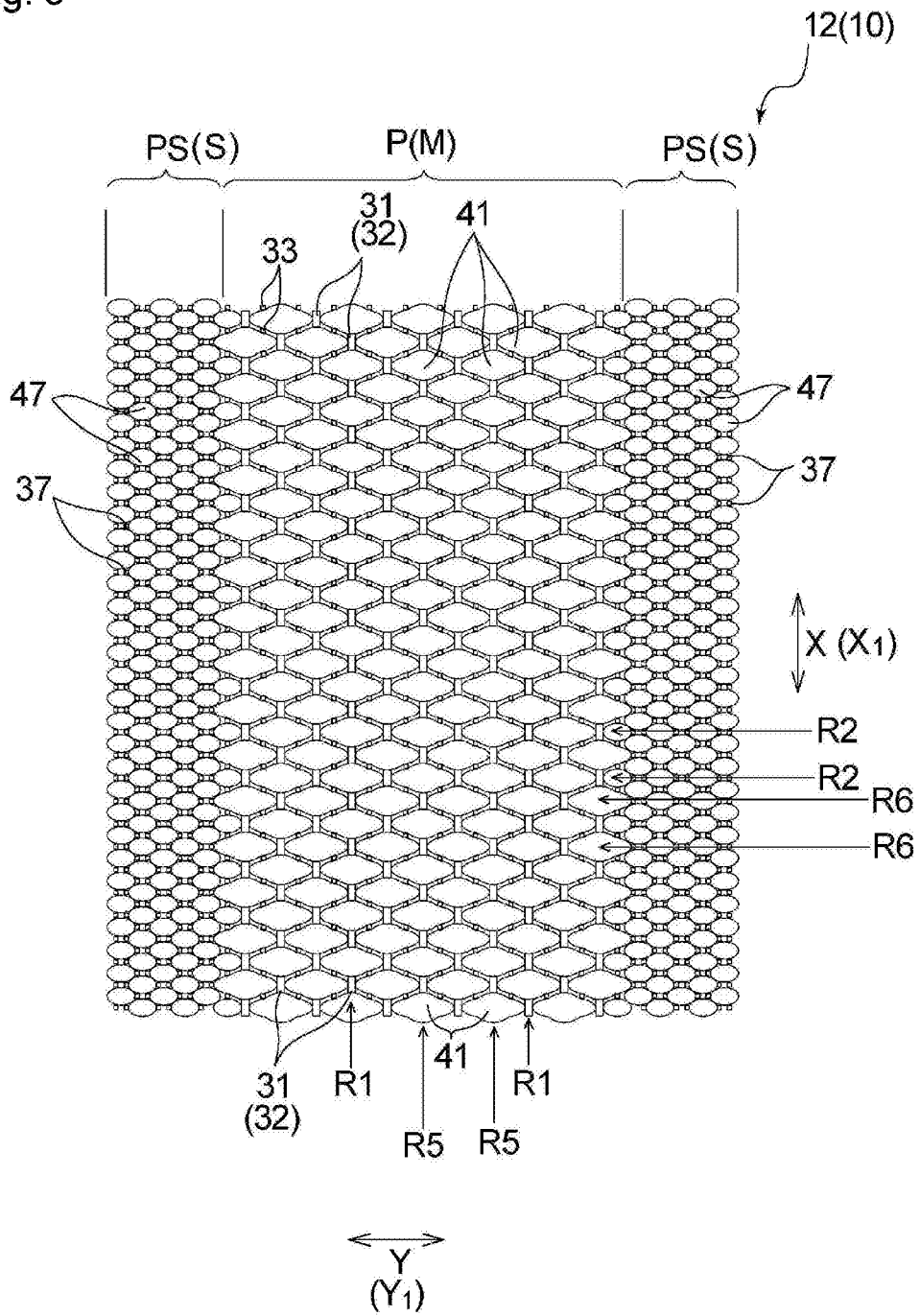


Fig. 3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PS(S)
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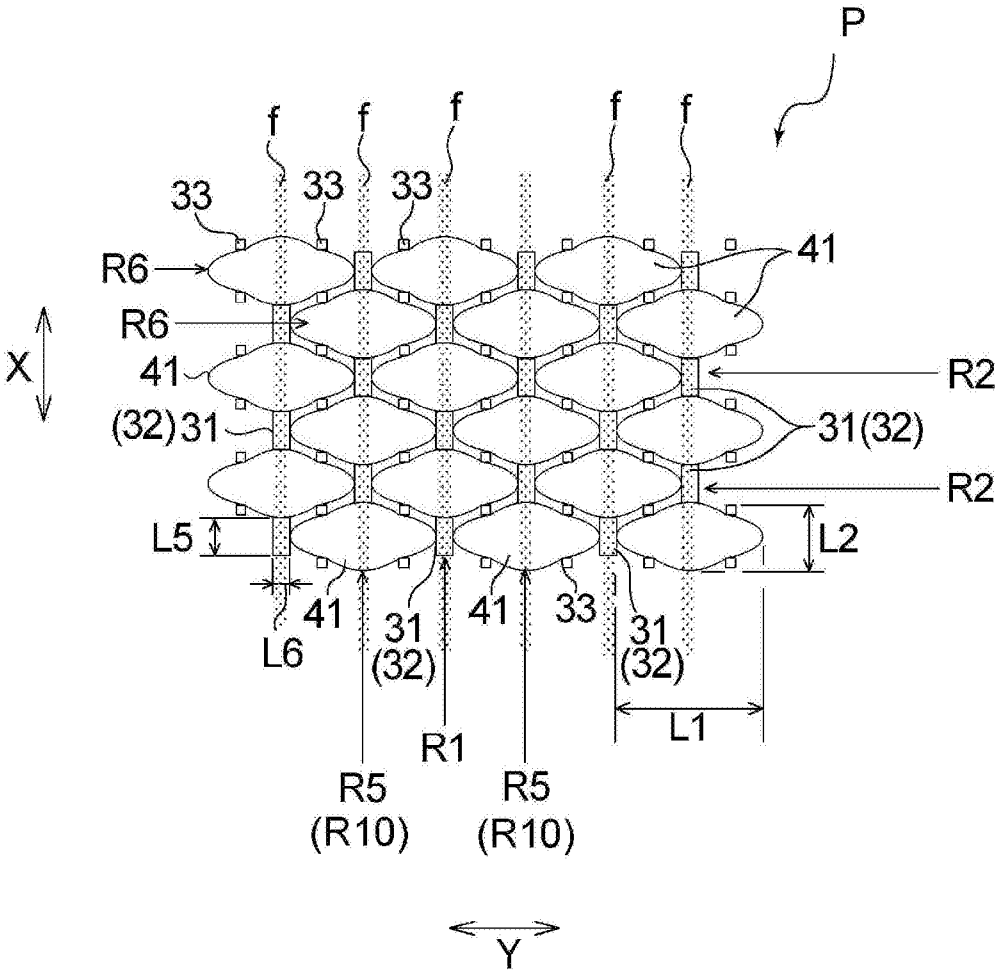
(32)
41
33
47
47
37
37
X (X1)
R2
R2
R6
R6
31
(32)
R1
41
R1
R5
R5
Y
(Y1)

Fig. 4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R6
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R2
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L5
L2
41
L6
31
(32)
41
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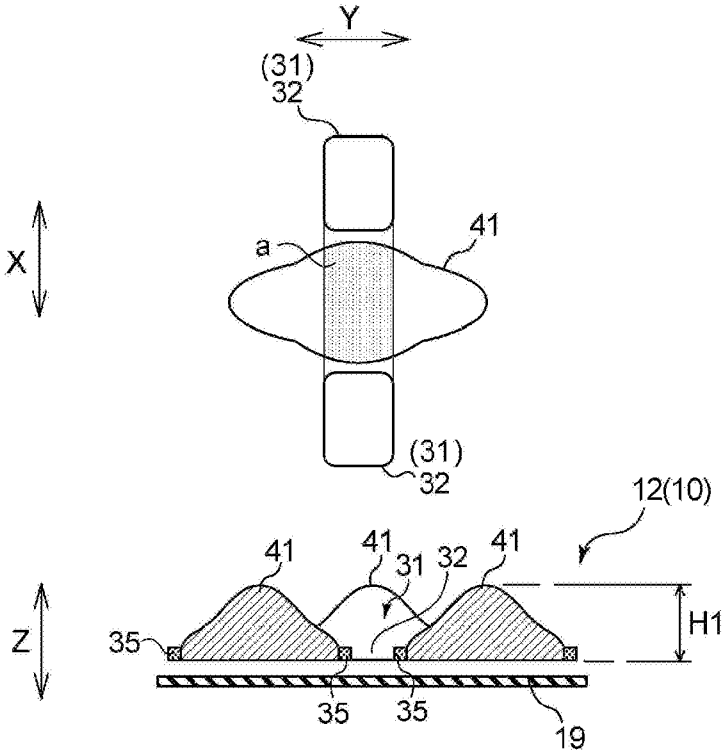
31
(32)
L1
R1
R5
(R10)
R5
(R10)
Y

Fig. 5(a)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X
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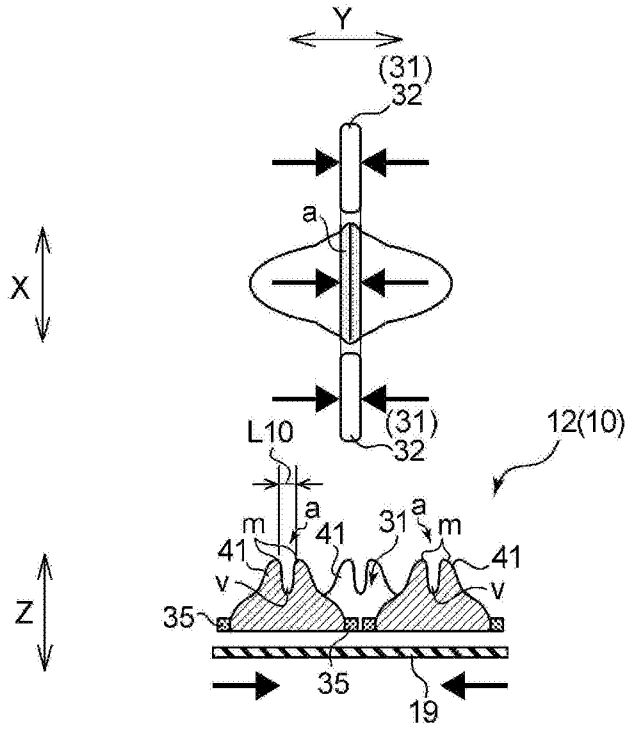
41
31
32
41
Z
35
H1
35
35
19

Fig. 5(b)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v
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Z
35
35
19

Fig. 6

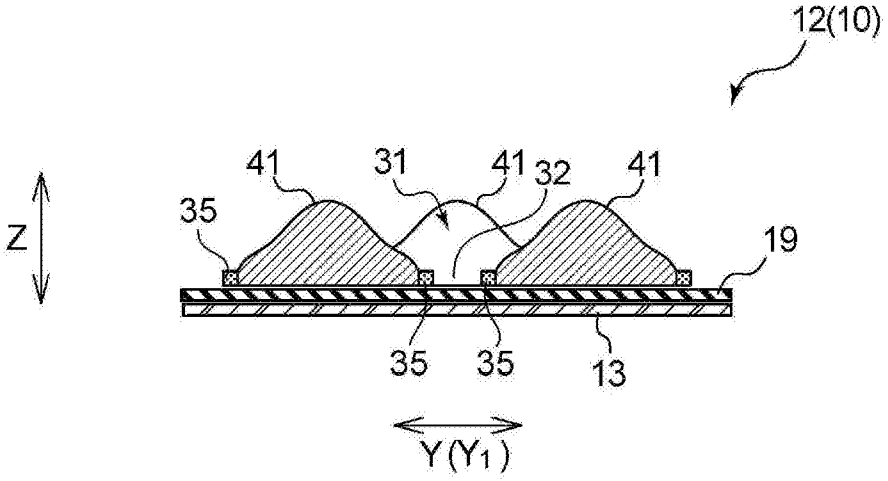


Fig. 7

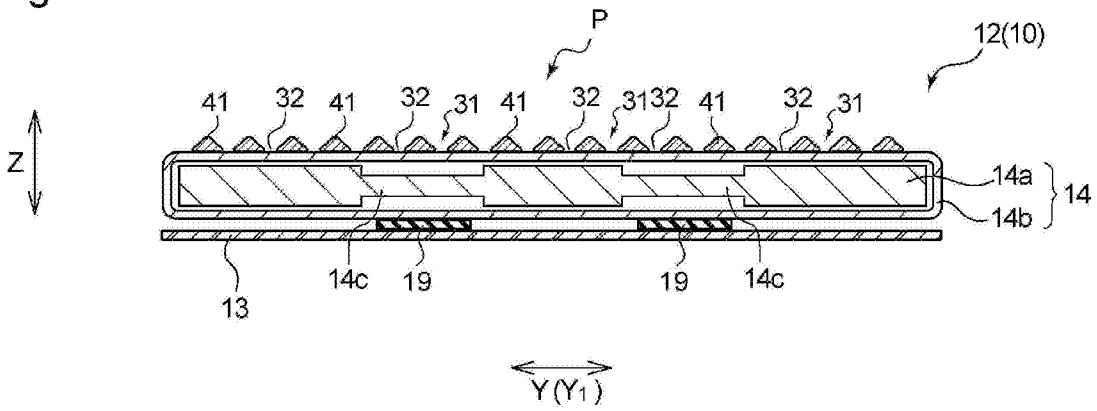


Fig. 8

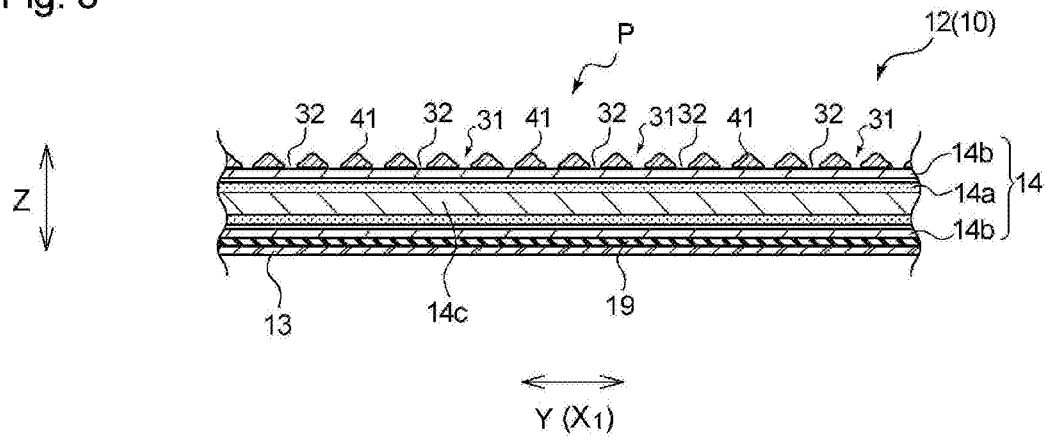
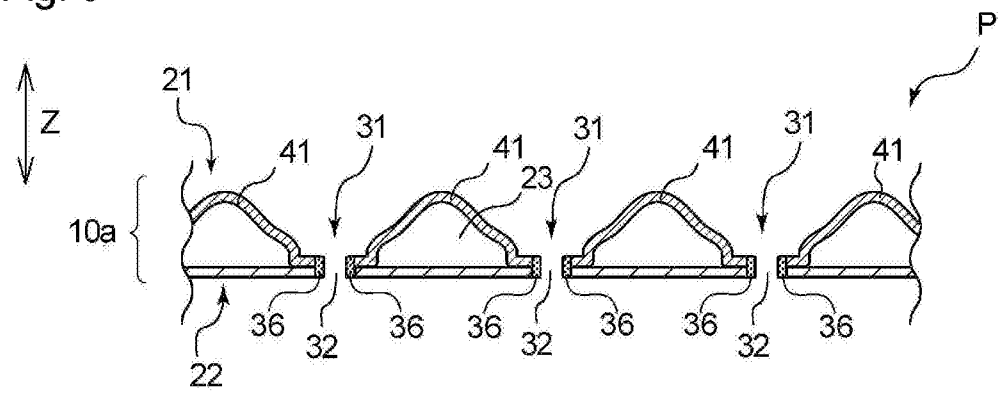


Fig. 9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31
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32
36
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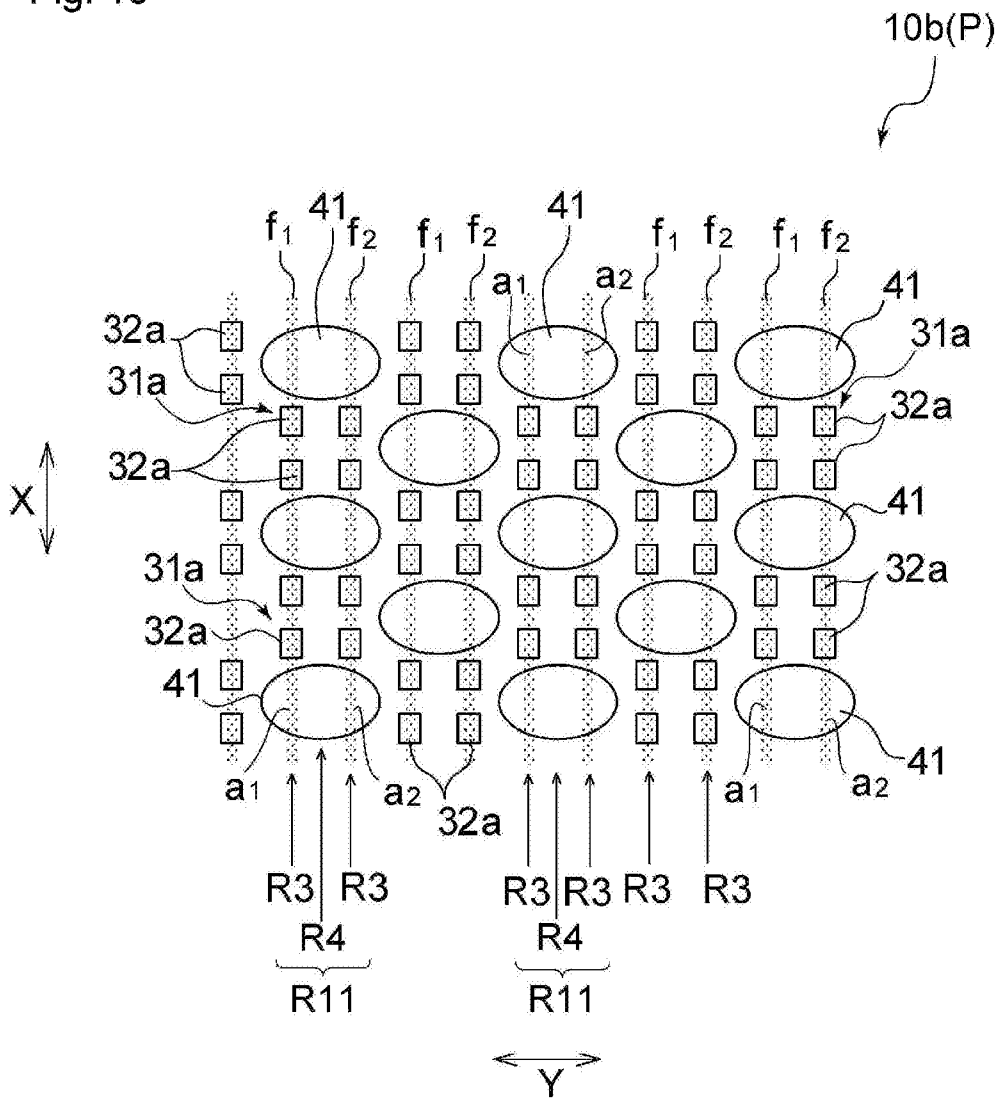
32
36
36
32
36
22

Fig. 10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f2
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a1
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a1
a2
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R3
R4
R4
R11
R11
Y

Fig. 11

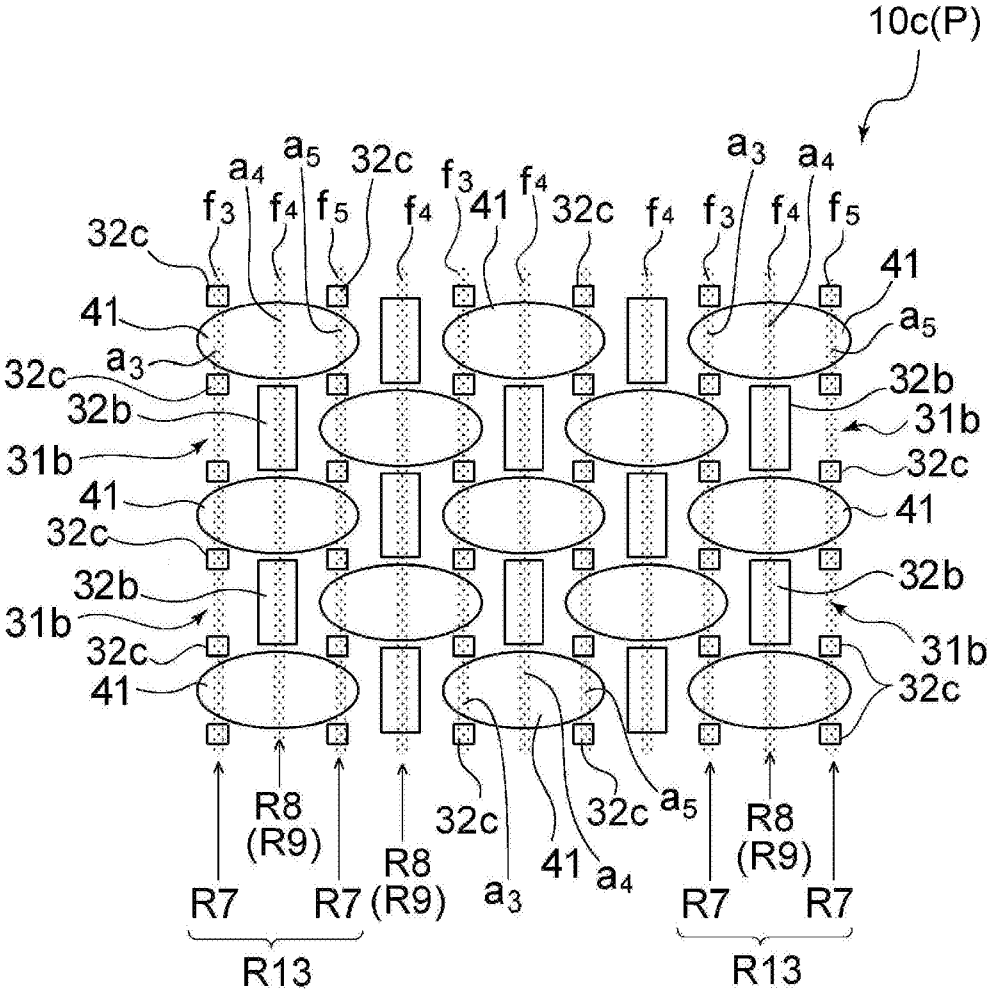
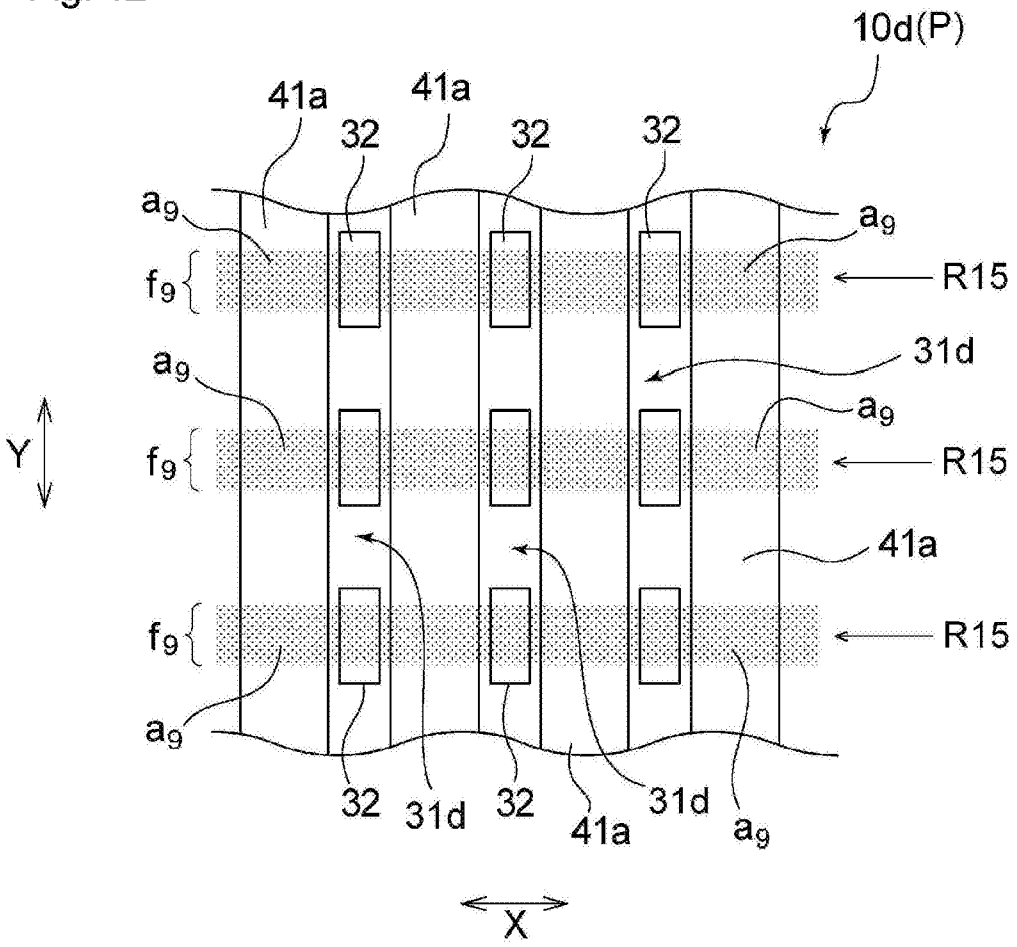


Fig. 12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f_9
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32
41a
31d
a_9
Y
X

Fig. 13

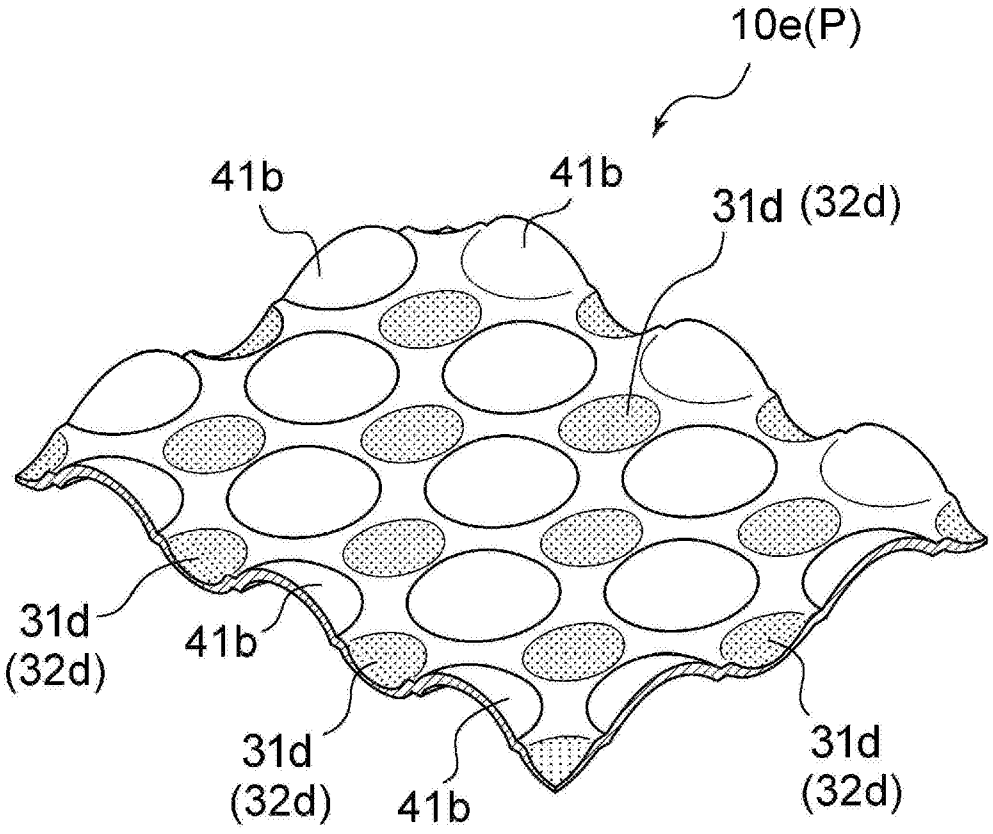
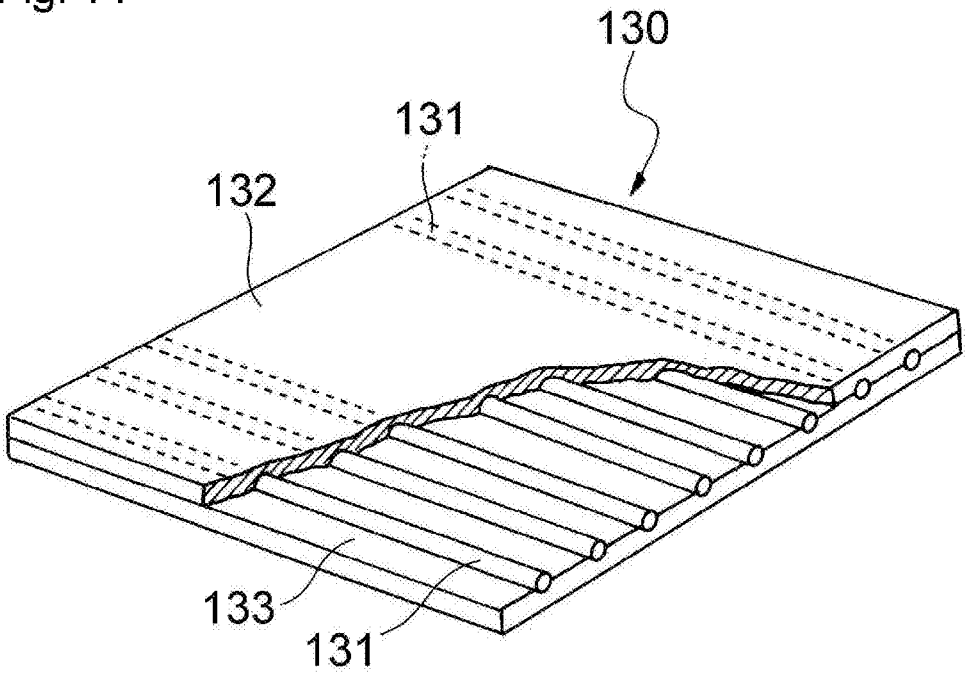

10e(P)
41b
41b
31d (32d)
31d
(32d)
41b
31d
(32d)
41b
31d
(32d)

Fig. 14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131
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133
131

DESCRIPTION

Title of Invention: ABSORBENT ARTICLE

Technical Field

[0001]

The present invention relates to absorbent articles, including disposable diapers, urine pads, incontinence pads, and sanitary napkins.

Background Art

[0002]

Absorbent articles, such as disposable diapers, generally have a sheet that comes to contact with the skin of a wearer. It is known that such a skin-contacting sheet of absorbent articles may have its skin facing surface three-dimensionally textured from the viewpoint of the feel to the tough, breathability, and the like.

For instance, patent literature 1 listed below discloses an absorbent article with a topsheet composed of a first layer and a second layer stacked on each other. The topsheet has first compressed depressions in a predetermined pattern, raised portions formed of the first layer, and second compressed depressions each formed in the individual raised portions, the depth of the second compressed depressions not reaching the second layer.

[0003]

Patent literature 2, which is commonly assigned with this patent application, proposes an absorbent article having an apertured topsheet including a stack of a first nonwoven sheet and a second nonwoven sheet. The topsheet has fused portions along the periphery of the apertures, where the first and second nonwoven sheets are fused together, and projections formed of the first nonwoven sheet bulging away from the second nonwoven sheet in portions other than the fused portions. Each fused portion has a bump projecting toward a sublayer so that, when the topsheet is pressed toward the sublayer, the sublayer is pressed in parts by the bumps.

[0004]

Patent literature 3, which is commonly assigned with this patent application,

discloses an absorbent article having an elasticized region, where elastic members are fixed to extend in the lateral direction, and a non-elasticized region located between the elasticized region and the end of an absorbent core, where no elastic members are provided. The topsheet has a three-dimensionally textured region overlapping the non-elasticized region. The texture region comprises projections arranged in a predetermined pattern, longitudinally extending grooves, and laterally extending grooves each running between the projections. The longitudinally extending groove has a greater degree of winding than the laterally extending groove.

Citation List

Patent Literature:

[0005]

Patent literature 1: JP 2006-263296A

Patent literature 2: JP 2018-088997A

Patent literature 3: JP 2019-076499A

Summary of Invention

[0006]

The present invention relates to an absorbent article having a longitudinal direction corresponding to the front-to-back direction of a wearer and a lateral direction perpendicular to the longitudinal direction and including a skin-contacting sheet having a textured region and configured to have the textured region come into contact with the skin of a wearer while worn.

The textured region has a first direction and a second direction perpendicular to the first direction and preferably has a plurality of projections longer in the first direction than in the second direction and a plurality of depressions each located between the projections adjacent in the first or second direction.

The depression preferably has a low basis weight portion with a lower basis weight of a fiber material than the projections.

The absorbent article preferably further includes an elastic member which extends along the first direction, the elastic member being located on the non-skin facing surface side than the skin-contacting sheet.

Brief Description of Drawings

[0007]

[Fig. 1] Fig. 1 is a schematic plan of the skin facing surface side (inner side) of a disposable diaper as an embodiment of the absorbent article of the present invention in its flat-out, uncontracted configuration.

[Fig. 2] Fig. 2 is a cross-section taken along line II-II of Fig. 1.

[Fig. 3] Fig. 3 is a plan of the topsheet (skin-contacting sheet) of a disposable diaper according to a first embodiment of the present invention.

[Fig. 4] Fig. 4 is an enlarged plan showing a part of the textured region of the skin-contacting sheet of Fig. 3.

[Fig. 5] Fig. 5 presents plans of a projection overlapping an elastic member in the skin-contacting sheet and corresponding cross-sections, of which Fig. 5a shows the projection before deformation, and Fig. 5b displays the projection after deformation.

[Fig. 6] Fig. 6 is a cross-section showing a positional relationship between the textured region of the skin-contacting sheet and an elastic member.

[Fig. 7] Fig. 7 is a cross-section showing another positional relationship between the textured region of the skin-contacting sheet and elastic members.

[Fig. 8] Fig. 8 is a cross-section showing still another positional relationship between the textured region and an elastic member.

[Fig. 9] Fig. 9 is a cross-section of a skin-contacting sheet in another embodiment of the present invention.

[Fig. 10] Fig. 10 is a plan of the textured region of a skin-contacting sheet according to still another embodiment of the present invention, which corresponds to Fig. 4.

[Fig. 11] Fig. 11 is a plan of the textured region of a skin-contacting sheet according to yet another embodiment of the present invention, which corresponds to Fig. 4.

[Fig. 12] Fig. 12 is a plan of the textured region of a skin-contacting sheet according to still yet another embodiment of the present invention, which corresponds to Fig. 4.

[Fig. 13] Fig. 13 is a perspective of the textured region of a skin-contacting sheet according to still yet another embodiment of the present invention.

[Fig. 14] Fig. 14 is a perspective with part cut away of a stretch sheet that may serve as an elastic member used in the present invention.

Description of Embodiments

[0008]

The projections of a textured sheet coming into contact with the skin of a wearer are generally more deformable in conformity to the skin with an increase in their size to provide better comfort to touch. However, when projections overlap elastic members stretchable in one direction, the projections can collapse as a whole with the contraction of the elastic members, and the collapsed projections in close contact with the skin can reduce breathability. Patent literatures 1 to 3 do not disclose techniques for solving the problem of the projections collapsing with the contraction of elastic members.

[0009]

The present invention relates to an absorbent article having projections that are designed to be effectively prevented from collapsing with the contraction of an elastic member without damaging their pleasant feel to the touch.

[0010]

The present invention will be described on the basis of its preferred embodiments with reference to the accompanying drawings.

Figs. 1 and 2 show a basic structure of a disposable diaper 1, simply "diaper 1", as one embodiment of the absorbent article of the present invention.

As illustrated, the diaper 1 includes a liquid permeable topsheet 12, a liquid impermeable backsheet 3, and an absorbent member 14 interposed between the sheets 12 and 13. As used herein with respect to the backsheet 13, the term "liquid impermeable" is intended to include "sparingly liquid impermeable", so that the backsheet 13 may be completely impermeable to liquid or just water-repellant. While the topsheet 12 has textured regions P and PS on the skin facing surface as will be elaborated upon, the three-dimensional texture of the regions P and PS are omitted from the illustration in Figs. 1 and 2.

[0011]

Fig. 1 illustrates the diaper 1 in its flat-out, uncontracted configuration. The diaper 1 has a longitudinal direction X_1 corresponding to the front-to-back direction of a wearer and a lateral direction Y_1 perpendicular to the longitudinal direction X_1. Divided

into three equal thirds in the longitudinal direction X_1, the diaper 1 is sectioned into a front portion A adapted to be worn about the front of a wearer, a rear portion B adapted to be worn about the back of a wearer, and a crotch portion C intermediate between the front portion A and the rear portion B. The diaper 1 is an open-style disposable diaper, provided with a pair of fastening tapes 17 on opposed lateral side edges of the rear portion B and a landing zone 18 on the outer surface of the front portion A, to which the fastening tapes 17 are to be secured.

[0012]

As used herein, the term "flat-out, uncontracted configuration" means a state in which the diaper 1 is spread flat to its design dimension with every elastic member stretched out or with any influences of elastic members eliminated. The term "skin facing surface" refers to the side of a diaper or a member constituting the diaper (e.g., an absorbent member) facing the wearer's skin while worn, and the term "non-skin facing surface" refers to the side of a diaper or a member constituting the diaper facing away from the wearer's skin while worn. In other words, the skin facing surface is relatively closer to the wearer's skin during wear, and non-skin facing surface is relatively farther from the wearer's skin. The expression "while worn" or "during wear" means the state of a diaper applied in the right position to the body of a wearer.

[0013]

The absorbent member 14 of the diaper 1 includes an absorbent core 14a and a core wrap sheet 14b covering the absorbent core 14a. The absorbent core 14a may be made of a fiber stack of absorbent fibers, such as pulp fiber, or a fiber stack mixture of absorbent fibers and an absorbent polymer. Examples of the absorbent fibers include cellulosic hydrophilic fibers, such as pulp fiber, rayon fiber, cotton fiber, and cellulose acetate. In addition to the cellulosic hydrophilic fibers, synthetic resin fibers, such as polyolefins, polyesters, and polyamides, having been rendered hydrophilic by the treatment with a surfactant are also useful. The core wrap sheet 14b may be, for example, a tissue paper or a water pervious nonwoven fabric sheet. The core wrap sheet 14b may be a single sheet wrapping the entire surface of the absorbent core 14a or may be a plurality of sheets wrapping the absorbent core 14a in combination. The backsheet 13 may be a liquid impermeable or water-repellent resin film or a laminate of a resin film

and nonwoven fabric.

[0014]

The diaper 1 further includes a barrier cuff-forming sheet 15 in opposed longitudinal side portions thereof. The barrier cuff-forming sheet 15 has an elastic member 15a. On contraction of the elastic member 15a, the sheet 15 gathers and rises toward the wearer's skin to form a standing barrier cuff in the crotch portion C during wear. The diaper 1 further includes a leg elastic member 16 fixed in its stretched state along the portion worn around each wearer's leg in the crotch portion C. On contraction of the leg elastic member 16, a leg cuff is formed in the crotch portion C to provide improved fit about the wearer's leg during wear. In the present embodiment the stretch direction of the elastic members 15a and 16 coincide with the longitudinal direction X_1 of the diaper 1.

[0015]

The diaper 1 of the embodiment has a waist flap WF in the rear portion B. The "waist flap" is the portion extending longitudinally outward from each longitudinal end of the absorbent member 4. The waist flap WF of the embodiment includes the pair of barrier cuff-forming sheets 15, the topsheet 12, and the backsheet 13. These sheets are joined to one another by a known bonding means, such as adhesive, heat sealing, or ultrasonic sealing, in the region extending from each longitudinal end of the absorbent member 4. The waist flap WF is applied to near the wearer's waist when worn.

[0016]

As illustrated in Fig. 1, the diaper 1 of the embodiment has waist elastic members 19 fixed in their stretched state along the lateral direction Y_1 in the waist flap WF of the rear portion B. On contraction of the waist elastic members 19, the waist flap WF of the rear portion B gathers to form wrinkles. In the embodiment the waist elastic members 19 are fixed in their stretched state along the lateral direction Y_1 between the topsheet 12 and the backsheet 13 in the waist flap WF. The diaper 1 may also have a waist elastic member(s) 19 in the waist flap WF in the front portion A. In the embodiment, the stretch direction of the waist elastic members 19 coincides with the lateral direction Y_1 of the diaper 1.

[0017]

The diaper 1 includes a skin-contacting sheet 10 adapted to contact the wearer's skin while worn. The skin-contacting sheet 10 has a textured region textured with a plurality of projections and a plurality of depressions. The textured region, more specifically the projections, of the skin-contacting sheet 10 come into contact with the wearer's skin while worn. The topsheet 12 of the diaper 1 of the embodiment corresponds to the skin-contacting sheet 10 and has a textured region on its skin facing surface.

[0018]

The topsheet 12 of the embodiment, i.e., the skin-contacting sheet 10 has a middle portion M in the lateral middle thereof and a side portion S on both lateral sides of the middle portion M as illustrated in Fig. 3. While each of the middle portion M and the opposing side portions S has the textured region, the arrangement pattern of the projections and depressions is different between the middle portion M and the side portions S. The textured region P of the middle portion M will be called a textured middle region P, and that of each side portion S a textured side region PS.

[0019]

The skin-contacting sheet 10 of the embodiment and its textured middle region P have a first direction Y and a second direction X perpendicular to the first direction Y. In the embodiment, the first direction Y is coincident with the lateral direction Y_1 of the diaper 1, and the second direction X with the longitudinal direction X_1 of the diaper. The textured middle region P extends over the entire area of the middle portion M.

The textured middle region P has a plurality of projections 41 that are longer in the first direction Y than in the second direction X. The projection 41 longer in the first direction Y will hereinafter be designated oblong projection 41. The textured region P may have the oblong projections 41 and a plurality of depressions 31 each located between the oblong projections 41 adjacent in the first direction Y or the second direction X.

[0020]

The oblong projection 41 of the embodiment is generally rhombic in plan view,

with the major axis coincident with the first direction Y, and the minor axis with the second direction X.

As illustrated in Figs. 3 and 4, the oblong projections 41 are discretely arranged in the textured middle region P in both the first direction Y and the second direction X. More specifically, as shown in Fig. 3, the oblong projections 41 are arranged in a staggered pattern, in which a plurality of the oblong projections 41 line up in the second direction X to form a plurality of vertical rows R5 aligned in the first direction Y, with the oblong projections 41 in adjacent vertical rows R5 in the first direction Y being offset by half a pitch in the second direction X. The individual oblong projections 41 in one vertical row R5 and those in the adjacent vertical row R5 partially overlap each other in the second direction X.

Vertical rows R5 in which the individual oblong projections 41 are aligned in position in the second direction X are equally spaced in the first direction Y. Such an arrangement of the oblong projections 41 allows for easily regulating the sizes of the oblong projections 41 and the hereinafter described large depressions 31 and further improving the feel and breathability of the textured region P.

In the textured middle region P, a plurality of oblong projections 41 line up in the first direction Y to form a plurality of horizontal rows R6 that are aligned in the second direction X. Horizontal rows R6 in which the individual oblong projections 41 are aligned in position in the first direction Y are spaced equally in the second direction X.

[0021]

The textured middle region P of the embodiment have a plurality of depressions 31 and 33 each located between oblong projections 41 adjacent in both the first direction Y and the second direction X. The textured middle region P has two types of depressions 31 and 33 that are different in size. The larger one of the two types will be designated a large depression 31, and the smaller one a small depression 33.

[0022]

The large depressions 31 are each located between adjacent ends of oblong projections 41 adjacent in the vertical row R5 and between adjacent ends of oblong projections 41 adjacent in the horizontal row R6.

The individual large depressions 31 have a low basis weight portion 32 with a

lower basis weight of a fiber material (hereinafter referred to as fiber basis weight) than the projections 41. The low basis weight portion 32 may be a portion containing a fiber material but at a lower basis weight than the oblong projections 41 or a fiber-free portion, namely an aperture going through the thickness of the skin-contacting sheet 10. With a view to facilitating the hereinafter described deformation of the oblong projections 41, the low basis weight portion 32 is preferably an aperture.

As illustrated in the cross-section of Fig. 5a, the large depression 31 of the embodiment has a high-density portion 35, where the fiber material is densified as a result of, for example, embossing, along the periphery of the low basis weight portion 32. The large depressions 31 may not have such a high-density portion 35 around the low basis weight portion 32. The high-density portions 35 are omitted from the plan views of Figs. 4 and 5.

[0023]

As illustrated in Figs. 3 and 4, the low basis weight portions 32 of the large depressions 31 are arranged in a staggered pattern. More specifically, a plurality of the low basis weight portions 32 line up in the second direction X to form a plurality of vertical rows R1 that are spaced in the first direction Y. The positions of the low basis weight portions 32 in adjacent vertical rows R1 in the first direction Y are offset by half a pitch in the second direction X.

The plurality of vertical rows R1 of the low basis weight portions are equally spaced in the first direction Y. When the low basis weight portions in the vertical rows R1 have different sizes, the interval between adjacent vertical rows R1 in the first direction Y is defined to be the distance between centerlines each bisecting the vertical row in the first direction Y.

In the textured middle region P, the plurality of low basis weight portions 32 line up in the first direction Y to form a plurality of horizontal rows R2 aligned in the second direction X.

Back to Fig. 4, the overlaps between the vertical rows R1 of the low basis weight portions and the vertical rows R5 of the projections are indicated by a reference f.

[0024]

The oblong projections 41 and the large depressions 31 alternate in both the first

direction Y and the second direction X in the textured middle region P. In other words, the oblong projections 41 and the large depressions 31 alternate in the second direction X to form a plurality of vertical rows R10 of projections and depressions, the vertical rows R10 being aligned in the first direction Y.

The positions of the oblong projections 41 and the large depressions 31 in adjacent vertical rows R10 in the first direction Y are offset by half a pitch in the second direction X.

[0025]

The textured middle region P of the embodiment has pairs of small depressions 33. Each pair of the small depressions 33 is located on each side of the individual large depression 31 in the first direction Y, and the two small depressions 33 of each pair face each other across the large depression 31 in the second direction X. The plurality of the pairs of small depressions 33 line up straight along the second direction X to form a plurality of rows of small depressions 33 that are equally spaced in the first direction Y. The positions of the small depressions 33 in adjacent rows of small depressions in the first direction Y are coincident with each other in the second direction X.

[0026]

The diaper 1 has an elastic member which extends along the first direction Y, the elastic member provided on the non-skin facing surface side from the skin-contacting sheet 10,. The diaper 1 of the embodiment has waist elastic members 19 fixed on the non-skin facing surface side of the skin-contacting sheet 10, which is the topsheet 12, in their stretched state along the first direction Y so that the waist elastic members 19 have stretch in the first direction Y.

The diaper 1 of the embodiment has the waist elastic members 19 in an overlapping relation with the textured middle region P in the waist flap WF.

[0027]

Referring to Fig. 5a, the individual oblong projections 41 have a region a that overlaps the large depressions 31 in the first direction Y. When the waist elastic members 19, which have stretch in the first direction Y, contract, the textured middle region P is compressed in the first direction Y, and the skin-contacting sheet 10 deforms as a result.

Specifically, with the compression of the large depressions 31 in the first direction Y, the region a of the oblong projection 41, which overlaps the large depressions 31 in the first direction Y, is also compressed in the first direction Y. As a result of the compression, the oblong projection 41 deforms in such a fashion that the region a overlapping the large depressions 31 in the first direction Y folds or caves inward as illustrated in Fig. 5b. This deformation due to the contraction of the elastic member will be referred to as infolding, and the portion capable of folding inward will be called an infolding portion a.

Thus, the diaper 1 of the embodiment allows the long depressions 41 to partially deform, whereby the projections are effectively prevented from totally collapsing with the contraction of the elastic members 19 so that the good feel of the oblong projections 41 is retained. Since the textured middle region P keeps the shape of the oblong projections 41 in a satisfactory manner, not only is the skin-contacting sheet 10 prevented from coming into surface contact with the wearer's skin, but stuffiness inside the worn diaper 1 is reduced to provide good breathability.

With a view to enhancing the improvement in feel to the touch and breathability, it is preferred that the oblong projections 41 having folded inward with the contraction of the elastic members 19 restore their shape before the infolding with stretch of the elastic members 19.

[0028]

In the textured middle region P of the embodiment, the oblong projections 41 overlap the vertical row R1 of low basis weight portions. The individua large depressions 31 have a low basis weight portion 32 that is less stiff than the other areas. This structure helps the large depressions 31 to be compressed in the first direction Y with the contraction of the elastic members 19 (Fig. 5b). With the compression of the large depressions 31, the region a of the oblong projections 41, which overlaps the large depressions 31 in the first direction Y, is also compressed easily in the same direction, whereby the infolding of the oblong projections 41 occurs more easily (Fig. 5b).

In the embodiment, the infolding portion a is located on the skin facing surface side than the low basis weight portion 32. The elastic member 19 is located on the non-skin facing surface side than the low basis weight portion 32.

[0029]

In order to improve the breathability inside the diaper 1, it is preferred that the infolding occur in a plurality of the oblong projections 41. For instance, the textured middle region P preferably has a plurality of the overlapping regions f, where a vertical row R1 of low basis weight portions and a vertical row R5 of projections overlap each other in the first direction Y.

[0030]

With the view of causing the infolding to occur in the oblong projections 41 more easily, the elastic member 19 preferably has a stretch stress of at least 8 cN/10 mm, more preferably 10 cN/10 mm or higher, preferably 50 cN/10 mm or lower, more preferably 40 cN/10 mm or lower, specifically preferably 8 to 50 cN/10 mm, more preferably 10 to 40 cN/10 mm. The stretch stress can be determined by the method below.

[0031]

Method for determining stretch stress:

An elastic member (specimen) is cut out with a length of 50 mm in the stretch direction from an area of a diaper in a flat-out, uncontracted configuration where the elastic member is in an overlapping relation with the textured region P and exhibits stretchability. The specimen is clamped in jaws of Tensilon tensile tester (RTC-1210A from ORIENTEC COPORATION) at an initial jaw separation of 10 mm, pulled to 40 mm at a rate of 50 mm/min, and then allowed to contract to 38 mm at which the tensile load (cN/10 mm) is recorded. The tensile test is conducted three times, and the average of the readings, i.e., the tensile loads at the contraction to 38 mm, is defined to be a stretch stress (cN/10 mm).

[0032]

When the low basis weight portions 32 are portions containing a fiber material but at a low fiber basis weight, the fiber basis weight of the low basis weight portions 32 is preferably 10% or less, more preferably 20% or less, of that of the oblong projections 41, and preferably 30 g/m^2 or lower, more preferably 20 g/m^2 or lower, with the view of causing the oblong projections 41 to fold inward more easily.

[0033]

Back to Fig. 5b, the infolding portion a of the infolded oblong projection 41 is formed of a valley v and mountains m located on the skin facing surface side than the valley. For easy formation of the mountains m, the oblong projection 41 preferably has a first portion where the fibers making up the skin-contacting sheet 10 are oriented in the second direction X. The first portion having the fiber orientation in the second direction X easily forms the mountain m of the infolding portion a because it is less susceptible to the compressive force to the low basis weight portion 32, i.e., the contractive force in the first direction Y.

For easy formation of the valley v, the oblong projection 41 preferably has a second portion where the fibers making up the skin-contacting sheet 10 are oriented in the first direction Y. The second portion having the fiber orientation in the first direction Y easily folds in to form the valley v of the infolding portion a.

For easy formation of the infolding portion a, the oblong projection 41 preferably has both the first portion and the second portion on each side of the first portion in the first direction Y.

[0034]

The fiber orientation in a sheet can be confirmed as follows. The sheet to be evaluated is stripped off using a cooling spray or otherwise removed from an absorbent article. A 2 cm square specimen containing an oblong projection 41 is cut from the sheet using, e.g., a cutter with its sides parallel to the first and second direction X and Y. The specimen is observed using a microscope (e.g., digital microscope VHX-1000 from Keyence Corp.) at a magnification of 60 to 200 times. Two points of any fibers at which the fiber is longest are decided within a certain observation area (e.g., 1 mm square), and the angle formed by the straight line connecting the two points with the first direction Y is measured. This measurement is performed for at least three observation areas, and the direction of fiber orientation is obtained from the arithmetic mean of the angles measured for a total of 30 or more fibers. When the angle with the first direction Y is 45° or smaller, the orientation direction is determined to be the first direction Y. When the angle with the first direction Y is larger than 45°, the orientation direction is determined to be the second direction X. The magnification of observation is preferably such that at least 10 fibers are measurable in one observation area.

[0035]

With the view of causing the oblong projections 41 to fold in more easily, the oblong projections 41 preferably satisfy formula (1) below when the elastic member 19 is extended to its maximum.

$$La > H1 \qquad (1)$$

Wherein La is a half the length L1 of an oblong projection 41 in the first direction Y; and H1 is the height of the oblong projection 41.

The length L1 of the oblong projection 41 in the first direction Y is defined to be the maximum length of the oblong projection 41 in that direction (Fig. 4).

The height H1 is measured with a thickness measurement system, such as a laser displacement sensor LK-080 from Keyence Corp., with a load of 0.05 kPa applied to the skin-contacting sheet 10.

[0036]

With the same view as above, it is preferred that the La to H1 ratio, La/H1, be 1.5 or greater, more preferably 2.0 or greater, preferably 15.0 or smaller, more preferably 10.0 or smaller, and specifically preferably 1.5 to 15.0, more preferably 2.0 to 10.0, wherein La is a half the length of the oblong projection 41 (L1/2) in the first direction Y, and H1 (Fig. 5a) is the height of the oblong projection 41.

[0037]

With the same view as above, it is preferred that the L1 to L2 ratio, L1/L2, be 1.5 or greater, more preferably 1.8 or greater, preferably 5.0 or smaller, more preferably 3.0 or smaller, and specifically preferably 1.5 to 5.0, more preferably 1.8 to 3.0, wherein L1 (Fig. 4) is the length of the oblong projection 41 in the first direction Y, and L2 (Fig. 4) is the length of the oblong projection 41 in the second direction.

[0038]

With a view to facilitating compression of the low basis weight portion 32 and causing the oblong projection 41 to fold in more easily, it is preferred that the L5 to L2 ratio, L5/L2, be 0.3 or greater, more preferably 0.4 or greater, preferably 0.8 or smaller,

more preferably 0.7 or smaller, and specifically preferably 0.3 to 0.8, more preferably 0.4 to 0.7, wherein L2 (Fig. 4) is the length of the oblong projection 41 in the second direction X, and L5 (Fig. 4) is the length of the low basis weight portion 32 in the second direction X.

[0039]

With a view to making the low basis weight portion 32 more susceptible to the compressive force in the first direction Y thereby to cause the oblong projection 41 to fold in more easily, the L6 to L2 ratio, L6/L2, be preferably 0.3 or greater, more preferably 0.4 or greater, preferably 1.5 or smaller, more preferably 1.0 or smaller, and specifically preferably 0.3 to 1.5, more preferably 0.4 to 1.0, wherein L2 (Fig. 4) is the length of the oblong projection 41 in the second direction X, and L6 (Fig. 4) is the length of the low basis weight portion 32 in the first direction Y.

[0040]

The oblong projection 41 of the embodiment has the region a that overlaps the large depressions 31 in the first direction. That is, there is only one infolding portion a in the first direction Y in one oblong projection 41.

The length of the infolding portion a in the first direction Y being taken as L10 (Fig. 5b), the ratio of L10 to L1 (i.e., the length of the oblong projection 41 in the first direction Y (Fig. 4)), L10/L1, is preferably 0.2 or greater, more preferably 0.3 or greater, preferably 0.8 or smaller, more preferably 0.7 or smaller, and specifically preferably 0.2 to 0.8, more preferably 0.3 to 0.7. The length L10 of the infolding portion a in the first direction Y is defined to be the greatest width of the infolded valley v measured in the first direction Y (Fig. 5b).

In the case where a single oblong projection 41 has two or more infolding portions a in the first direction Y as in third and fourth embodiments hereinafter described, the length L10 is the total length of the infolding portions a in the first direction Y. For instance, when one oblong projection 41 has two infolding portions a_1 and a_2 as in the third embodiment, the length L10 is the sum of the length of a_1 and that of a_2 in the first direction Y.

[0041]

To further improve the feel of the textured region P, the oblong projections 41 and the low basis weight portions 32 preferably have the following dimensions.

The length L1 (Fig. 4) of the oblong projection 41 in the first direction Y is preferably 4.0 mm or longer, more preferably 6.0 mm or longer, preferably 35.0 mm or shorter, more preferably 25.0 mm or shorter, and specifically preferably 4.0 to 35.0 mm, more preferably 6.0 to 25.0 mm.

The length L2 (Fig. 4) of the oblong projection 41, i.e., the dimension in the second direction Y is preferably 2.0 mm or longer, more preferably 3.0 mm or longer, preferably 7.0 mm or shorter, more preferably 5.0 mm or shorter, and specifically preferably 2.0 to 7.0 mm, more preferably 3.0 to 5.0 mm.

The height H1 (Fig. 5a) of the oblong projection 41 is preferably 0.5 mm or greater, more preferably 0.8 mm or greater, preferably 4.0 mm or smaller, more preferably 3.0 mm or smaller, and specifically preferably 0.5 to 4.0 mm, more preferably 0.8 to 3.0 mm.

[0042]

The length L6 (Fig. 4) of the low basis weight portion 32 in the first direction Y is preferably 0.8 or greater, more preferably 1.0 mm or greater, preferably 10.0 mm or smaller, more preferably 7.0 mm or smaller, and specifically preferably 0.8 to 10.0 mm, more preferably 1.0 to 7.0 mm.

The length L5 (Fig. 4) of the low basis weight portion 32 in the second direction X is preferably 0.8 mm or greater, more preferably 1.0 mm or greater, preferably 6.0 mm or smaller, more preferably 4.0 mm or smaller, and specifically preferably 0.8 to 6.0 mm, more preferably 1.0 to 4.0 mm.

[0043]

Turning back to Fig. 3, the textured middle region P of the embodiment contains the small depressions 33 in addition to the large depressions 31. The individual small depressions 33 of the embodiment have an unshown aperture as a low basis weight portion. The small depressions 33 may not have a low basis weight portion.

Even when an elastic member having stretch in the first direction Y contracts, the oblong projection 41 of the embodiment does not fold inward in its area sandwiched between the small depressions 33 aligned in the second direction X. In that way, the

textured middle region P may have such depressions 33 that do not contribute to the infolding of the oblong projections 41.

The depressions 33 having no contribution to the infolding of the oblong projections 41 may be, for example, depressions with a length of less than 0.5 mm in the first direction Y or depressions having no low basis weight portions as formed by densification such as embossing.

[0044]

In the diaper 1 of the embodiment, the waist elastic members 19 are stretchable and contractible in the lateral direction Y_1. The waist elastic members 19 overlap the textured middle region P in the longitudinal end portion of the diaper 1, specifically in the waist flap WF of the rear portion B. Since the diaper 1 of the embodiment has the textured middle region P with the oblong projections 41 capable of folding inward located to be applied to the waist area of a wearer while worn, not only does the skin-contacting sheet 10 snugly fit against the waist area, but also better breathability is provided by the textured region P to prevent stuffiness.

[0045]

As illustrated in Fig. 6, the diaper 1 of the embodiment has disposed, in the waist flap WF, the waist elastic members 19 in their stretch state between the topsheet 12 as the skin-contacting sheet 10 and the backsheet 13. The topsheet 12 and the waist elastic members 19 are in direct contact with each other. This structure makes it easier for the contractive force (stretch stress) of the elastic members 19 to be imposed to the large depressions 31 or the low basis weight portions 32, thereby causing the oblong projections 41 to fold inward more easily.

[0046]

There may be another member interposed between the skin-contacting sheet 10 and the elastic members 19 that are arranged to develop stretch in the first direction. For instance, as shown in Figs. 7 and 8, there may be the absorbent member 14 between the topsheet 12, which is the skin-contacting layer 10, and the elastic members 19 arranged to have stretch in the first direction Y. In these structures, it is preferred for the absorbent core 14a to have low basis weight portions 14c with a low basis weight of the absorbent

material in such an arrangement that the low basis weight portion 14c of the absorbent core 14a overlaps the elastic member 19 and the textured region P with the oblong projections 41 capable of folding inward, so that the contractive force (stretch stress) of the elastic member 19 may be surely transmitted to the large depressions 31 or low basis weight portions 32.

The low basis weight portion 14c of the absorbent core 14a may be a portion containing an absorbent material but at a lower basis weight than the other portions of the absorbent core 14a or an absorbent material-free portion, namely an aperture going through the thickness of the absorbent core 14a.

[0047]

When the low basis weight portion 14c of the absorbent core is a portion having a low basis weight, with the view to ensuring transmission of the contractive force (stretch stress) of the elastic member 19 to the low basis weight portions 32, the absorbent material basis weight of the low basis weight portion 14c is preferably higher than 0%, more preferably 20% or higher, preferably 80% or lower, more preferably 60% or lower, specifically preferably higher than 0% up to 80%, more preferably 20% to 60%, of that of the other portions of the absorbent core 14c, and preferably higher than 0 g/m^2, more preferably 40 g/m^2 or higher, preferably 500 g/m^2 or lower, more preferably 400 g/m^2 or lower, and specifically preferably higher than 0 g/m^2 up to 500 g/m^2, more preferably 40 to 400 g/m^2.

[0048]

In the embodiment of Fig. 7, the first direction Y of the oblong projections 41 and the stretch direction of the elastic members 19 are coincident with the lateral direction Y_1 of the diaper, while the low basis weight portions 14c of the absorbent core extend in the longitudinal direction X_1.

In the embodiment of Fig. 8, the first direction Y of the oblong projections 41, the stretch direction of the elastic member 19, and the extending direction of the low basis weight portion 14c of the absorbent core are coincident with the longitudinal direction X_1 of the diaper. This structure, in which the first direction Y of the oblong projections 41 in the textured region P is coincident with the extending direction of the low basis weight portion 14c of the absorbent core, is advantageous in that the fit of the skin-contacting

sheet 10 is further improved.

[0049]

As illustrated in Figs. 7 and 8, the textured region P may be configured such that the projections 41 capable of folding inward may fold inward with the contraction of the elastic members 19 having stretch in the lateral direction Y_1 or in the longitudinal direction X_1. In other words, the first direction of the oblong projections 41 may be coincident with either the lateral direction Y_1 of the diaper or the longitudinal direction X_1.

In the embodiment of Fig. 8, it is preferred that the elastic member having stretch in the longitudinal direction X_1 and the textured region P having the oblong projections 41 capable of folding inward overlap each other in the longitudinal middle of the diaper 1, more preferably in the crotch portion C. This configuration is effective in reducing clinging of the skin-contacting sheet 10 to the wearer's skin and thereby preventing stuffiness due to the bodily waste, such as urine, absorbed by the absorbent member 14 and retransmission of liquid waste from the absorbent member 14 to the topsheet 12 due to the wearer's body pressure, namely rewet.

[0050]

The skin-contacting sheet 10 of the embodiment has projections 47 and depressions 37 in a staggered arrangement in its textured side regions PS. The projections 47 in the textured side regions PS may or may not fold in with the contraction of the elastic members.

In the case where the projections 47 of the textured side regions PS are capable of folding in, the foregoing description about the textured middle region P equally applies as appropriate.

[0051]

Figs. 9 through 13 show second to sixth embodiments of the skin-facing sheet of the present invention. The description of the second to sixth embodiments of the skin-contacting sheet will generally be confined to the difference from the first embodiment shown in Figs. 1 through 8. Other similar parts are indicated by similar numerals and will not be redundantly described. Unless the context specifically states otherwise, the description of the first embodiment applies equally to the second to sixth embodiments.

[0052]

As illustrated in Figs. 5 and 6, the skin-contacting sheet 10 according to the first embodiment has a single layer structure, with the oblong projections 41 being solid. The non-skin facing surface of the skin-contacting sheet 10 is flat in a stretched-out state in the first direction Y. The phrase "in a stretched-out state" means that the skin-contacting sheet 10 having the projections 41 capable of folding inward is in such a stretched-out condition as described below.

The diaper 1 is stretched flat in the first direction Y to its design dimension, i.e., the dimension with any influences of elastic members eliminated, and two marks are made on the skin-contacting sheet 10 with a permanent marker at a distance of L0 (e.g., 100 mm) in the first direction Y. The skin-contacting sheet 10 is then removed from the diaper 1 and stretched until the distance between the two marks reaches L0. This state of the sheet is referred to as a stretched-out state.

[0053]

The sheet having a single layer structure may be replaced with a skin-contacting sheet 10a having a composite sheet structure as in the second embodiment illustrated in Fig. 9. The skin-contacting sheet 10a, or the composite sheet 10a, is a stack of a first sheet 21 and a second sheet 22 joined to each other at a plurality of bonds 36. In this embodiment the first sheet 21 forms oblong projections 41 bulging away from the second sheet 22 at locations other than depressions 31 and 33.

The non-skin facing surface of the composite sheet 10a, which is defined by the second sheet 22, is flat in a straightened-up state in the first direction Y. Because the composite sheet 10a has hollow oblong projections 41 and is dual-layered, the compressive force of the low basis weight portions 32 tends to be concentrated to the first sheet 21. As a result, the oblong projections 41 formed of the first sheet 21 fold inward easily.

[0054]

Figs. 10 and 11 represent skin-contacting sheets 10b and 10c of the third and fourth embodiments, respectively. The sheets 10b and 10c differ from the sheet 10 of the first embodiment in the texturing pattern of the textured region P.

As illustrated in Fig. 10, the skin-contacting sheet 10b of the third embodiment

has the oblong projections 41 in a staggered pattern in which depressions 31a each having four low basis weight portions 32a are arranged between oblong projections 41 adjacent in the second direction X. The oblong projections 41 and the depressions 31a alternate in the second direction X to form a plurality of vertical rows R11 aligned in the first direction Y.

In the third embodiment, the positions of the oblong projections 41 and the depressions 31a in adjacent vertical rows R11 in the first direction Y are offset by half a pitch in the second direction X. In between oblong projections 41 aligned adjacent in the first direction Y are arranged two pairs of low basis weight portions 32a, each pair being composed of two low basis weight portions 32a aligned in the second direction X. The groups of the two pairs, i.e., four low basis weight portions 32a, and the oblong projections 41 alternate in the second direction X.

Each vertical row R11 includes a row R4 of oblong projections 41 spaced in the second direction X and two rows R3 of low basis weight portions 32a, each row R3 being composed of pairs of low basis weight portions 32a, the paired basis weight portions 32a being spacedly aligned in the second direction X.

In the third embodiment each vertical row R11 of projections and depressions includes a region f_1 and a region f_2, in which the individual oblong projections 41 overlap in the first direction Y with one and the other, respectively, of the two low basis weight portions 32a aligned in the first direction Y. To put it another way, the individual oblong projections 41 have two regions in each of which they overlap the low basis weight portions 32a in the first direction Y. Infolding of the oblong projections 41 occurs preferentially in these regions f_1 and f_2, where the oblong projections 41 overlap the low basis weight portions 32a in the first direction Y, with the contraction of the elastic members 19. That is, the oblong projections 41 of the third embodiment each have two infolding portions designated a_1 and a_2 aligned in the first direction Y, so that infolding takes place in each of the infolding portions a_1 and a_2 with the contraction of the elastic members having stretch in the first direction Y.

[0055]

While in the third embodiment the oblong projections 41 have two infolding portions a_1 and a_2 aligned in the first direction Y, the oblong projections 41 may have three or more infolding portions in the first direction Y.

As illustrated in Fig. 11, the skin-contacting sheet 10c of the fourth embodiment

has oblong projections 41 in a staggered pattern and depressions 31b each located between two of the oblong projections 41 adjacent in the second direction X. Each depression 31b includes a rectangular large low basis weight portion 32b and four small low basis weight portions 32c, each smaller low basis weight portion 32c being located outside and generally diagonal to the large low basis weight portion 32b. The oblong projections 41 and the depressions 31 alternate in the second direction X to form a plurality of vertical rows R13 aligned in the first direction Y.

In the fourth embodiment the positions of the oblong projections 41 and the depressions 31b in adjacent vertical rows R13 in the first direction Y are offset by half a pitch in the second direction X. Each vertical row R13 is composed of the large low basis weight portions 32b and the oblong projections 41 alternating each other in the second direction X.

The two small low basis weight portions 32c on either side of the individual large low basis weight portions 32b are aligned in the second direction X and alternate with the oblong projections 41 in the second direction X.

Each vertical row R13 includes a row R8 of oblong projections 41 spaced in the second direction X, two rows R7 of small low basis weight portions 32c, each row R7 being composed of pairs of small low basis weight portions 32c spaced in the second direction X between the oblong projections 41, the paired small low basis weight portions 32c being aligned in the second direction X, and a row R9 of large low basis weight portions 32b spaced in the second direction X.

In the fourth embodiment each vertical row R13 includes a region f_4, in which the individual oblong projections 41 overlap the large low basis weight portions 32b in the first direction Y, and regions f_3 and f_5, in which the individual oblong projections 41 overlap couples of two small basis weight portions 32c in the first direction Y. Infolding of the oblong projections 41 occurs preferentially in these three regions f_3, f_4, and f_5 with the contraction of the elastic members 19 as in the third embodiment. That is, the oblong projections 41 of the fourth embodiment each have a plurality of infolding portions designated a_3, a_4, and a_5 aligned in the first direction Y, so that infolding takes place in each of the infolding portions a_3, a_4, and a_5 with the contraction of the elastic members having stretch in the first direction Y.

[0056]

While in the first to fourth embodiments the textured region has the oblong

projections 41 and depressions 31 arranged discretely, each of the individual oblong projections 41 and each of the depressions 31 may be continuous in one direction.

For instance, Fig. 12 illustrates a skin-contacting sheet 10d of the fifth embodiment. The skin-contacting sheet 10d has its skin facing surface textured with ridges and troughs. Specifically, the texturing pattern is composed of projections 41a continuously extending in the first direction Y to form ridges and depressions 31d continuously extending in the same direction as the continuous projections 41a, to form troughs, the projections 41a and the troughs 31d alternating in the second direction X. While not shown, the skin facing surface of the skin-contacting sheet 10d is corrugated in the direction perpendicular to the direction of the ridges and troughs.

The individual continuous depressions 31d of the fifth embodiment has a plurality of low basis weight portions 32 spacedly arranged in the first direction Y. The positions in the second direction X of the low basis weight portions 32 of the continuous depressions 31d adjacent in the second direction X are coincident with one another. The continuous projections 41a and the low basis weight portions 32 of the continuous depressions 31d are aligned alternately in the second direction X to form a plurality of vertical rows R15 aligned in the first direction Y.

The skin-contacting sheet 10d of the fifth embodiment has a plurality of regions f_g in each of which the continuous projections 41a overlap the low basis weight portions 32 in the first direction Y in each of the vertical rows R15 aligned in the second direction X. Infolding occurs preferentially in these regions f_g with the contraction of the elastic members 19 as in the third embodiment. That is, the individual oblong projections 41 of the fifth embodiment have a plurality of infolding portions a_9 arrayed in the first direction Y and therefore undergo infolding at every infolding portion a_9 with the contraction of the elastic members having stretch in the first direction Y.

[0057]

When the textured region has continuous projections 41a and continuous depressions 31d as in the fifth embodiment, the length L1 of the oblong projection in the first direction Y is defined as follows. Assuming that the continuous projection 41a is a projection per unit area (e.g., 30 mm square), the length L1 is the whole length of the projection in the first direction Y, i.e., 30 mm.

Assuming that the continuous projection 41a is a projection per unit area (e.g., 30 mm square), the total length L10 of the infolding portions a_9 in the first direction Y is

the sum of lengths of the infolding portions a_9 in the first direction Y that are present in the projection per unit area. The total length L10 of the infolding portions a_9 in the first direction Y is an average for five projections per unit area that are randomly chosen from each one of ten randomly chosen continuous projections 41a. The projection per unit area is decided so that the projection can have the greatest number of the infolding portions a_9.

[0058]

Fig. 13 illustrates a skin-contacting sheet 10e according to the sixth embodiment. As illustrated, the skin-contacting sheet 10e has a plurality of oblong projections 41b and depressions 31d on its skin facing surface side. The individual oblong projections 41b provide spaces open on the non-skin facing surface side of the sheet 10e. The reverse side, i.e., the non-skin facing surface side of each depression 31d protrudes away from the wearer's skin to form projections on the non-skin facing surface side. The individual depressions 31b provide spaces open on the skin facing surface side of the sheet 10e. These oblong projections 41b and the depressions 31d alternate in two directions intersecting in plan view over the entire area of the skin-contacting sheet 10e. The depressions 31d of the sixth embodiment each have a low basis weight portion 32d that is the aforementioned portion containing a fiber material but at a lower basis weight than the oblong projections.

[0059]

Materials forming the above-described parts and members making up the diaper will be elaborated upon. The backsheet 13 and the absorbent member 14 can be made of any materials conventionally used in absorbent articles. The backsheet 3 may be formed of sparingly liquid permeable resin films or laminates of resin films and nonwovens. The absorbent core 14a of the absorbent member 14 may be an aggregate of hydrophilic fibers, such as wood pulp or hydrophilized synthetic fibers. The fiber aggregate may have an absorbent polymer held therein. The core wrap sheet 14b may be formed of the same sheet as the topsheet 12. The barrier cuff-forming sheets 15 may be formed of water-repellent nonwoven.

[0060]

The topsheet 12, which is the skin-contacting sheet 10, may be formed of liquid

permeable nonwovens conventionally used in absorbent articles. Useful nonwovens include through-air bonded, spun-bonded, spun-laced, melt-blown, resin-bonded, and needle-punched nonwovens. Complex nonwoven fabrics composed of two or more of these nonwovens are also useful.

[0061]

Various thermoplastic resin fibers may be used to make up the nonwovens. Examples of the thermoplastic resins include polyolefins such as polyethylene and polypropylene, polyesters such as polyethylene terephthalate, polyamides such as nylon 6 and nylon 66, polyacrylic acid, polymethacrylic acid alkyl esters, polyvinyl chloride, and polyvinylidene chloride. These resins may be used either individually or in combination of two or more thereof, for example, in the form of a polyblend or a conjugate fiber having a sheath/core or side-by-side configuration.

[0062]

The elastic members 15a, 16, and 19 may be made of synthetic rubbers, such as styrene-butadiene, butadiene, isoprene, and neoprene, natural rubber, EVA, stretch polyolefins, and polyurethane. Exemplary forms of the elastic members include threads or strings (or tapes) with a rectangular, square, circular, elliptic, or polygonal section, and multifilamentous twine.

[0063]

The elastic members 15a, 16, and 19 may be a stretch sheet 130 shown in Fig. 14, which is composed of extensible nonwoven fabric sheets 132 and 133 and a plurality of elastic filaments 131 arranged to stretch in one direction in non-intersecting relationship to each other and bonded over their whole length in their substantially non-stretched state between the two sheets 132 and 133.

[0064]

Every elastic filament 131 is bonded to the first nonwoven sheet 132 and the second nonwoven sheet 133. The first and second nonwoven sheets 132 and 133 may be the same or different. By “the same” is meant that they are the same in all aspects of fabrication process, material of fibers, thickness and length of fibers, sheet thickness and

basis weight, and so on. If any one of these properties is different, the sheets are considered different. As used herein, the term "elastic" refers to having stretchability and, on being stretched 100% (to double its length) and then relaxed from the stretch, capability of contracting to 125% or less of its original length.

[0065]

Both the nonwoven sheets 132 and 133 are extensible. They are configured to be extensible in the same direction as the stretch direction of the elastic filaments 131. The term "extensible" as used herein with respect to nonwoven sheets is contemplated to include not only a nonwoven fabric whose constituent fibers *per se* are extensible but also a nonwoven fabric whose constituent fibers are not *per se* extensible but which shows extensibility as a whole as a result of debonding of the fibers that have been bonded at their intersections, structural change of a three-dimensional structure formed of a plurality of fibers bonded to one another, breaks of the fibers, or straightening of slack fibers.

[0066]

The nonwoven sheets 132 and 133 in web form may previously be made extensible before being joined with the elastic filaments 131. Alternatively, the nonwoven sheets in web form may be inextensible before being joined with the elastic filaments 131 and, after being joined with the elastic filaments 131, be subjected to processing to be rendered extensible. Methods for making a nonwoven fabric sheet extensible include heat treatment, stretching between spaced pairs of rollers, stretching by a bite between corrugating members, and stretching by a tenter.

[0067]

Each elastic filament 131 is substantially continuous over the whole length of the stretch sheet 130. The elastic filament 131 contains an elastic resin. The elastic filaments 131 are arranged to extend in one direction in non-intersecting relationship to each other. It is acceptable that the elastic filaments 131 unintentionally intersect with each other due to unavoidable fluctuation of conditions in the production of the stretch sheet 130. The individual elastic filaments 131 may extend straight or in a serpentine fashion as long as they do not intersect with one another.

[0068]

While the above-described stretch sheet 130 has the elastic filaments 131 sandwiched in between two extensible nonwoven sheets 132 and 133, it may be replaced with a stretch sheet having the elastic filaments 131 fixed to a single extensible nonwoven sheet. In that case, the elastic filaments 131 are exposed.

[0069]

The skin-contacting sheet of the present invention can be made using known methods. For example, the skin-contacting sheet 10 of the first embodiment can be produced by a method including texturing a sheet to form depressions and projections and forming a low basis weight portion in the individual depressions. This method is carried out by introducing a sheet into between an embossing roller and a flat roller to achieve texturing and then forming low basis weight portions in the depressions using, for example, ultrasonic treatment.

The skin-contacting sheet 10a of the second embodiment, i.e., the composite sheet can be produced by the method described in JP 2018-099883A, which includes texturing the first sheet 21, joining the second sheet 22 to the first sheet 21, and applying ultrasonic vibration to these sheets (ultrasonication). The texturing is performed by introducing the first sheet 21 into the bite between first and second rollers having projections and recesses on their periphery and rotating in mesh. The joining of the two sheets is conducted by superposing the second sheet 22 on the textured first sheet 21 moving as held onto the first roller. The ultrasonication is carried out by applying ultrasonic vibration to the superposed sheets 21 and 22 sandwiched between the projections of the first roller and an ultrasonic horn of an ultrasonic fusing machine to form apertures going through the thickness of the skin-contacting sheet 10a as low basis weight portions 32.

[0070]

Formation of apertures as low basis weight portions 32 may also be achieved using a known cutting means capable of cutting out parts of a textured sheet, such as a cutting machine including a cutter roller and an anvil roller, the cutter roller having cutting blades shaped to the periphery of the aperture on its peripheral surface.

[0071]

While the present invention has been described on the basis of its preferred embodiments, it should be understood that the present invention is not deemed to be limited thereto, and various changes and modifications can be made therein.

For example, while the skin-contacting sheet 10 of the first embodiment has the textured middle region P and textured side region PS on either side of the textured middle region P, it may have its entire area textured with the oblong projections 41 and depressions 31 and 33 in the same pattern as in the middle region P.

The textured region P may have an area overlapping the elastic members 19 and an area non-overlapping the elastic members 19. In this case, the projection in the area overlapping the elastic members 19 and that in the area non-overlapping the elastic members 19 may have the same or different lengths in the first direction Y. For instance, the projections in the area overlapping the elastic members 19 may have a smaller width in the first direction Y than those in the area non-overlapping the elastic members 19.

[0072]

The low basis weight portions 32 may have any geometric shape oblong in the first direction Y. For example, the low basis weight portions 32 may be rectangular, elliptic, stadium-shaped, triangular, pentagonal, hexagonal, star-shaped, or heart-shaped.

The absorbent articles of the present invention are not limited to open-style disposable diapers and may be pull-on disposable diapers, panty-type sanitary napkins, flat type sanitary napkins, incontinence pads, or panty liners.

[0073]

The following clauses are illustrative of various embodiments and features of the absorbent articles disclosed herein.

1. An absorbent article having a longitudinal direction corresponding to the front-to-back direction of a wearer and a lateral direction perpendicular to the longitudinal direction and including a skin-contacting sheet having a textured region and configured to have the textured region come into contact with the skin of a wearer while worn,

the textured region having a first direction and a second direction perpendicular to the first direction and including a plurality of projections longer in the first direction than in the second direction and a plurality of depressions located between the projections

adjacent in the first or second direction,

the depressions each having a low basis weight portion with a lower fiber basis weight than the projections, and

the absorbent article further comprising an elastic member extending along the first direction, the elastic member being located on the non-skin facing surface side than the skin-contacting sheet.

[0074]

2. The absorbent article according to clause 1, wherein the low basis weight portions are arranged in a plurality of rows, with the rows extending in the second direction and being spaced in the first direction, and the projections each have a region sandwiched between the depressions adjacent in the second direction, the region having an infolding portion capable of folding inward of the individual projections with the contraction of the elastic member.

3. The absorbent article according to clause 2, wherein the infolding portion is located on the skin facing surface side than the low basis weight portion.

4. The absorbent article according to clause 1, wherein the low basis weight portions are arranged in a plurality of rows, with the rows extending in the second direction and being spaced in the first direction.

5. The absorbent article according to clause 2 or 4, wherein the rows of low basis weight portions are spaced equally in the first direction.

6. The absorbent article according to any one of clauses 1 to 5, wherein the elastic member is configured to have stretch in the first direction.

7. The absorbent article according to any one of clauses 1 to 6, wherein the elastic member has a stretch stress of 8 to 50 cN/10 mm, preferably 10 to 40 cN/10 mm.

8. The absorbent article according to any one of clauses 1 to 7, wherein the elastic

member is located on the non-skin facing surface side than the low basis weight portion.

9. The absorbent article according to any one of clauses 1 to 8, wherein the low basis weight portion has a fiber basis weight of 10% or less, more preferably 20% or less, of that of the projections longer in the first direction than in the second direction.

10. The absorbent article according to any one of clauses 1 to 9, wherein the low basis weight portion has a fiber basis weight of 30 g/m^2 or lower, preferably 20 g/m^2 or lower.

[0075]

11. The absorbent article according to any one of clauses 1 to 10, wherein the low basis weight portion is an aperture going through the thickness of the skin-contacting sheet.

12. The absorbent article according to any one of clauses 1 to 11, wherein the projection has a length L2 in the second direction, and the low basis weight portion has a length L5 in the second direction, with the L5 to L2 ratio, L5/L2, being 0.3 or greater, preferably 0.3 to 0.8, more preferably 0.4 to 0.7.

13. The absorbent article according to any one of clauses 1 to 12, wherein the projection has a length L2 in the second direction, and the low basis weight portion has a length L6 in the first direction, with the L6 to L2 ratio, L6/L2, being 0.3 or greater, preferably 0.3 to 1.5, more preferably 0.4 to 1.0

14. The absorbent article according to any one of clauses 1 to 13, wherein the projection has one or more portions sandwiched between the low basis weight portions adjacent in the second direction, the portions being arranged in the first direction,

the projection has a length L1 in the first direction, and the one or more portions have a total length L10 in the first direction, with the ratio of L10 to L1, L10/L1, being 0.2 or greater, preferably 0.2 to 0.8, more preferably 0.3 to 0.7.

15. The absorbent article according to any one of clauses 1 to 14, wherein the projection has a portion where the fibers making up the skin-contacting sheet are oriented in the second direction.

16. The absorbent article according to any one of clauses 1 to 15, wherein the projection has a portion where the fibers making up the skin-contacting sheet are oriented in the first direction.

17. The absorbent article according to any one of clauses 1 to 16, wherein the projection satisfies formula (1) below when the elastic member is extended to its maximum.

$$La > H1 \qquad (1)$$

Wherein La is a half the length L1 of the projection in the first direction; and H1 is the height of the projection.

18. The absorbent article according to clause 17, wherein the ratio of La to H1, La/H1, is 1.5 to 15.0, preferably 2.0 to 10.0.

19. The absorbent article according to any one of clauses 1 to 18, wherein the skin-contacting sheet is a composite sheet composed of a stack of a first sheet and a second sheet joined to each other at a plurality of bonds,

the first sheet forming the projections bulging away from the second sheet at locations other than depressions, and

the composite sheet having a flat surface on its side defined by the second sheet in a stretched-out state in the first direction.

20. The absorbent article according to any one of clauses 1 to 19, wherein the projection has a length L2 in the second direction and a length L1 in the first direction, with the L1 to L2 ratio, L1/L2, being 1.5 to 5.0, preferably 1.8 to 3.0.

[0076]

21. The absorbent article according to any one of clauses 1 to 20, wherein the elastic member has stretch in the lateral direction, and the elastic member and the textured region overlap each other in a longitudinal end portion of the absorbent article.

22. The absorbent article according to any one of clauses 1 to 21, wherein the elastic member has stretch in the longitudinal direction, and the elastic member and the textured region overlap each other in the longitudinal middle of the absorbent article.

23. The absorbent article according to clause 22, further including an absorbent core containing an absorbent material,

the absorbent core having a low basis weight portion extending in the longitudinal direction and having a low basis weight of the absorbent material, and

the elastic member, the textured region, and the low basis weight portion of the absorbent core overlapping each other.

24. The absorbent article according to clause 23, wherein the absorbent material basis weight of the low basis weight portion of the absorbent core is higher than 0% up to 80%, preferably 20% to 60%, of that of the other portions of the absorbent core.

25. The absorbent article according to clause 23 or 24, wherein the low basis weight portion of the absorbent core has an absorbent material basis weight of higher than 0 g/m^2 up to 500 g/m^2, preferably 40 to 400 g/m^2.

26. The absorbent article according to any one of clauses 1 to 25, wherein the elastic member includes a stretch sheet composed of a plurality of elastic filaments bonded to an extensible nonwoven fabric sheet.

27. The absorbent article according to any one of clauses 1 to 26, wherein the textured region has an area overlapping the elastic member and an area non-overlapping the elastic member,

the projections in the area overlapping the elastic member having a smaller width

in the first direction than those in the area non-overlapping the elastic member.

Industrial Applicability

[0077]

The present invention provides an absorbent article having projections that are designed to be effectively prevented from collapsing with the contraction of an elastic member without damaging their pleasant feel to the touch. The absorbent article so configured has good breathability.

CLAIMS

1. An absorbent article having a longitudinal direction corresponding to the front-to-back direction of a wearer and a lateral direction perpendicular to the longitudinal direction and comprising a skin-contacting sheet having a textured region and configured to have the textured region come into contact with the skin of a wearer while worn,

the textured region having a first direction and a second direction perpendicular to the first direction and comprising a plurality of projections longer in the first direction than in the second direction and a plurality of depressions located between the projections adjacent in the first or second direction,

the depressions each having a low basis weight portion with a lower fiber basis weight than the projections,

the absorbent article further comprising an elastic member which extends along the first direction, the elastic member being located on the non-skin facing surface side than the skin-contacting sheet, and

the low basis weight portions being arranged in a plurality of rows, with the rows extending in the second direction and being spaced in the first direction,

wherein a region of the projection that overlaps the depressions in the first direction forms an infolding portion capable of folding inward of the individual projection with the contraction of the elastic member.

2. The absorbent article according to claim 1, wherein the infolding portion is located on the skin facing surface side than the low basis weight portion.

3. The absorbent article according to claim 1 or 2, wherein the rows of low basis weight portions are spaced equally in the first direction.

4. The absorbent article according to any one of claims 1 to 3, wherein the low basis weight portion is an aperture going through the thickness of the skin-contacting sheet.

5. The absorbent article according to any one of claims 1 to 4, wherein the projection has a portion where fibers making up the skin-contacting sheet are oriented in the second direction.

6. The absorbent article according to any one of claims 1 to 5, wherein the projection has a portion where fibers making up the skin-contacting sheet are oriented in the first direction.

7. The absorbent article according to any one of claims 1 to 6, wherein the projection satisfies formula (1) below when the elastic member is extended to its maximum.

$$La > H1 \qquad (1)$$

Wherein La is a half the length L1 of the projection in the first direction; and H1 is the height of the projection.

8. The absorbent article according to any one of claims 1 to 7, wherein the skin-contacting sheet is a composite sheet composed of a stack of a first sheet and a second sheet joined to each other at a plurality of bonds,

the first sheet forming the projections bulging away from the second sheet at locations other than depressions, and

the composite sheet having a flat surface on its side defined by the second sheet in a stretched-out state in the first direction.

9. The absorbent article according to any one of claims 1 to 8, wherein the elastic member has stretch in the lateral direction, and the elastic member and the textured region overlap each other in a longitudinal end portion of the absorbent article.

10. The absorbent article according to any one of claims 1 to 9, wherein the elastic member has stretch in the longitudinal direction, and the elastic member and the textured region overlap each other in the longitudinal middle of the absorbent article, and wherein the first direction is coincident with the longitudinal direction.

11. The absorbent article according to claim 10, further comprising an absorbent core containing an absorbent material,

the absorbent core having a low basis weight portion extending in the longitudinal direction and having a low basis weight of the absorbent material, and

the elastic member, the textured region, and the low basis weight portion of the absorbent core overlapping each other.