

FEMININE HYGIENE ARTICLE WITH WAVY PATTERNS

FIELD OF THE INVENTION

The invention relates to feminine hygiene articles for external use. More specifically the invention relates to feminine hygiene articles having on their body-facing surface an embossed wavy pattern and a non-embossed wavy pattern.

BACKGROUND OF THE INVENTION

Feminine hygiene articles such as sanitary napkins are used by women during their menstrual periods to receive and contain blood discharges from the vagina. These absorbent sanitary articles are normally placed between the user's crotch and her undergarment. In addition to collecting menses, these articles may also be used to protect the wearer's undergarment from other bodily fluid such as urine in the case of light incontinence of the user.

These articles are generally flat and comprise a body-facing surface and an opposite garment-facing surface. Many commercial products are decorated on their body-facing surface with embossments. Various embossed decorative patterns have been proposed, see for example US design USD403,764, USD430,292. It has also been proposed to use non-embossed decorations, in particular coloured pattern, on the body-facing surface of such articles for aesthetic reasons or to convey a functional benefit. For example in WO03/53313 a concentric multi-tone non-embossed combination is used in the center of the body-surfacing to convey an impression of depth and absorbency to the user. In WO02/07662, dark non-embossed absorbent articles are proposed to be worn with dark underwear to be less conspicuous.

Only few products have been marketed showing on their body-facing surface at the same time an embossed pattern and a non-embossed pattern. One reason for this is the additional cost and complexity of applying two patterns of different natures in a coordinated way ("registration"). For example, because embossment and ink are applied in different process steps, it is easy for slight variations or displacements in the horizontal, vertical or both directions to occur during the high-speed manufacturing process. This is not a problem when only one decorative pattern is applied, as the slight shift away from the ideally desired position will generally not be noticed by the user. However when two kinds of patterns such as a non-embossed (e.g. coloured) and an embossed pattern are applied, they are normally expected to have some degree of

correspondence to provide an aesthetic effect. An accidental displacement of one or the other pattern will be easily recognized by a consumer because these patterns will no longer match each others in the originally desired way. Continuously monitoring and correcting the position of the patterns however significantly raise the cost and manufacturing complexity of the process.

There is therefore a need for a feminine hygiene article comprising on its body-facing surface an embossed pattern and a non-embossed pattern that provide the appearance or appeal of registration but do not require continuous registration.

The inventors have found that instead of continuously monitoring and correcting the position of the patterns during manufacture, it was possible to achieve results having for the user the appeal of registration even after slight horizontal or vertical displacements of any or both of the patterns. This result is obtained by applying a wavy embossed pattern and a wavy non-embossed pattern having certain geometric parameters. In these conditions, it was found that the visual appeal for the users (the appearance of registration) is kept even when slight shifts occur.

SUMMARY OF THE INVENTION

The invention relates to a feminine hygiene article comprising a body-facing surface, a longitudinal centerline and a transverse centerline, wherein the longitudinal centerline has a length L, and the transverse centerline has a width W. The body-facing surface comprises:

i) an embossed wavy pattern, said embossed wavy pattern comprising waves having a maximum wavelength L1 and a maximum amplitude A1, and

ii) a non-embossed wavy pattern, said non-embossed wavy pattern comprising waves having a maximum wavelength L2 and a maximum amplitude A2,

wherein each of the values of the ratio $L1/L$ and $L2/L$ are independently less than 1, and wherein each of the values of the ratio $A1/W$ and $A2/W$ are independently less than 0.3.

The invention is also for a method of manufacturing a feminine hygiene article comprising two lateral topsheet stripes having a wavy edge, said lateral topsheet stripes being symmetrically disposed across the longitudinal centerline C, said method comprising the steps of:

- i) providing a band of material,
- ii) cutting this band of material in its middle along a wavy cut pattern to form two strips of material each having a wavy edge,
- iii) de-phasing one of the strip in relation to the other by half a phase so that said
- 5 strips appear to be mirror image of each other,
- iv) placing said strips of material over the topsheet,
- iv) attaching the strips to the topsheet so that they form lateral topsheet stripes.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims which particularly point out and
10 distinctly claim the invention, it is believed the present invention will be better understood from the following description of preferred embodiments taken in conjunction with the accompanying drawings, in which like reference numerals identify identical elements and in which:

Figure 1 is a perspective view of an exemplary feminine hygiene article according
15 to the invention.

Figure 2 is an exploded view of the article of Fig.1.

Figure 3 is a top view of the body-facing surface of the embodiment of Fig.1.

Figure 4 is a top view of the body-facing surface of an alternative embodiment.

Figure 5 is a top view of the body-facing surface of the embodiment of Fig.1
20 wherein a slight shift in the longitudinal direction occurred.

Figure 6 is a top view of the body-facing surface of the embodiment of Fig.1 wherein a slight shift in the longitudinal and transversal direction occurred.

Figure 7 is a top view of the body-facing surface of another embodiment of the invention.

25 Figure 8 is a schematic view of an implementation of a process for making lateral topsheet stripes having a regular wavy cut and being mirror image of each other.

Figure 9 is a close-up view of the embossing unit of Figure 8.

DETAILED DESCRIPTION OF THE INVENTION

Feminine hygiene article 10

30 As used herein, the term "feminine hygiene articles" refers to the type of disposable absorbent articles externally worn by women for menstrual and/or light incontinence control. These articles are commonly referred to as pads, sanitary

napkins or sanitary towels. These articles have generally flat surfaces and are typically held in place adjacent the user's externally-visible genitalia (i.e., the pubic region) by the user's undergarment on which they are affixed via adhesive or other joining means.

The term "body-facing surface" refers to the side of the absorbent article facing the body of the user when in use. The "garment-facing surface" is the opposite surface of the article.

Fig. 1 shows a perspective view of the body-facing surface of a feminine hygiene article 10 according to the invention, herein represented as a liner. The articles of the invention will normally have a generally flat body-facing surface. However the feminine hygiene articles of the invention are not limited to a particular design construction.

Fig. 2 shows the different layers of the exemplary embodiment of Fig. 1. The articles of the invention normally comprise a topsheet 12, a backsheet 14, and an absorbent core 16 intermediate the topsheet 12 and backsheet 14. The topsheet wholly or partially forms the body-facing surface of the article, whilst the backsheet forms the garment-facing surface. Further additional elements to improve the performance of the articles may also be used and are represented, such as lateral topsheet stripes 18, a secondary topsheet 20, and/or a secondary backsheet 22. The article may also comprise a release paper 24.

The dimensions of the feminine hygiene articles of the invention should be adapted for the use intended. For example, pantyliners ("liners") are generally smaller and compacter than pads. The thickness of the absorbent articles is usually of from about 2 mm to about 50 mm. Thin sanitary napkin articles can have a thickness of less than 6 mm, or even less than about 4 mm.

The term "longitudinal centerline" refers to the imaginary line centered between the longitudinal side edges of the article and which is generally aligned with the vertical plane which bisects a standing wearer into left and right body halves and is represented by the line C on the drawings. The term "transverse centerline" refers to the imaginary line T centered between the transversal side edges of the article and which is perpendicular to the longitudinal centerline. The length L of the article along the longitudinal centerline of the article may be between 10 cm and 25 cm, and also between 12 cm and 21 cm. The width W of the article along the transversal centerline may be between 3 and 10 cm, for example between 4 and 7 cm. All these dimensions

are merely indicative and not limitative, because the normal dimensions of these and other types of absorbent sanitary articles may differ, as is known in the art.

Body-facing surface

As shown in Fig. 3 and following, the articles of the invention have a generally flat
5 body-facing surface, which normally may enter at least partially in contact with the user's body when it is worn. The body-facing surface of the article is normally partially or totally formed by the topsheet layer 12 of the article. In addition, the body-facing surface may further comprise two lateral topsheet stripes 18, each placed along one of the longitudinal sides of the body-surface of the article, atop the topsheet 12.

10 Typically, the body-facing surface area of feminine hygiene articles is of at least about 50 square centimeters to prevent discharged liquids from missing the target area, although some "micro" products may have a smaller surface area (e.g. 30 cm²).

Wavy patterns 26X, 28Y

The articles of the invention comprise at least one embossed wavy pattern 26X (X
15 being 0, 1, 2, 3, 4 or 5 in the drawings) and at least one non-embossed wavy pattern 28Y (Y being 0 or 1 in the drawings). By "wavy pattern" we mean a visually discernible form having the general aspect of a wave propagating in the longitudinal direction of the article. All kind types of waves may be used, such as sine waves, sawtooth waves, square waves, etc... although waves which are smooth i.e. without sharp angles, such
20 as sine type waves are preferred. The wavy pattern has alternating crests (hills) and troughs (valleys). By "wavelength" we mean the distance between two contiguous crests or two contiguous troughs. By "amplitude" we mean the difference in height between one crest and a contiguous trough.

The wavy patterns may be regular, by which we mean that a periodic pattern
25 where the wavelength and amplitudes remain constant, such as a simple sine function as is represented on Fig. 3 for the embossed patterns 260, 261, 262, 263 and the non-embossed patterns 280, 281. The wavy patterns may also be non-regular periodic, for example the wavelength may be shorter in one part of the article than the other, or the amplitude may vary but this is not preferred. The amplitude and wavelength for each
30 wavy pattern may remain substantially constant along the length of the wave, as represented in Fig. 3, or may vary at different points of the wave. By "maximum

wavelength" we mean the longest wavelength measurable on the article. By "maximum amplitude" we mean the largest amplitude measurable on the article.

The wavy patterns may be continuous, i.e. without showing any interruption, or may be discontinuous, as shown on Fig .3 for the embossed patterns 260, 261, 262, 263. A discontinuous pattern may be for example made of dots, broken lines or other interrupted elements. The number of elements per unit length does not need be constant but may vary along the length of the pattern or across the different discontinuous patterns when more than one are present. For example, on Fig. 3 the embossed patterns 260, 263 and 261, 262 have different numbers of embossed elements per unit length. Both the embossed wavy pattern and the non-embossed wavy pattern should be visually discernible on the body-facing surface of the article. Thus the patterns are preferably recognizable by an individual having a good vision (10 for each eye) when holding the product at a distance of 50 cm from the eyes under a normal incandescent lighting (e.g. under a 100W light bulb in an average sized room).

The wavy patterns according to the invention (whether embossed or non-embossed) may or may not extend along the whole length of the article. The wavy patterns preferably extend substantially along the whole length L of the article in the longitudinal direction, as represented in Fig. 3.

The invention requires at least one embossed wavy pattern 26X and at least one non-embossed wavy pattern 28Y on the body-facing surface of the article, although it may be preferred to have an even number of embossed wavy patterns so that they can be arranged symmetrically on both side of the longitudinal centerline C. For example the article represented on Fig. 3 comprises four embossed wavy patterns 260, 261, 262, 263, which are arranged as pairs 260, 261 and 262, 263 on each side of the longitudinal centerline L. Similarly the article of Fig. 3 comprises two non-embossed wavy patterns 280, 281 symmetrically arranged on each side of the article. In the embodiment of Fig. 3, the two embossed wavy patterns 261 and 262 are superposed with the wavy non-embossed patterns 280 and 281 respectively in the registered (optimal) situation.

It may also possible to have only one wavy pattern of each type, for example in a central position across the centerline if an impression of symmetry is to be given to the article. It may also be possible to have more than two embossed wavy patterns on each side of the longitudinal centerline, for example three on each side, as represented

in Fig. 4. The longitudinal centerline L of the article may be, at least approximately, as an axis of symmetry for the body-facing surface of the article.

The embossed wavy pattern of the invention has a maximum wavelength L1 and maximum amplitude A1. The value of the ratio of the maximum wavelength L1 to the length of the article L along the longitudinal centerline ($L1/L$) is less than 1, and the value of the ratio of the maximum amplitude to the width of the article along the transversal centerline ($A1/W$) is less than 0.3. When the article comprises more than one embossed wavy pattern, at least one of these should fulfill the above requirements. The ratio $L1/L$ is preferably less than 0.5, or even of from 0.1 to 0.3. The ratio $A1/W$ is preferably of from 0.03 to 0.2. As discussed above, the embossed wavy patterns shown in the Figures are regular periodic and therefore their wavelength and amplitude does not vary along the length of each pattern but this is not necessarily the case.

Feminine hygiene articles with various embossments have been proposed in the past and the embossing technique is well known for this type of products. Embossing normally serves a dual function: first to provide aesthetic appeal and second to provide a bonding between the layers, in particular bond the lateral topsheet stripes (when these are present) with the topsheet or the topsheet with the secondary topsheet stripes. Suitable embossing can be achieved with standard techniques such as thermal, ultrasonic or pressure bond, or a combination of these. A suitable process is thermal bonding wherein the layers are passed through two steel rolls where one is engraved with the visual pattern and the other is flat. Both rolls are warmed to temperature suitable to melt the layer (typical range from 90 to 170°C).

The articles of the invention comprise on their body-facing surface at least one non-embossed wavy pattern 28Y, which may be a coloured pattern. The non-embossed wavy pattern of the invention has a maximum wavelength L2 and a maximum amplitude A2. The value of the ratio of the maximum wavelength L2 to the length of the article L along the longitudinal centerline $L2/L$ is less than 1, and the value of the ratio of the maximum amplitude A2 to the width of the article W along the transversal centerline $A2/W$ is less than 0.3. When the article comprises more than one non-embossed wavy pattern 28Y, at least one of these should fulfill the above requirements. The ratio $L2/L$ is preferably less than 0.5, or even from 0.1 to 0.3. The ratio $A2/W$ is preferably of from 0.03 to 0.2.

The non-embossed wavy pattern(s) may be formed by the wavy edge of a layer of the article, for example the inwardly facing edges of the lateral topsheet stripes 18 when present, as is represented on Fig .3, or by other means. For example one or more non-embossed, coloured, lines may be printed on the article, either directly on the body-facing surface of the article (LTS or TS) or even on an underlying layer (e.g. the STS) if the colour is visible by transparency through the overlying layers. With the word "non-embossed" we mean that the non-embossed wavy pattern displays a visual or tactile contrast with the rest of body-facing surface which is not due to an embossment. For feminine hygiene articles which are substantially white, as it is traditionally the case, the non-embossed pattern may be a coloured pattern, realized by any shade of black, gray, blue, red, green, yellow, violet or any other colors, or tints. Recently, coloured feminine hygiene articles have been proposed which can be worn with garments having a matching colour, and in these cases the non-embossed wavy pattern may be white over a coloured background. Some treatments of a portion of the surface of the article may also give it a visually distinctive appearance without changing its color, for example chemicals may be used to give a contrasting brightness or mateness to the surface of the article and this may create a non-embossed pattern as intended in the present invention. The non-embossed wavy pattern may also be formed by using a material having a different tactile sensation as the rest of the body-facing surface of the article, such as a different texture or thickness.

In a preferred embodiment, discussed in further details below, non-embossed wavy patterns may be formed on each side of the longitudinal centerline by coloured lateral topsheet stripes having a wavy cut on their inwardly facing edges.

The articles of the present invention comprise at least one embossed wavy pattern and at least one non-embossed wavy pattern, but may comprise more such patterns as long as at least one embossed and at least one non-embossed wavy pattern have the geometric properties claimed. Preferably all the wavy patterns present on the body-facing surface of the article have the claimed properties.

The article represented on Fig. 3 comprises registered wavy patterns, as embossed and non-embossed patterns are in phase and perfectly symmetrical relative to the centerline C. As discussed above, during the high speed processing of modern production chain, it is easy for these patterns to lose their registration (i.e. their intended placement). Fig. 5 shows the result of such a small transversal displacement

S_T , or shift, of the lateral topsheet stripes 18. While the distance between the two lateral topsheet stripes remained constant, their relative position has slightly shifted in the transversal direction to the left so that the non-embossed wavy patterns formed by the inwardly-facing edges of the lateral topsheet stripes are no longer registered with the embossed patterns 260, 261, 262, 263. However it was found that the article still keeps a visually pleasing appearance for the user. Fig. 5 shows the result of an additional displacement or shift S_L , this time upwards in the machine direction axis. This displacement has little impact in the consumer acceptance of the product, thanks to the parameters chosen for these wavy patterns.

Fig. 7 shows another possible configuration wherein the wavelength L_1 of the embossed patterns 26X is different from the wavelength L_2 of the non-embossed pattern 28Y. In the embodiment of Fig. 7, L_1 is inferior to L_2 , but the opposite relation may be used in other embodiments. In one embodiment the value of L_1 is equal to $\pm 50\%$, or even $\pm 20\%$ of the value of L_2 , but other values outside this range may be used. When L_1 is substantially equal to L_2 as shown in Fig. 3, it may be decided to phase both embossed and non-embossed wavy patterns as shown, or these wavy patterns may also be de-phased, by a given value (for example half a wavelength) or may be randomly de-phased. Similarly, the value of A_1 may be selected to be equal to $\pm 50\%$, or even $\pm 20\%$, of the value of A_2 or be substantially the same value. The values for A_1 and A_2 may also be different such as A_1 being inferior or superior to A_2 by more than 50%.

Topsheet 12

The topsheet is a layer of the article that contacts the body of the wearer and receives bodily discharges. The topsheet is liquid pervious and may be flexible and non-irritating to the skin. The term "liquid pervious" as used herein refers to components that allow liquids to pass therethrough without significantly retarding or obstructing the transmission of such liquids therethrough. As used herein the term "flexible" refers to materials which are compliant and readily conform to the shape of the body or respond by easily deforming in the presence of external forces. Components are considered absorbent if such components not only transmit such liquids, but also can retain a portion of the liquids deposited on such components.

Any conventional topsheet materials may be used within the invention. Preferably the topsheet is not noisy, to provide discretion for the wearer. The topsheet should be

sanitary, clean in appearance and somewhat opaque to hide the bodily discharges collected in and absorbed by the core. Suitable topsheets may be made from nonwoven materials or perforated polyolefinic films.

5 If desired, the topsheet may be sprayed with a surfactant to enhance liquid penetration to the core. The surfactant is typically non-ionic and should be nonirritating to the skin. A surfactant density of about 0.01 milligrams per square centimeter of topsheet area is normally suitable. A suitable surfactant is sold by the Glyco Chemical, Inc. of Greenwich, Connecticut as Pegospense 200 ML.

10 The topsheet may have a plurality of apertures to permit liquids deposited thereon to pass through to the core. An apertured polyolefinic film topsheet having about 5 to about 50 percent open area, typically about 25 percent open area, and a thickness of about 0.01 to about 0.03 millimeters prior to aperturing and about 0.42 to about 0.51 millimeters after aperturing is usual.

Lateral topsheet stripes 18

15 The articles of the invention may comprise a pair of nonwoven lateral topsheet stripes 18 placed above the topsheet 12, and which may deliver cloth like, soft feeling of the article edges and improve the aesthetic of the article.

The lateral topsheet stripes can for example be made of all conventional type of nonwovens, such as carded thermal bonded, spun bonded, hydro entangled, melt
20 blown, and using all range of suitable synthetic or natural fibers such as polypropylene, polyethylene, polyester, rayon, cotton, and in a mixed form or in the form of monocomponent, bicomponent fiber. For example, Pegas a.s (Czech Republic) supplies a suitable nonwoven based of bicomponent fibers made of Polypropylene (PP) as core and Polyethylene (PE) as sheath, with a polymer ratio: PP core 70%/PE sheath
25 30%.

The lateral topsheet stripes may take the form of two parallel stripes extending substantially along the whole length of the longitudinal sides of the article. Typically, the outwardly facing edges of the lateral topsheet stripes are contiguous to the longitudinal sides of the article on its periphery. The inwardly facing edge of the lateral stripes can
30 be linear or have any other shapes. In the preferred embodiment represented in the Figures, the lateral topsheet stripes are made of a coloured material and the inwardly facing side of the edge is cut along a wavy pattern to form the non-embossed wavy pattern of the invention. An example of suitable pigment that can be introduced in

bicomponent nonwoven mentioned above is Pantone color 270 Sanylen violet PP 42000634 ex Clariant. This pigment may for example be introduced in the polypropylene master batch.

The lateral topsheet stripes may be mirror image of each other relative to the longitudinal centerline C. By "mirror" image we mean that the longitudinal centerline C is an axis of symmetry for the lateral topsheet stripes, at least in the registered configuration (i.e. notwithstanding accidental lateral shifts of the position of the lateral topsheet stripes during the manufacture). An economical process to obtain lateral topsheet stripes having a regular wavy pattern cut and being mirror image of each others is shown in Fig. 8 and Fig. 9. In this process, a standard straight band of material 26 is passed through cut unit 28, which cuts an approximately regular wavy pattern along the middle of the band 26 and forms two strips of material 30, 32 having corresponding wavy edges. By regular we mean that the wavy pattern has waves having constant wavelength and amplitude. A gap between the two strips of material may be introduced by a separating roll or bar 34. A pitching unit 36 then displaces the strip 32 by approximately half a phase relative to the other strip of material 30 so that they become mirror image of each other. This may be done by increasing the distance traveled by the strip 32 by $(2n + 1)/2$ times the wavelength of the wavy pattern relative to the distance traveled by the other strip 30 (n being any integer, including the null value). The strips of material 30, 32 may then brought back into parallel running and then applied on the topsheet of the article 12 to form lateral topsheet stripes 18 which are mirror image of each others. The lateral topsheet stripes may be adhered to the topsheet and cut by any standard techniques such as heat embossing via an embossing roll 40 or by any other conventional means, such as gluing, heat bonding or a combination thereof.

This process is economical as it allows manufacturing lateral topsheet stripes with wavy cut edges without loss of material due to the wavy cut. In a next step (not represented) the periphery of the topsheet and lateral topsheet stripes may be cut and embossed to the desired shape by a die cut machine if it is not rectangular, for example as represented on Fig. 3 with concave longitudinal edges and convex transversal side edges.

The presence of lateral topsheet stripes may be beneficial in a number of ways, such as improving tactile sensation, appearance and performance of the product. It

was found to be particularly beneficial to provide the article with lateral topsheet stripes having their inwardly facing edge with a wavy cut, wherein the lateral topsheet stripes are made of a coloured material to provide the article with a wavy non-embossed pattern according to the invention. The coloured lateral topsheet stripes can be
5 obtained by printing the lateral topsheet stripes, or including a coloured pigment in the fiber master batch. For example in case of bicomponent fiber the pigment can be incorporated either in the core of the fiber or in the sheath or in both.

It may be preferred that the lateral topsheet stripes are made of a material having water-repelling properties, in other words an hydrophobic material, to help preventing
10 side leakage or re-wetting of the body facing surface of the article. Examples of hydrophobic materials suitable for the lateral topsheet stripes include the synthetic polymeric materials cited above, in particular polyethylene, polypropylene and their mixtures.

In a preferred embodiment, the wavy embossed pattern(s) at least partially
15 overlaps the lateral topsheet stripes. This overlap provides for at least some bonding between the lateral topsheet stripes and the topsheet. It may be preferred that a least 30% of the total surface of the wavy embossed pattern(s) overlaps the lateral topsheet stripes. Higher overlapping percentages are suitable for even stronger bonding, such as at least 50% or at least 75%. It was found that when the inwardly facing edges of
20 each lateral topsheet stripes feature a wavy cut forming a non-embossed wavy pattern according to the claims, it is particularly beneficial to have at least one or more wavy embossed patterns according to the claim at least partially overlapping these lateral topsheet stripes. Because of the specific geometrical features claimed for the wavy patterns, it was found that even when a mis-registration of the lateral topsheet stripes
25 and/or embossment takes place, there is still a sufficient overlapping of the wavy embossed pattern over the wavy cut lateral stripes to provide satisfactory bonding between the lateral topsheet stripes and the topsheet.

Absorbent core 16

The articles of the invention may comprise an absorbent core 16 disposed
30 between the topsheet 12 and the backsheet 14. As used herein, the term "absorbent core" refers to a material or combination of materials suitable for absorbing, distributing, and storing aqueous fluids such as urine, blood, menses, and other body exudates.

The size and shape of the absorbent core can be altered to meet absorbent capacity requirements, and to provide comfort to the wearer. As with the other elements of the articles of the invention, there are no particular requirements for the absorbent core and any standard liquid-absorbent material known in the art for use in absorbent articles will normally be suitable.

Non-limiting examples of liquid-absorbent materials suitable for use as the absorbent core include comminuted wood pulp which is generally referred to as airfelt; creped cellulose wadding; absorbent gelling materials including superabsorbent polymers such as hydrogel-forming polymeric gelling agents; chemically stiffened, modified, or cross-linked cellulose fibers; meltblown polymers including co-form; synthetic fibers including crimped polyester fibers; tissue including tissue wraps and tissue laminates; capillary channel fibers; absorbent foams; absorbent sponges; synthetic staple fibers; peat moss; or any equivalent material; or combinations thereof. The core, as the article itself, may be generally planar, i.e. does not have a significant variation in thickness.

Typically the absorbent core is rectangularly shaped, for ease of manufacturing. However, the core may be differently shaped, for example there is frequently a wearer preference for an absorbent core which is narrower at the center than at the ends, to comfortably accommodate the legs, and obviate or minimize occurrences of bunching or wadding of the core. Oval shaped core have also been proposed (e.g. WO2005/084596). Further generic and specific information regarding absorbent cores can be found for example in WO0207662A1 and WO09119471.

Backsheet 14

The backsheet 14 may be any flexible, liquid resistant, and liquid impervious material. The backsheet prevents discharges collected by and contained in the sanitary napkin, and particularly discharges absorbed by the core, from escaping the sanitary napkin and soiling the clothing and bedding of the wearer. Preferably the backsheet is not noisy, to provide discretion for the wearer. In some executions, a secondary backsheet (discussed below) may be placed intermediate the core and the backsheet to second the backsheet, for example to provide liquid imperviousness.

Any conventional backsheet materials may be used within the invention, such as polyolefinic films. The backsheet may be impervious to malodorous gases generated by absorbed bodily discharges, so that the malodors do not escape. The backsheet

may or may not be breathable. A low density polyethylene backsheet about 0.01 to about 0.08 millimeters in thickness, preferably about 0.05 millimeters in thickness, is usual. A polyethylene film, such as is sold by the Tredegar Corporation of Terre Haute, Indiana, under model X-813 may be used. Further, the backsheet may be made of a
5 soft cloth like material which is hydrophobic relative to the topsheet, e.g. a polyester or polyolefinic fiber backsheet.

The topsheet and the backsheet are preferentially peripherally joined using known techniques, either entirely so that the entire perimeter of the sanitary article is circumscribed by such joinder or are partially peripherally joined at the perimeter. The
10 term "joined" refers to the condition where a first component is affixed, or connected, to a second component either directly; or indirectly, where the first component is affixed, or connected, to an intermediate component which in turn is affixed, or connected, to the second component. The joined condition between the first component, and the second component, is intended to remain for the life of the sanitary napkin. Conversely,
15 components are considered "removably affixed" if the components may be detached and separated from each other without destruction or unintended gross deformation of either.

Any joined arrangement that provides for capture of the core intermediate the topsheet and the backsheet and a unitary assembly is suitable. Such an assembly has
20 two mutually opposed major faces, one defined by the topsheet and one defined by the backsheet.

The outwardly oriented (garment facing) face of the backsheet may further comprise means for attaching the sanitary napkin to the undergarment of the wearer. Pressure sensitive adhesive has been commonly found to work well for this purpose.
25 Preferably a strip of longitudinally oriented adhesive provides good protection against either the front or the back of the sanitary napkin becoming detached from the wearer's undergarment. The adhesive strip may be continuous or intermittent. A particularly preferred arrangement utilizes two longitudinally oriented strips, one on each side of the longitudinal centerline.

30 The backsheet typically extends across the whole of the absorbent structure and can extend into and form part of or all of the sideflaps, side wrapping elements or wings, when present.

Secondary topsheet 20

The articles of the invention may optionally comprise a secondary topsheet layer 20 intermediate the topsheet 12 and the absorbent core 16.

Such a secondary layer might be manufactured from a wide range of materials
5 such as woven, nonwoven materials, polymeric materials such as apertured formed thermoplastic films, apertured plastic film, hydro formed thermoplastic films, porous foams, reticulated foams, reticulated thermoplastic films and thermoplastic scrims. Any material described hereinbefore for the topsheet can be used for the secondary layer. In a preferred embodiment, this secondary topsheet layer underlies the apertured
10 topsheet on the entire surface thereof, i.e., the secondary layer extends to the periphery of the topsheet so that the secondary layer underlies the topsheet on the entire inner surface of the topsheet.

The purpose of the secondary topsheet is normally to readily transfer the acquired body fluid from the topsheet to the absorbent core, the transfer of fluid occurring not
15 only vertically in the thickness of the secondary topsheet, but also along the length and the width directions of the absorbent product. This helps the fluid capacity of the underlying storage layer to be fully utilized. Although preferred, the presence of secondary topsheet is however optional.

Secondary backsheet 22

20 The articles of the invention may comprise a secondary backsheet layer 22 intermediate the absorbent core 16 and the backsheet layer 14. The use of a secondary backsheet is particularly indicated in presence of air permeable backsheet. The purpose of the secondary backsheet is to retard or prevent liquid from passing from the absorbent core to the outside of the product, while allowing free air flow
25 through it. A particularly suitable example of secondary backsheet is a resilient three dimensional polymeric web, which consist of a liquid impervious film which has apertures forming capillarity or cones. The film with capillaries or cones is oriented such us the apex of the cones face the absorbent core, this to prevent passage of fluid. The capillaries or cones can have a slanted shape in order to partly close or completely
30 close when compressed.

Release paper 24

The adhesive coated on the backsheet surface are typically provided with a protective cover, which is removed prior to use. The protective cover may be a silicone coated release paper, a plastic film or any other easily removable cover. The protective cover may be in a single piece or in a multitude of pieces, e.g. to cover the individual adhesive areas. It also can perform other functions such as providing individualized packaging for the article or provide a disposal function. Any commercially available release paper or film may be used. Suitable examples include BL 30 MG-A SILOX EI/O, BL 30 MG-A SILOX 4 P/O available from Akrosil Corporation, and M&W films available from Gronau in Germany, under the code X-5432.

Method of manufacture

The feminine hygiene articles of the present invention may comprise the usual layers or components normally found in commercially available standard articles which may be joined together by standard means such as embossing (e.g. thermal bonding) or gluing or combination of both, and the articles may be produced industrially by conventional means. In particular the embossed wavy pattern may be applied by conventional heat embossing rolls. The non-embossed wavy pattern may be obtained by various methods as discussed above, for example by providing non-embossed lateral topsheet stripes with a wavy cut on their inwardly facing edge or by printing such a pattern with an ink on the topsheet, lateral topsheet stripes or secondary topsheet or any combination of them, as is known in the art. In this case the ink application step may take place on an isolated layer (e.g. the secondary topsheet) before this layer is joined with any of the other layers, or on the other hand, the ink may be applied on the layer already attached or fixed, entirely or partially, to another layer. When present the lateral topsheet stripes may be obtained by conventional means (cutting) or by the process discussed above.

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".

CLAIMS

1. A feminine hygiene article (10) comprising a body-facing surface, wherein the body-facing surface has a longitudinal centerline (C) having a length L, and a transverse centerline (T) having a width W, wherein the body-facing surface comprises:
 - i) at least one embossed wavy pattern (26X), said embossed wavy pattern comprising waves having a maximum wavelength L1 and a maximum amplitude A1, wherein the values of the ratio $L1/L$ is less than 1 and wherein the values of the ratio $A1/W$ is less than 0.3; and
 - ii) at least one non-embossed wavy pattern (28Y), said non-embossed wavy pattern comprising waves having a maximum wavelength L2 and a maximum amplitude A2, wherein the values of the ratio $L2/L$ is less than 1 and wherein the values of the ratio $A2/W$ is less than 0.3.
2. An article to claim 1 wherein the at least one non-embossed wavy pattern (28Y) is coloured.
3. An article to claim 1 or 2 wherein the article comprises a first set (260, 261, 280) of said embossed wavy pattern(s) and said non-embossed wavy pattern(s) on one side of the longitudinal centerline and a second set (262, 263, 281) of said embossed wavy pattern(s) and said non-embossed pattern(s) on the other side of the longitudinal centerline.
4. An article according to claim 1 or 2 wherein L1 is equal to L2 with a $\pm 50\%$ margin and/or wherein A1 is equal to A2 with a $\pm 50\%$ margin.
5. An article according to any of the preceding claims wherein said embossed wavy pattern(s), said non-embossed wavy pattern(s) or both have constant amplitude and/or wavelength values across the article.

6. An article according to any of the preceding claims wherein the article comprise one lateral topsheet stripe (18) on each longitudinal side of the article.
7. An article according to claim 6 wherein said lateral topsheet stripe is made of a coloured material.
8. An article according to claim 6 or 7 wherein the inwardly-facing edges of said lateral topsheet stripes (18) are cut according to a wavy pattern cut, so that these inwardly-facing edges form at least two of said wavy non-embossed pattern (280, 281).
9. An article according to the claim 6 or 7 or 8, wherein at least one of said embossed wavy pattern(s) at least partially overlaps at least one of the lateral topsheet stripes.
10. An article according to claim 9 wherein at least 30% of the total surface of said embossed wavy pattern(s) overlaps the lateral topsheet stripes.
11. An article according to any of the preceding claims wherein the longitudinal centerline of the article is an axis of symmetry for the body-facing surface of the article.
12. A method for manufacturing a feminine hygiene article (10) comprising a topsheet (12), said feminine hygiene article (10) comprising a body-facing surface, wherein the body-facing surface has a longitudinal centerline (C) having a length L, and a transverse centerline (T) having a width W, and wherein the body-facing surface comprises:
 - a) at least one embossed wavy pattern (26X), said embossed wavy pattern comprising waves having a maximum wavelength L1 and a maximum amplitude A1, wherein the values of the ratio $L1/L$ is less than 1 and wherein the values of the ratio $A1/W$ is less than 0.3; and

- b) at least two non-embossed wavy patterns (28Y), said non-embossed wavy patterns comprising waves having a maximum wavelength L_2 and a maximum amplitude A_2 , wherein the values of the ratio L_2/L is less than 1 and wherein the values of the ratio A_2/W is less than 0.3

said article comprising two lateral topsheet stripes (18) each having a wavy inwardly-facing edge, said lateral topsheet stripes being symmetrically disposed across the longitudinal centerline (C),

wherein the inwardly-facing edges of said lateral topsheet stripes (18) are cut according to a wavy pattern cut, so that these inwardly-facing edges form at least two of said non-embossed wavy pattern (280, 281),

said method comprising the steps of:

- i) providing a band of material (26),
- ii) cutting this band of material in its middle along a regular wavy cut pattern to form two strips of material (30, 32) each having a wavy edge, said wavy cut pattern comprising waves having a maximum wavelength L_2 and a maximum amplitude A_2 , wherein the values of the ratio L_2/L is less than 1 and wherein the ratio A_2/W is less than 0.3;
- iii) de-phasing one of the strip (32) in relation to the other by half a phase so that said strips (30, 32) appear to be mirror image of each other,
- iv) superposing said strips of material on the topsheet (12),
- v) attaching the strips of material to the topsheet (12) so that they form lateral topsheet stripes (18) and wherein said lateral topsheet stripes form said non-embossed wavy patterns (28Y),
- vi) embossing the body-facing surface of the article with at least one embossed wavy pattern (26X), said embossed wavy pattern comprising waves having a maximum wavelength L_1 and a maximum amplitude A_1 , wherein the values of the ratio L_1/L is less than 1 and therein the values of the ratio A_1/W is less than 0.3.

13. A method according to claim 12 wherein the band of material (26) is made of a coloured non-woven material.