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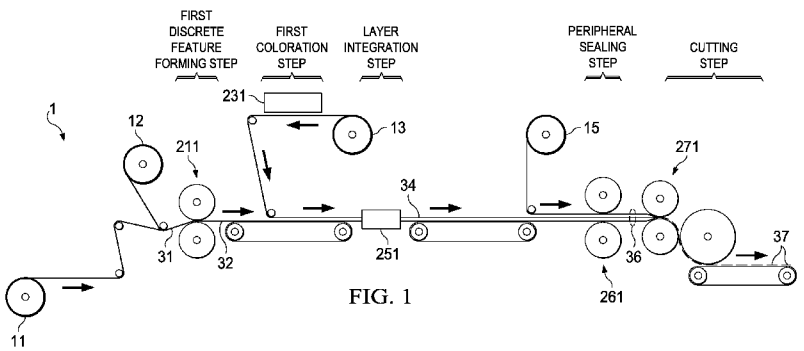

FIG. 1

(57) Abstract: The present invention relates to a method for fabricating absorbent article having multiple layers, and deformed zones of targeted performance, and colored regions, the method comprising the steps of forming discrete features on at least one layer, printing colored regions on at least one layer, integrating multiple layers to form an absorbent assembly, and cutting the absorbent assembly into individual absorbent articles, wherein the steps are carried out continuously.

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METHOD FOR FABRICATING ABSORBENT ARTICLES

FIELD OF THE INVENTION

The present invention relates to methods for fabricating absorbent articles. Specifically, the method can be used to fabricate absorbent articles having a colored region and a deformed topsheet in a continuous process.

BACKGROUND OF THE INVENTION

Absorbent articles such as sanitary napkins and female adult incontinence articles that function to collect fluid discharged from a woman's vagina or urethra often include a deformed surface region and a colored region in the absorbent article.

A colored region on or below a top surface of an absorbent article that is visible through a topsheet can provide functional and perceptional advantages. The colored region can overcome a problem of unsightly staining during, for example, a woman's menstrual period. The colored region on a layer below the topsheet, which can be viewed through the topsheet, can also provide for a perception of depth and greater fluid storage capacity within the absorbent article. In addition, by including a colored region in the central portion of the absorbent article, manufacturers of absorbent articles may effectively teach consumers that the central portion of the absorbent article is where the fluid collected should reside.

Meanwhile, various fluid handling demands on different portions of an absorbent article, different physical interactions between portions of an absorbent article and portions of a wearer's body, and different moisture and chemical environments of different portions of a wearer's crotch region create unique needs for different regions of the topsheet. Some absorbent articles designed to have a topsheet with deformed regions that are arranged to provide fluid handling benefits where needed and/or skin comfort benefits where needed are, for example, disclosed in WO 10/17360; WO 10/17362; and WO 10/17351.

Provision of a colored region and/or deformed regions on a web has been carried out separately from an absorbent article fabrication.

In many cases to provide best functionality of absorbent articles, it is best to provide each step of the manufacturing process next to each other and in the right sequence so that one does not have issues with performance of the absorbent articles that could occur if made separately. For instance, formation of features in a topsheet far apart or in a different sequence may cause weakening of the topsheet structure, thereby causing tearing in use or during the manufacturing

process. Further, separation of unit steps of feature formations may increase the possibility that some or many features closely co-located in a topsheet formed in different unit steps overlap which leads to increased aperture size which would cause rewet problems.

Accordingly, there is a need for a process which can provide zones of targeted performance, and colored regions in a high-speed continuous operation.

SUMMARY OF THE INVENTION

The present invention is directed to a method for fabricating absorbent article having multiple layers, deformed zones of targeted performance, and colored regions, the method comprising the steps of forming discrete features on a topsheet, printing a colored region on at least one layer, integrating multiple layers to form an absorbent assembly, and cutting the absorbent assembly into individual absorbent articles, wherein the steps are carried out continuously.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic representation of a process of the present invention.

FIG. 2 is a schematic representation of another embodiment of a process of the present invention.

FIG. 3 is a schematic representation of another means of forming first discrete features in a process of the present invention.

FIG. 4 is a schematic representation of an exemplary process for selectively aperturing a web in the process of the present invention;

FIG. 5 is an enlarged perspective illustration of a web weakening arrangement of the process of FIG. 4.

FIG. 6 is an enlarged perspective illustration of an incremental stretching system in the process of FIG. 4.

FIG. 7 is a schematic representation of another process for selectively aperturing a web in the process of the present invention;

FIG. 8 is an enlarged perspective illustration of another web weakening arrangement of the process of FIG. 7.

FIG. 9 is a schematic representation of optional discrete extended elements forming step of a process of the present invention.

FIG. 10 is a schematic representation of another embodiment of a process of the present invention.

FIG. 11A is a schematic representation of another means of forming first and second discrete features in a process of the present invention.

FIG. 11B is a schematic representation of another means of forming first and second discrete features in a process of the present invention.

FIG. 11C is perspective representation of an apparatus and a method shown in FIG. 11A for forming first and second discrete features in a process of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The term "absorbent article", as used herein, includes disposable articles such as sanitary napkins, panty liners, diapers, adult incontinence articles, and the like. Such absorbent articles are intended for the absorption of body liquids, such as menses or blood, vaginal discharges, urine, and feces. Various absorbent articles described above will typically comprise a liquid permeable topsheet, a liquid impermeable backsheet joined to the topsheet, and an absorbent core between the topsheet and backsheet.

The term "aperture", as used herein, refers to a hole. The apertures can either be punched cleanly through the web so that the material surrounding the aperture lies in the same plane as the web prior to the formation of the aperture, or holes formed in which at least some of the material surrounding the opening is pushed out of the plane of the web. In the latter case, the apertures may resemble a protrusion or depression with an aperture therein.

The term 'color' as referred to herein includes any color, i.e., white, black, red, blue, violet, orange, yellow, green, and indigo as well as different shades thereof or mixtures thereof.

The term "component" of an absorbent article, as used herein, refers to an individual constituent of an absorbent article such as a topsheet, acquisition layer, liquid handling layer, absorbent core or layers of absorbent cores, backsheets, and barriers such as barrier layers and barrier cuffs, and functional or aesthetic design elements such as colored regions, channels, and features formed on a topsheet.

The term "comprising", as used herein and in the claims, is inclusive or open-ended and does not exclude additional unrecited elements, compositional components, or method steps.

The term "discrete", as used herein, means distinct or unconnected. When the term "discrete" is used relative to forming elements on a forming member, it is meant that the distal (or radially outwardmost) ends of the forming elements are distinct or unconnected in all

directions, including in the machine and cross-machine directions (even though bases of the forming elements may be formed into the same surface of a roller, for example).

The term “forming elements”, as used herein, refers to any elements on the surface of a forming member such as a roller that are capable of deforming a web. The term “forming elements” includes both continuous or non-discrete forming elements such as the ridges and grooves on ring rolls, and discrete forming elements.

The term "joined", as used herein, 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 absorbent article.

The term “machine direction” or “MD”, as used herein, refers to the path that material, such as a web, follows through a manufacturing process, while the term “cross machine direction” or “CD” is the direction substantially perpendicular to the MD and in the plane generally defined by the web. Directions within 45 degrees of the cross direction are considered to be cross directional.

The term "nonwoven", as used herein, refers to a material having a structure of individual fibers or threads which are interlaid, but not in a repeating pattern as in a woven or knitted fabric, which do not typically have randomly oriented fibers. Nonwoven has been formed from many processes, such as, for example, meltblowing processes, spunbonding processes, hydroentangling, and bonded carded web processes, including carded thermal bonding. The constituent fibers of a nonwoven can be polymer fibers, and can be monocomponent, bicomponent, and/or biconstituent, and a mixture of different fiber types.

The term “odor control composition”, as used herein, refers to such compositions usually contain, sometimes along with conventional perfume ingredients, ingredients which are able to chemically react with the malodorant molecules released from the body fluids (such as ammonia) thus neutralizing the source of the malodor, and/or ingredients which are able to interact with nose receptors so that their perception of the malodorant molecules is reduced.

The term “phase”, as used herein, refers to the positional relationship between two or more parts of a machine that performs repetitive motion. For example, phase may refer to the relative position of a punch that stamps apertures into a component used in the manufacturing process. When utilized as verbs, the terms “phasing,” “phased,” “phase,” and the like refer to the act of changing the phase of a device from one phase to another. For example, the act of

phasing a roller may refer to advancing or retarding the rotation of the roller about its primary axis.

The term "polymer" generally includes, but is not limited to, homopolymers, copolymers, such as for example, block, graft, random and alternating copolymers, terpolymers, etc., and blends and modifications thereof. In addition, unless otherwise specifically limited, the term "polymer" includes all possible geometric configurations of the material. The configurations include, but are not limited to, isotactic, atactic, syndiotactic, and random symmetries.

The term “tuft”, as used herein, refers to a particular type of protrusion. Tufts typically have a tunnel-like configuration, and in some cases may be open at one or both of their ends.

The term "upper", as used herein, refers to absorbent members, such as layers, that are nearer to the wearer of the absorbent article during use, i.e. towards the topsheet of an absorbent article; conversely, the term "lower" refers to absorbent members that are further away from the wearer of the absorbent article towards the backsheet.

The term "web", as used herein, refers to any suitable deformable material, such as a woven, nonwoven, film, combination, or laminate of any of the foregoing materials.

Absorbent Article

Absorbent articles manufactured by a method according to the present invention comprise a liquid permeable deformed topsheet; a liquid permeable colored sheet, and a liquid impermeable backsheet joined to the topsheet, wherein the topsheet comprises a polymer film and a nonwoven, and have a plurality of first discrete features; wherein the colored sheet has a first colored region and comprises a precursor sheet; and wherein the backsheet comprises a precursor backsheet. In one embodiment, the topsheet further comprises a plurality of second discrete features.

In one embodiment, the polymer film is a polymer film including materials normally extruded or cast as films such as polyolefins, nylons, polyesters, and the like. Such films can be thermoplastic materials such as low density polyethylene, medium density polyethylene, high density polyethylene, linear low density polyethylene, polypropylenes and copolymers and blends containing substantial fractions of these materials.

The polymer film can have a plurality of discrete extended elements. Patent publications disclosing such a plurality of discrete extended elements include WO 01/76842; WO 10/104996; WO 10/105122; WO 10/105124 and US20120277701A1. In one embodiment, the polymer film can have a plurality of discrete extended elements comprising open proximal ends, open or closed distal ends, and sidewalls, wherein the discrete extended elements comprise thinned

portions at the distal ends of the discrete extended elements and/or along the sidewalls of the discrete extended elements, and wherein the discrete extended elements have a diameter of less than about 500 microns; the discrete extended elements have an aspect ratio of at least about 0.2; and/or the polymer film comprises at least about 95 discrete extended elements per square centimeter.

In another embodiment, the nonwoven constituting the topsheet is a colored nonwoven.

In the present invention, the colored sheet comprising a precursor sheet may function as a secondary topsheet in an absorbent article. The precursor sheet can be any sheet material that allows a colored region to be readily seen from a body-facing surface of an absorbent article, and can be manufactured from a wide range of materials such as woven, nonwoven materials, latex or thermally bonded airlaid 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.

In the present invention, a precursor backsheet can be backsheet materials commonly used for absorbent articles such as polyolefinic films like polyethylene, polypropylene and a combination thereof. In some embodiments, 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.

An absorbent article manufactured by the method according to the present invention has a background region and a first colored region, and optionally a second colored region being viewable from the body-facing surface of the absorbent article. The background region is visually distinguishable from the first colored region and the optional second colored region. The background region can be white or any other color visually distinguishable from the first colored region and second colored region. The first colored region and the optional second colored region can be visually distinguishable in terms of color and/or shade of a color. Colors are believed to be visually distinguishable if there is a ΔE calculated according to the equation below between the two colors of at least about 1. The first colored region and the second colored region, respectively, can have multiple colored regions. The multiple colored regions can be visually distinguishable in terms of color and/or shade of a color.

The color of the first colored region, the second colored region and background region are measured by the reflectance spectrophotometer according to the method disclosed in WO 11/25486. The difference in color is calculated using the L*, a*, and b* values by the formula $\Delta E = [(L^*_X. - L^*_Y)^2 + (a^*_X. - a^*_Y)^2 + (b^*_X - b^*_Y)^2]^{1/2}$. Herein, the 'X' in the equation may

represent the first colored region, the second colored region or the background region, and 'Y' may represent the color of another region against which the color of such region is compared. X and Y should not be the same two points of measurement at the same time.

The absorbent articles of the present invention may further comprise an absorbent core joined with the topsheet, the backsheet, or both in any manner as is known by attachment means such as those well known in the art. Embodiments of the present invention are envisioned wherein portions of the entire absorbent core are unattached to either the topsheet, the secondary topsheet, the backsheet, or more than one of these layers. The absorbent core can be formed from any of the materials well known to those of ordinary skill in the art. Examples of such materials include multiple plies of creped cellulose wadding, fluffed cellulose fibers, wood pulp fibers also known as airfelt, textile fibers, a blend of fibers, a mass or batt of fibers, airlaid webs of fibers, a web of polymeric fibers, and a blend of polymeric fibers. Other suitable absorbent core materials include absorbent foams such as polyurethane foams or high internal phase emulsion ("HIPE") foams. Suitable HIPE foams are disclosed in US 5,550,167, US 5,387,207, US 5,352,711, and US 5,331,015. The absorbent core can comprise superabsorbent materials such as absorbent gelling materials (AGM), including AGM fibers, as is known in the art.

The absorbent articles of the present invention may have a pair of flaps on longitudinal sides of a body-facing surface for folding around and securing the absorbent article to the undergarment, the flaps comprising the polymer film and the precursor backsheet. Alternatively, the flaps can comprise the polymer film, nonwoven, and the precursor backsheet. The layers in the flaps can be laminated by either adhesive or thermally bonded means, where thermal bonding includes but is not restricted to technologies such as ultrasonic bonding, cold pressure bonding, and hot pressure bonding. The flaps may have a plurality of third discrete features thereon. The third discrete features may be the same as or different from the first discrete features or the optional second discrete features. In one embodiment, the plurality of third discrete features can be formed simultaneously with the plurality of first discrete features. In another embodiment where the topsheet further comrprises a plurality of second discrete features, the plurality of third discrete features can be formed simultaneously with the plurality of second discrete features. For example, a plurality of third discrete features may be depressions formed toward a garment facing side of a topsheet. In one embodiment, depression type of third discrete features can be formed simultaneously with a plurality of first discrete features when the plurality of first discrete features are apertures toward a garment facing side of a topsheet.

The invention is applicable to the production of absorbent articles from discrete components, and it is particularly advantageous for the production of absorbent articles from at least one continuous sheet or web.

A schematic representing a method according to the invention is depicted in FIG. 1. In FIG. 1, the machine direction is from left to right. The method of the invention may form the absorbent article upside down. Alternatively, the absorbent article can be formed top-side up. The process 1 carried out according to the example in FIG. 1 comprises supplying a nonwoven 12 onto a polymer film 11 to form a layered composite 31 of the polymer film 11 and the nonwoven 12, feeding the layered composite 31 to a first discrete feature forming unit 211 to form a first deformed layered composite 32. Though the process shown in FIG. 1 indicates a step of layered composite formation and a step of first discrete features formation are carried out sequentially, these two steps can be carried out simultaneously as shown in FIG. 3.

In one example, the first discrete feature forming units 211 may comprise a pair of two generally cylindrical rollers wherein at least one of the two rollers has discrete feature forming elements on its surface. In another example when the first discrete features are apertures, the first discrete feature forming units 211 may comprise a means for weakening a web, layered composite 31 in this case, at a plurality of locations to create a plurality of weakened, melt-stabilized locations, and a means for applying a tensioning force to the layered composite 31 to rupture the layered composite 31 at the plurality of weakened, melt-stabilized locations creating a plurality of apertures in the layered composite 31 coincident with the plurality of weakened, melt-stabilized locations. Referring to FIGS. 4 and 7, a means for weakening web at a plurality of locations to create a plurality of weakened may be a web weakening roller arrangement 108 or 308, and a means for applying a tensioning force to the web to rupture the web at the plurality of weakened may be a incremental stretching system 132 or 332 shown in FIGS. 4 and 7.

Separately, a precursor sheet 13 is provided with a first colored region in a first coloration unit 231, and then is supplied onto a nonwoven side of the first deformed layered composite 32. When the precursor sheet 13 already has a first colored region before conducting the first coloration step, the first coloration step may be skipped, or still employed to provide an additional colored region on the precursor sheet 13. Then, the precursor sheet 13 and the first deformed layered composite 32 are integrated to form an integrated layered composite 34 in an integration unit 251. And then, a precursor backsheet 15 is supplied onto a precursor sheet side of the integrated layered composite 34 and integrated by peripheral sealing along a peripheral

line of an absorbent article in a peripheral seal unit 261 to form an absorbent article assembly 36. The absorbent article assembly 36 is cut in a cutting unit 271 into individual absorbent articles 37.

Referring to FIG. 2, there is shown another example of a method according to the invention with several optional steps. In the process 2 carried out in FIG. 2, initially a polymer film 11 is produced with a second colored region in a second coloration unit 241. The second colored region can be provided on either side of the polymer film 11. Alternatively, the second colored region can be provided in a nonwoven 12. When the polymer film 11 or the nonwoven 12 already has a second colored region before conducting the second coloration step, the second coloration step may be skipped, or still employed to provide additional colored region on the polymer film 11 or the nonwoven 12. The nonwoven 12 is supplied onto the colored polymer film 40 to form a layered composite 41, the layered composite 41 is fed into a first discrete feature forming unit 211 to form a first deformed layered composite 42, and the first deformed layered composite 42 is fed into a second discrete feature forming unit 221 to form a second deformed layered composite 43. A step of forming the layered composite 41 and a step of forming the first discrete features can be carried out sequentially as illustrated in FIG. 2 or simultaneously as shown in FIG. 3.

In one example, the first and second discrete feature forming units 211 and 221, respectively, may comprise a pair of two generally cylindrical rollers wherein at least one of the two rollers in each unit has discrete feature forming elements on its surface. In another example, when the first discrete features are apertures, the first discrete feature forming units 211 may comprise a means for weakening a web, layered composite 41 in this case, at a plurality of locations to create a plurality of weakened, melt-stabilized locations, and a means for applying a tensioning force to the layered composite 41 to rupture the layered composite 41 at the plurality of weakened, melt-stabilized locations creating a plurality of apertures in the layered composite 41 coincident with the plurality of weakened, melt-stabilized locations. Referring to FIGS. 4 and 7, a means for weakening web at a plurality of locations to create a plurality of weakened may be a web weakening roller arrangement 108 or 308, and a means for applying a tensioning force to the web to rupture the web at the plurality of weakened may be a incremental stretching system 132 or 332 shown in FIGS. 4 and 7.

Then, the precursor sheet 13 is supplied onto a nonwoven side of the second deformed layered composite 43. The precursor sheet 13, before being supplied onto the second deformed layered composite 43 to form an integrated layered composite 44, is provided with a first colored region in a first coloration unit 231, and may be cut into a predetermined size and shape, then is

supplied onto a nonwoven side of the second deformed layered composite 43. When the precursor sheet 13 already has a first colored region before conducting the first coloration step, the first coloration step may be skipped, or still employed to provide additional colored region on the precursor sheet 13. Then, the second deformed layered composite 43 and the precursor sheet 13 are integrated to form an integrated layered composite 44, and an absorbent core 14, which can be a continuous sheet or in a determined size and shape, is supplied onto a precursor sheet side of the integrated layered composite 44 to form a core layered composite 45. A precursor backsheet 15 is supplied and adhered onto an absorbent core side of the core layered composite 45 to provide peripheral seal in a peripheral seal unit 261 along a peripheral line of an absorbent article and to form an absorbent article assembly 46. The absorbent article assembly 46 is then cut by a cutting unit 271 into individual absorbent articles 47.

The polymer film 11 can have a plurality of discrete extended elements which may be formed in a step continuously proceeding with a method according to the invention. Formation of a plurality of discrete extended elements can be carried out prior to formation of a plurality of first discrete features. Referring to FIG. 9, the polymer film 11 is fed into a discrete extended elements forming unit 281 to form a plurality of discrete extended elements before forming a first deformed layered composite 52. Examples of the discrete extended elements forming unit 281 and discrete extended elements forming processes are disclosed in WO 10/105009; WO 10/105002; WO 10/105017; WO 11/112213; and WO 12/148936.

Referring to FIG. 10, there is shown another example of a method according to the invention. The process 3 carried out according to the example in FIG. 10 comprises feeding a laminate 61 comprising a polymer film and a nonwoven film to a first discrete feature forming unit 211 to form a first deformed laminate 62. Following steps may be conducted according to the process of the example of FIG. 1 or FIG. 2. When the following steps is conducted according to FIG. 1, a precursor sheet 13 is provided with a first colored region in a first coloration unit 231, and then is supplied onto a nonwoven side of the first deformed laminate 62. When the precursor sheet 13 already has a first colored region before conducting the first coloration step, the first coloration step may be skipped, or still employed to provide an additional colored region on the precursor sheet 13. Then, the precursor sheet 13 and the first deformed laminate 62 are integrated to form an integrated laminate 64 in an integration unit 251. And then, a precursor backsheet 15 is supplied onto a precursor sheet side of the integrated laminate 64 and integrated by peripheral sealing along a peripheral line of an absorbent article in a peripheral seal unit 261 to form an absorbent article assembly 66. The absorbent article

assembly 66 is cut in a cutting unit 271 into individual absorbent articles 67. The process according to FIG. 10 may comprise a step of providing a second colored region on either the polymer film side or the nonwoven side of the laminate 61 prior to the step of forming the first discrete features on the laminate 61. The process according to FIG. 10 may further comprise at least one of the optional steps described in the example of FIG 2.

In the examples above, the first and second discrete feature forming units 211 and 221, respectively, may comprise two generally cylindrical rolls wherein at least one of the two rolls in each unit has discrete feature forming elements on its surface.

In another example, when the first discrete features are apertures, the first discrete feature forming units 211 may comprise a means for weakening a web, a laminate 61 comprising a polymer film and a nonwoven in this case, at a plurality of locations to create a plurality of weakened, melt-stabilized locations, and a means for applying a tensioning force to the laminate 61 to rupture the laminate 61 at the plurality of weakened, melt-stabilized locations creating a plurality of apertures in the laminate 61 coincident with the plurality of weakened, melt-stabilized locations. Referring to FIGS. 4 and 7, a means for weakening web at a plurality of locations to create a plurality of weakened may be a web weakening roller arrangement 108 or 308, and a means for applying a tensioning force to the web to rupture the web at the plurality of weakened may be a incremental stretching system 132 or 332 shown in FIGS. 4 and 7.

Formation of First Discrete Features and Optional Second Discrete Features

In the present invention, the first discrete features and the optional second discrete features may be of any suitable configuration. Suitable configurations for the features include, but are not limited to: apertures; ridges (continuous protrusions) and grooves (continuous depressions); tufts; columnar shapes; dome-shapes, tent-shapes, volcano-shapes; features having plan view configurations including circular, oval, hour-glass shaped, star shaped, polygonal, polygonal with rounded corners, and the like, and combinations thereof. Polygonal shapes include, but are not limited to rectangular (inclusive of square), triangular, hexagonal, or trapezoidal. In one embodiment, the first discrete features are features selected from the group consisting of apertures, protrusions, depressions, tufts, and combinations thereof, and the second discrete feature are features selected from the group consisting of apertures, protrusions, depressions, tufts, and combinations thereof. In another embodiment where the topsheet further comprises second discrete features, the first discrete features are apertures and the second discrete features are tufts.

The first discrete features and the second discrete features may differ from each other in terms of one or more of the following properties: type, shape, size, aspect ratio, edge-to-edge spacing, height or depth, density, color, surface treatment (e.g., lotion, etc.), number of web layers within the features, and orientation (protruding from different sides of the web). The term "type", as used herein, refers to whether the feature is an aperture, a protrusion such as a tuft and other kind of protrusion, or a depression. In the present invention, discrete features may be of any suitable size. Typically, either the first features or the optional second feature may be macroscopic. In some embodiments, the first features and the second features may both be macroscopic. The plan view area of the individual features may, in some embodiments of the web, be greater than or equal to about 0.5mm^2, 1mm^2, 5mm^2, 10mm^2, or 15mm^2, or lie in any range between two of these numbers. The methods described herein can, however, be used to create first features and/or second features that are microscopic which have plan view areas less than 0.5mm^2.

Various methods and apparatuses for deforming webs by forming discrete features on webs known in the art can be utilized to form the first and the optional second discrete features in the present application. Patents disclosing such methods include: US Patent 4,189,344; US Patent 4,276,336; US Patent 4,609,518; US Patent 5,143,679; US Patent 5,562,645; US Patent 5,743,999; US Patent 5,779,965; US Patent 5,998,696; US Patent 6,332,955; US Patent 6,739,024; US Patent Application Publication 2004/0110442 A1; EP 1 440 197 B1; US Patent 6,916,969; US Patent Application Publication No. 2006/0151914 A1; US Patent 7,147,453; US Patent 7,423,003; US Patent 7,323,072; US Patent Application Publication No. 2006/0063454 A1; US Patent Application Publication No. 2007/0029694 A1; US Patent Application Publication No. 2008/0224351 A1; US Patent Application Publication No. 2009/0026651 A1; US Patent 7,521,588; US Patent Application Publication No. 2010/0201024 A1; WO2012/148980; WO2012/149074; WO2012/148935; and WO2012/148946.

One type of features preferred for discrete features in the present invention are apertures. Apertures in a topsheet in an absorbent article may enhance penetration of body exudates through the topsheet into the underlying secondary topsheet or absorbent core. Various methods and apparatuses for forming apertures are disclosed in the patent literature. Patents disclosing such methods include: US Patent 8,241,543, US Patent 3,355,974; US Patent 2,748,863 and US Patent 4,272,473 disclosing aperture forming methods using apparatus having heated aperture forming elements; US Patent 5,628,097 disclosing a method for selectively aperturing a nonwoven web or a laminate by weakening the web at a plurality of locations; US

Patent 5,735,984 disclosing ultrasonic aperturing; US Patents 4,342,314 and 4,463,045 disclosing vacuum aperturing; US Patents 4,609,518; 4,629,643 and 4,695,422 disclosing hydroforming apertures; and US 5,628,097 disclosing weakening a web along a plurality of locations and then applying a tensioning force to the web causing the web to rupture at the plurality of weakened location.

Referring to FIG. 4 there is schematically illustrated at 100 a process for selectively aperturing a web. A web may be a composite comprising a polymer film layer and a nonwoven layer, or a laminate comprising a polymer film layer and a nonwoven layer.

According to the present invention, a web 10 travels and passes through a nip 106 of the web weakening roller arrangement 108 formed by rollers 110 and 112.

Referring to FIGS. 4 and 5, the web weakening roller arrangement 108 preferably comprises a patterned calendar roller 110 and a smooth anvil roller 112. One or both of the patterned calendar roller 110 and the smooth anvil roller 112 may be heated and the pressure between the two rollers may be adjusted by well known means to provide the desired temperature, if any, and pressure to concurrently weaken and melt-stabilize the web 10 at a plurality of locations.

The patterned calendar roller 110 is configured to have a circular cylindrical surface 114, and a plurality of protuberances or pattern elements 116 which extend outwardly from surface 114. The protuberances 116 are disposed in a predetermined pattern with each protuberance 116 being configured and disposed to precipitate a weakened, melt-stabilized location in the web 10 to effect a predetermined pattern of weakened, melt-stabilized locations in web 10. As shown in FIG. 5, patterned calendar roller 110 has a repeating pattern of protuberances 116 which extend about the entire circumference of surface 114. Alternatively, the protuberances 116 may extend around a portion, or portions of the circumference of surface 114.

The protuberances 116 are preferably truncated conical shapes which extend radially outwardly from surface 114 and which have elliptical distal end surfaces 117. Although it is not intended to thereby limit the scope of the present invention to protuberances of only this configuration. Other suitable shapes for distal ends 117 include, but are not limited to circular, square, rectangular, etc. The roller 110 is finished so that all of the end surfaces 117 lie in an imaginary right circular cylinder which is coaxial with respect to the axis of rotation of roller 110.

The protuberances 116 are disposed in a regular predetermined pattern of rows and columns in the embodiment shown in FIG. 5, although it is not intended to thereby limit the

scope of the present invention to the pattern of protuberances of only this configuration. The protuberances may be disposed in any predetermined pattern about patterned calendar roller 110.

Anvil roller 112 is preferably a smooth surfaced, right circular cylinder of steel.

Referring now to FIG. 6, there is shown a fragmentary enlarged view of the incremental stretching system 132 comprising incremental stretching rollers 134 and 136. The incremental stretching roller 134 includes a plurality of teeth 160 and corresponding grooves 161 which extend about the entire circumference of roller 134. Incremental stretching roller 136 includes a plurality of teeth 162 and a plurality of corresponding grooves 163. The teeth 160 on roller 134 intermesh with or engage the grooves 163 on roller 136, while the teeth 162 on roller 136 intermesh with or engage the grooves 161 on roller 134. As the web 10 having weakened, melt-stabilized locations 202 passes through the incremental stretching system 132 the web 10 is subjected to tensioning in the CD or cross-machine direction causing the web 10 to be extended in the CD direction. Alternatively, or additionally the web 10 may be tensioned in the MD or machine direction. The tensioning force placed on the web 10 is adjusted such that it causes the weakened, melt-stabilized locations 202 to rupture creating a plurality of apertures 204 coincident with the weakened melt-stabilized locations 202 in the web 10. However, the bonds of the web 10 are preferably strong enough such that they do not rupture during tensioning, thereby maintaining the web 10 in a coherent condition even as the weakened, melt-stabilized locations rupture. However, it may be desirable to have some of the bonds rupture during tensioning.

Other exemplary structures of incremental stretching mechanisms suitable for incrementally stretching or tensioning the web are described in International Patent Publication No. WO 95/03765, published February 9, 1995, in the name of Chappell, et al., the disclosure of which is incorporated herein by reference.

The web 10 is preferably taken up on wind-up roller 180 and stored. Alternatively, the web 10 may be fed directly to a production line where it is used to form a topsheet on a disposable absorbent article.

Referring to FIG. 7 there is schematically illustrated at 300 another process for selectively aperturing a web. A web 10 is forwarded through the weakening arrangement 308, and passed directly through the weakening arrangement 308.

Referring to FIGS. 7 and 8, the weakening arrangement 308 preferably comprises an ultrasonic transducer 306 and a cylinder 310. As web 10 is forwarded between the ultrasonic transducer 306 and the anvil cylinder 310, the web 10 is subjected to ultrasonic vibrational

energy whereupon predetermined pattern locations of the web 10 are weakened and melt-stabilized. Anvil 310 has a multiplicity of discrete pattern protuberances which are generally designated 316 disposed on its outwardly facing surface 314 in a predetermined pattern which extends about the entire circumference of the anvil cylinder. The protuberances 316 are disposed in a predetermined pattern with each protuberance 316 being configured and disposed to precipitate a weakened, melt-stabilized location 304 in the web 10 to effect a predetermined pattern of weakened, melt-stabilized locations in the web 10. As shown in FIG. 8, anvil 310 has a repeating pattern of protuberances 316 which extend about the entire circumference of surface 314. Alternatively, the protuberances 316 may extend around a portion, or portions of the circumference of surface 314.

The protuberances 316 are preferably truncated conical shapes which extend radially outward from the surface 314 and which have elliptical distal end surfaces. Other suitable shapes for the distal end include, but are not limited to, circular, square, rectangular, etc. The anvil 310 is finished so that all of the end surfaces lie in an imaginary right circular cylinder which is coaxial with respect to the axis of rotation of anvil 310.

After having passed through the weakening arrangement 308, and prior to passing through the nip 330 of the incremental stretching system 332, the web 10 includes a plurality of weakened, melt-stabilized locations 304 which generally correspond to the pattern of protuberances 316 extending from the surface 314 of anvil 310.

From the weakening arrangement 308, the web 10 passes through nip 330 formed by the incremental stretching system 332 employing opposed pressure applicators having three-dimensional surfaces which at least to a degree are complementary to one another. The incremental stretching system 332 preferably comprises incremental stretching rollers 334 and 336. The incremental stretching roller 334 includes a plurality of teeth and corresponding grooves which extend about the entire circumference of the roller 334. Incremental stretching roller 336 includes a plurality of teeth and a plurality of corresponding grooves. Teeth on roller 334 intermesh or engage with the grooves on roller 136, while the teeth on roller 336 intermesh with or engage with the grooves on the roller 334. As the web 10 having weakened, melt-stabilized locations 304 passes through the incremental stretching system 332, the web 10 is subjected to tensioning causing the web 10 to be extended. The tensioning force placed on the web 10 is adjusted such that it causes the weakened, melt-stabilized locations 304 to rupture creating a plurality of apertures in the web 10 which are coincident with the weakened melt-stabilized locations.

Another type of discrete features preferred in the present invention are tufts. In many applications, it is desirable that fibrous webs have a bulky texture and/or softness. Layered composites or laminates of a polymer film and a nonwoven in which nonwoven fibers protrude or are partially exposed through a polymer film can be useful as a topsheet in absorbent articles as they provide an absorbent structure in which the nonwoven acts as the conveyor of fluid from one side of the polymer film to the other. The layered composite or laminate can be structured such that the fluid collecting side of the layered composite or laminate is the polymer film and nonwoven fibers protrude or are partially exposed through the polymer film to the fluid collecting side.

Various methods and apparatuses for forming tufts disclosed in patent literature. Patents disclosing such methods include: US Patents 3,485,706, 4,465,726 and 4,379,799 disclosing forming tufts using waterjet; US patent 4,741,941 disclosing forming tufts using air drawing; US patent 5,080,951 disclosing a needle punching method; and WO 1994/058117, WO 2004/59061, and WO 2010/117636 disclosing a method for making tufts on a web using an apparatus comprising a roller comprising a plurality of ridges and grooves.

In one embodiment, when both the first and second discrete features are formed by rolls, the first discrete features are formed by feeding a layered composite 31, 41 of a polymer film and a nonwoven, or a laminate 61 comprising a polymer film and a nonwoven in a machine direction into a first nip that is formed between two generally cylindrical rolls, the two rolls having surfaces wherein at least one of the two rolls has first discrete feature forming elements on its surface, and when the layered composite or laminate is fed into the nip, the layered composite or laminate is deformed. The second discrete features are formed by feeding a first deformed layered composite 32, 42 or a first deformed laminate 62 in a machine direction into a second nip that is formed between two generally cylindrical rolls, the two rolls having surfaces wherein at least one of the two rolls has second discrete feature forming elements on its surface. The two rolls forming the first discrete features and the two rolls forming the second discrete features can be separate pairs of rolls. When apertures as first or second discrete features are formed according to the method disclosed in US patent No. 5,628,097, the layered composite 31, 41 or the laminate 61 is weakened at a plurality of locations by for example heat and/or pressure prior to being fed into a nip formed between two rolls.

In another embodiment when both the first and second discrete features are formed by rolls, the two rolls forming the first discrete features and the two rolls forming the second discrete features can share one roller between the two pairs of rolls. As shown in FIG. 11A and

FIG. 11B respectively, the first discrete features are formed by feeding a layered composite 41 of a polymer film and a nonwoven, or a laminate 61 comprising a polymer film and a nonwoven in a machine direction into a first nip 305 that is formed between a first generally cylindrical roller 301 and a second generally cylindrical roller 302, and a first deformed layered composite 42 or a first deformed laminate 62 is prepared. Continuously, the second discrete features are formed by introducing the first deformed layered composite 42 or the first deformed laminate 62 in a machine direction into a second nip 307 that is formed between the second generally cylindrical roller 302 and a third generally cylindrical roller 303, forming a second deformed layered composite 43 or a second deformed laminate 63. Referring to FIG. 11C, there is shown in more detail the portion of means of forming the first and second discrete features shown in FIG. 11A that can form second deformed layered composite 43 having first and second discrete features. The particular placement of the first discrete features and the second discrete features on the layered composite 41 can depend on, for example, the arrangement of the absorbent article in which the second deformed layered composite 43 will ultimately be incorporated. For example, first discrete features may be formed into a region of the layered composite 41 which will be a central region of an absorbent article, and second discrete features may be formed into a region which will be an edge region surrounding the central region of an absorbent article.

In the illustrated embodiment, the first discrete features 113 and the second discrete features 123 include structural modifications formed by urging discrete portions of the layered composite 41 in a first direction while concurrently urging other discrete portions of the first deformed layered composite 42 in a different, opposite direction. More specifically, apertures 113 are formed by rolls 301 and 302 urging discrete portions of the layered composite 41 in a first direction and tufts 123 are formed by rolls 302 and 303 urging discrete portions of the first deformed layered composite 42 in a second direction. In the illustrated embodiment, the first and second directions generally extend in opposite directions that are parallel to the Z-direction.

Each of rolls 301, 302 and 303 rotates about an axis A, the axis A being parallel and in the same plane.

Roller 301 comprises a plurality of ridges 101 and corresponding grooves 102 which extend unbroken about the entire circumference of roller 301. In some embodiments, depending on what kind of pattern is desired as first discrete features, roller 301 can comprises ridges 101 wherein portions have been removed, such as by etching, milling or other machining processes, such that some or all of ridges 101 are not circumferentially continuous, but have breaks or gap. The breaks or gaps can be arranged to form a pattern.

Rolls 302 and 303 can each comprise a plurality of ridges 101 and corresponding grooves 102 which can extend unbroken about the entire circumference of the corresponding roller. The roller 302 comprises a plurality of rows of circumferentially-extending ridges that have been modified to be rows of circumferentially-spaced teeth 111 that extend in spaced relationship about at least a portion of the corresponding roller. The individual rows of teeth 111 can be separated by corresponding grooves 112. The roller 303 comprises a plurality of rows of circumferentially-extending ridges that have been modified to be rows of circumferentially-spaced teeth 121 that extend in spaced relationship about at least a portion of the corresponding roller. The individual rows of teeth 121 can be separated by corresponding grooves 122. In operation, rolls 302 and 303 intermesh such that the ridges 101 of one roller extend into the grooves 122 or 112 of the other roller, the teeth 111 of roller 302 extend into the grooves 122 of roller 303, and the teeth 121 of roller 303 extend into the grooves 112 of roller 302.

All or any one of rolls 301, 302 and 303 can be heated by means known in the art such as by incorporating hot oil filled rollers or electrically-heated rollers. Alternatively, both or either of the rolls may be heated by surface convection, induction, or by surface radiation.

In another embodiment, the first and the second discrete features are formed simultaneously by feeding a layered composite 31, 41 or a laminate 61 in a machine direction into a nip that is formed between two rolls, the rolls having surfaces wherein at least one of the two rolls has first discrete feature forming elements on its surface and at least one of the two rolls has second discrete feature forming elements on its surface, and when the layered composite 41 or the laminate 61 is fed into the nip, the layered composite 41 or the laminate 61 is deformed. In another embodiment, when one roller has first discrete feature forming elements on its surface, the other roller can have second discrete feature forming elements on its surface, causing features to be formed in opposite directions. When apertures as either first or second discrete features are formed according to the method disclosed in US patent No. 5,628,097, the layered composite 31, 41 or the laminate 61 is weakened at a plurality of locations by for example heat and/or pressure prior to being fed into a nip formed between two rolls.

The rolls used in the apparatuses and methods described herein are typically generally cylindrical. The term "generally cylindrical", as used herein, encompasses rolls that are not only perfectly cylindrical, but also cylindrical rolls that may have elements on their surface. The term "generally cylindrical" also includes rolls that may have a step-down in diameter, such as on the surface of the roller near the ends of the roller. It also includes ring rolls having

meshing teeth. This can enable forming deformed elements of different heights in respective zones of the same roller. The rolls are also typically rigid, that is, substantially non-deformable.

WO 2012/148935 discloses several mechanical deformation processes for forming discrete features such as an approach utilizing a single nip with two rolls comprising discrete male forming elements wherein at least one roller comprises two or more raised ridges, and another approach comprising a multi-hit (multi-nip) configuration that enables controlled placement and orientation of multiple sets of features. Each of these approaches may enable independent control of the features formed in a multi-layer structure, providing additional control over the function and aesthetics of the features. For example, this process could provide the ability to create multi-layer structures where some features have more layers through their thickness than other features.

In one embodiment, the first discrete feature forming elements or the second discrete feature forming elements can be heated.

In one embodiment when a plurality of the first and/or second discrete features are apertures, the first and/or the second discrete feature forming elements can comprise rounded teeth or triangular shaped teeth disclosed in WO 2005/13874. Alternatively, in the embodiment, the first and/or the second discrete feature forming elements can comprise being tapered from a base and a tip wherein the base of each tooth has a cross-sectional length dimension greater than a cross-sectional width dimension, wherein each tooth is oriented such that the cross-sectional length dimension of the tooth is disposed at an angle greater than zero relative to a predominant molecular orientation of the polymer film as described in WO 2010/90974.

In another embodiment, the polymer film may have apertures.

In another embodiment, the first deformed layered composite 32, 42 the second deformed layered composite 43, the first deformed laminate 62, the second deformed laminate 63 may be ring rolled with intermeshing rolls after forming the first or second discrete features, especially after forming apertures. Ring-rolling composites or laminates after forming discrete features, especially apertures, is expected to result in an increase in the size of the apertures and increase in the air permeability of the film.

In another embodiment when a plurality of second discrete features are tufts, the first discrete feature forming elements can comprise a plurality of ridges and corresponding grooves which extend unbroken about the entire circumference of a roller which has the second discrete feature forming elements discloses in WO 2004/59061, and WO 2010/117636. The tufts may comprise a plurality of tufted fibers being integral extensions of the nonwoven and extending

through the polymeric film. In another embodiment when a plurality of second discrete features are tufts, at least part of the distal portion of each of the tufts is covered by a cap, each cap being an integral extension of the polymer film extending over the distal portion of a discrete tuft.

Provision of a Colored Region on Colored Sheet

In the present invention, a first colored region on a precursor sheet can be provided by various methods and apparatus well known to those skilled in the art such as lithographic, screen printing, flexographic, gravure ink jet printing techniques or a method of producing color change using an activatable colorant, and virtually any graphic in any color or color combination can be rendered on the precursor sheet. Patents disclosing such methods include: US 7,736,688 disclosing flexographic printing; WO 2011/25486 disclosing a method of manufacturing an absorbent article having two colored regions and a method of color measurement; and WO2011/133464 and WO2011/133462 disclosing a method of producing color change on a web using an activatable colorant.

Supplying and Integration of Precursor Sheet

Hereinafter in this section of Supplying and Integration of Precursor Sheet, a deformed layered composite collectively denotes a first deformed layered composite of a polymer film and a nonwoven when a second discrete features are not formed and a second deformed layered composite of a polymer film and a nonwoven when a second discrete features are formed, and a deformed laminate collectively denotes a first deformed laminate of a polymer film and a nonwoven when a second discrete features are not formed and a second deformed laminate of a polymer film and a nonwoven when a second discrete features are formed.

A precursor sheet having a first colored region is introduced by an apparatus, such as a roller, onto the nonwoven side of the deformed layered composite or the deformed laminate; and the precursor sheet, and the deformed layered composite or the deformed laminate are both moving in a machine direction. The precursor sheet can be introduced onto the deformed layered composite or the deformed laminate as either a continuous layer or a discrete sheet cut before supplied onto the deformed layered composite into a predetermined size and shape. A discrete sheet of the precursor sheet having a first colored region can be prepared by printing a plurality of first colored regions on a continuous liquid pervious precursor sheet and cutting the continuous liquid pervious precursor sheet into discrete sheets in a predetermined shape and size using a cutting means well known to those skilled in the art. The exact dimensions of the size and shape of the discrete sheets may be determined depending on type of an absorbent article. In one example, the colored sheet comprising a precursor sheet is in size and shape which is

shorter in length than the final length of an absorbent article such that fluid cannot be transported or wicked to the end of the article. In another embodiment, the colored sheet comprising a precursor sheet extends to the periphery of the topsheet so that the precursor sheet layer underlies the topsheet on the entire inner surface of the topsheet. In the method according to the present invention, a precursor sheet and a layered composite of the first and nonwovens can be integrated by various methods and apparatus known to those skilled in the art. For examples, the integration can be carried out by a process selected from the group consisting of cold pressure bonding, heated pressure bonding, ultrasonic bonding, gluing and combinations thereof. Patents disclosing such methods include: US Patents 4,854,984 and 4,919,738 for cold pressure bonding.

In one embodiment, a precursor sheet having a first colored region in a predetermined size and shape and a deformed layered composite or a deformed laminate can be integrated by heated pressure bonding method comprising forwarding a layered composite of the precursor sheet, and the deformed layered composite or the deformed laminate through a generally cylindrical pattern defining roller and a mating anvil roller. The generally cylindrical pattern defining roller and mating anvil roller may be rotated at matched speeds or at differing speeds to one another.

Supplying and Integrating Precursor Backsheet

A precursor backsheet can be supplied by an apparatus such as an adhesive bonding roller or thermal sealing roller onto a precursor sheet side of the integrated layered composite 34, 44, or the integrated laminate 64 which are moving in a machine direction to form an absorbent article assembly 36, 46, 66. When an absorbent core is optionally provided onto the integrated layered composite or integrated laminate, the precursor backsheet can be introduced onto an absorbent core side.

The precursor backsheet is integrated to the integrated layered composite or integrated laminate so that in an absorbent article a backsheet is preferentially peripherally joined with a topsheet using known techniques, either entirely so that the entire perimeter of the absorbent article is circumscribed by such joinder or are partially peripherally joined at the perimeter.

Severing Absorbent Article Assembly

The absorbent article assembly is severed or cut using by a cutting unit conventional in the technical area of absorbent article fabrication, such as flex knife, rotary die, ultrasonic, water jet, or laser cutting, into individual absorbent articles to have a predetermined size and shape.

Optional Steps

Registration/Phasing

Absorbent articles comprise multiple functional and/or aesthetic components including compositional elements such as a topsheet, a backsheet and optionally secondary topsheet and an absorbent core, and design elements such as colored regions, discrete features formed on a topsheet, and optionally channels and a logo. During the manufacturing of absorbent articles, the position of components of article in each step of the manufacturing process may affect the overall quality of the articles and the acceptance of the articles by consumers, as consumers often desire consistency in the configuration of purchased goods for both functional and aesthetic reasons. For example, locations of the first discrete features, the second discrete feature, the first colored region and/or the second colored region need to be controlled as designed to secure best functional and aesthetic goods. To ensure consistency throughout the manufacturing process, components must be positioned uniformly.

Various methods and systems for inspecting the locations of selected components of an absorbent article during a manufacturing process have been known. Patents disclosing such methods and systems include: US Patent 5,359 525; EP 2090 951 A1; and WO 2012/161709 disclosing system and method of the automated regulation of production lines. In a method according to the present invention, a phasing can be conducted in between two consecutive steps to determine and control position of at least one component, and may be carried out at least once.

Formation of Apertures in Polymer Film

A method according to the present invention may comprise a step of forming a plurality of apertures on a polymer film prior to forming a layered composite of the polymer film and a nonwoven. Aperturing methods described in the section of "Formation of First Discrete Features and Optional Second Discrete Features" above are applicable for aperture formation on the polymer film.

Formation of a Plurality of Discrete Extended Elements

A method according to the present invention optionally comprises a step of forming a plurality of discrete extended elements on either a polymer film, a layered composite of a polymer film and a nonwoven, or a laminate comprising a polymer film and a nonwoven. Hereinafter in this section of Formation of a Plurality of Discrete Extended Elements, a polymer film, and a layered composite a polymer film and a nonwoven and a laminate comprising a polymer film and a nonwoven are collectively denoted as a precursor web. It can be beneficial for the precursor web to have a textured surface by having a plurality of discrete extended

elements which can provide the surface of the polymer film with a desirable feel, visual impression, and/or audible impression.

A plurality of discrete extended elements can be made in a vacuum forming process, a hydroforming process, a high static pressure forming process, a solid state deformation process in mated forming structures, or methods using a forming structure and a compliant substrate. With a typical vacuum forming process, a precursor web is heated and placed over a forming structure. Then a vacuum forces the precursor web to conform to the texture of the forming structure. The resulting web has texture that can provide a soft and silky tactile impression, depending upon the texture of the forming structure and degree of conformation. With a typical hydroforming process, a precursor web is placed over a forming structure and high pressure and high temperature water jets force the precursor web to conform to the texture of the forming structure. A high static pressure forming process employs a high pressure gas to deform the precursor web to the texture of a forming structure as disclosed in WO 10/105002, WO 10/105017 and WO 11/112213, while solid state deformation conveys the web between mating forming structures as disclosed in WO 12/148936, or uses a compliant substrate to impress the discrete extended elements into the precursor web as disclosed in WO 10/105009 and WO 10/105019.

A plurality of discrete extended elements in the present invention comprise open proximal ends, open or closed distal ends, and sidewalls, wherein the discrete extended elements comprise thinned portions at the distal ends of the discrete extended elements and/or along the sidewalls of the discrete extended elements, and wherein (a) the discrete extended elements have a diameter of less than about 500 microns, (b) the discrete extended elements have an aspect ratio of at least about 0.2, and/or (c) the polymer film comprises at least about 95 discrete extended elements per square centimeter.

In an embodiment, a plurality of discrete extended elements can be formed by a process comprising the steps of: i) providing a forming structure comprising a plurality of discrete protruded elements and lands completely surrounding the discrete protruded elements; ii) providing a compliant substrate; iii) providing a precursor web between the compliant substrate and the forming structure; and iv) providing pressure between the compliant substrate and the forming structure sufficient to conform the precursor web to the discrete protruded elements of the forming structure to form the embossed web.

In another embodiment, a plurality of discrete extended elements can be formed by a process comprising the steps of: i) feeding a precursor web between a static gas pressure plenum

and a forming structure comprising a plurality of discrete protruded elements, the discrete protruded elements having a height of at least substantially equal to a thickness of the precursor web; and ii) applying pressure from the static gas pressure plenum against the precursor web opposite the forming structure creating a pressure differential across the precursor web sufficient to conform the precursor web to the discrete protruded elements of the forming structure.

In another embodiment, a plurality of discrete extended elements can be formed by a process comprising the steps of: i) feeding a precursor web between a static gas pressure plenum and a forming structure comprising a plurality of discrete apertures, discrete depressions, or combinations thereof, the apertures or depressions having a depth of at least substantially equal to a thickness of the precursor web; and ii) applying pressure from the static gas pressure plenum against the precursor web opposite the forming structure creating a pressure differential across the precursor web sufficient to force the precursor web into the apertures or depressions of the forming structure, thereby forming the precursor web comprising a plurality of discrete extended elements.

In another embodiment, a plurality of discrete extended elements can be formed by a process comprising the steps of: i) providing a precursor web, ii) providing a pair of mated forming structures, including a first forming structure and a second forming structure, wherein at least the first forming structure comprises voids, and wherein at least the second forming structure comprises protrusions; and iii) moving the web through a deformation zone between the mated forming structures, wherein the voids of the first forming structure engage with the protrusions of the second forming structure at an engagement position.

Provision of a Second Colored Region

A method according to the present invention optionally comprises a step of providing a second colored region on the polymer film or the nonwoven prior to formation of the first discrete features. The second colored region can be provided either side of the polymer film or the nonwoven.

Coloration methods described in the section of Provision of a Colored Region on Colored Sheet above are applicable for coloration of the second colored region.

Introduction of Absorbent Core

A method according to the present invention optionally further comprises a step of supplying a precursor absorbent core to a precursor sheet side of an integrated layered composite 34, 44, or an integrated laminate 64, moving in a machine direction. The absorbent core can be supplied as a preformed core. In one embodiment, the absorbent core is cut in a predetermined

size and shape before being provided onto the precursor sheet side of the integrated layered composite. An absorbent core can be integrated to the integrated layered composite or an integrated laminate by various methods and apparatus known in the art such as cold pressure bonding, heated pressure bonding, ultrasonic bonding, gluing and combinations thereof. In one embodiment, an absorbent core can be integrated to form the core layered composite by gluing.

Application of Lotion Composition

Treatments of an absorbent article with lotion have been proposed to provide skin health benefits and to allow fluid to be absorbed into the article. To provide an absorbent article treated with a lotion, a method of the present invention may further comprise a step of applying a lotion composition to at least a portion of a topsheet, the inner surface of the backsheet, and/or any substrate (or surface thereof) disposed between the topsheet and the backsheet such as a secondary topsheet and an absorbent core. The lotion composition can be a liquid, a solid or a semi-solid at room temperature, and comprise at least one skin benefit agent. The lotion composition can be applied in any known manner, in any known pattern, and to any known portion of the absorbent article, as is well known in the art of lotioned absorbent articles. For example, the lotion composition can be applied in a pattern of generally parallel stripes or bands. The lotion composition can be a lotion coating on any part of the article, and on either side of any layer, such as upper surfaces, or lower surfaces. In one embodiment, a lotion composition can be disposed on the inner surface of the topsheet by disposing the lotion composition on at least one of a lower side of a polymer film, a upper side and a lower side of a nonwoven. The lotion can be applied prior to the first discrete forming step, after the first discrete forming step and/or after the second discrete forming step.

Application of Odor Control Composition

A method of the present invention may further comprise a step of applying an odor control composition. Use of a fragrance composition and/or an odor control composition in absorbent articles has been proposed for controlling and reducing malodors in the articles. In general, suitable components for odor control compositions include reactive components. Reactive components include components that can react with malodors, such as ammonia-based malodors or sulphur-based malodors (i.e. “malodor reactive components”), and components that mask malodors and/or react with receptors of the nose to block the perception of malodor by the nose of a consumer (i.e. “malodor masking components”). Suitable reactive components are described, for example, in US 2008/0071238 A1 and WO 07/113778, and suitable masking components are described, for example, in WO 08/114226.

An odor control composition may be applied on or within a layer of an absorbent article in any known manner, in any known pattern, and to any known portion of the absorbent article, as is well known in the art of absorbent articles. This means that, since the absorbent article is constituted by a series of layers, the odor control composition is applied onto one of the surfaces of these layers. An odor control composition can be applied onto the surface of application with any possible application pattern. In some cases it is possible that the odor control composition is applied on more than one layer within the article.

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".

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

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

CLAIMS

What is claimed is:

1. A method for fabricating an absorbent article, the absorbent article comprising a liquid permeable topsheet comprising a polymer film, a nonwoven, and a plurality of first discrete features; a colored sheet comprising a precursor sheet having a first colored region; and a liquid impermeable backsheet comprising a precursor backsheet, the absorbent article having a body-facing surface comprising the polymer film and a garment-facing surface positioned opposite to the body-facing surface, the method comprising the steps of:
   a) supplying the nonwoven onto the polymer film to form a layered composite of the polymer film and the nonwoven;
   b) forming the plurality of first discrete features on the layered composite to form a deformed layered composite;
   c) supplying the precursor sheet having the first colored region onto the nonwoven side of the deformed layered composite, and integrating the deformed layered composite and the precursor sheet to form an integrated layered composite;
   d) supplying the precursor backsheet onto the precursor sheet side of the integrated layered composite, and integrating the integrated layered composite and the precursor backsheet to form an absorbent article assembly; and
   e) severing the absorbent article assembly into individual absorbent articles,

   wherein the absorbent article has a background region, wherein the background region and the first colored region are viewable from the body facing surface, and wherein the first colored region differs in color from the background region.

2. The method according to claim 1, wherein the polymer film in step a) comprises a plurality of discrete extended elements, wherein the discrete extended elements comprise open proximal ends, open or closed distal ends, and sidewalls, wherein the discrete extended elements comprise thinned portions at the distal ends of the discrete extended elements and/or along the sidewalls of the discrete extended elements, and wherein
   a) the discrete extended elements have a diameter of less than about 500 microns;
   b) the discrete extended elements have an aspect ratio of at least about 0.2; or
   c) the polymer film comprises at least about 95 discrete extended elements per square centimeter.

3. The method according to any one of the preceding claims, wherein the polymer film in step a) further comprises apertures wherein the apertures have a diameter bigger than that of the plurality of discrete extended elements.

4. The method according to any one of the preceding claims, wherein the step a) and step b) are carried out simultaneously.

5. The method according to any one of the preceding claims, further comprising a step of forming a plurality of second discrete features on the first deformed layered composite between step b) and step c).

6. The method according to claim 5, wherein step b) and the step of forming a plurality of second discrete features on the first deformed layered composite are carried out simultaneously.

7. The method according to claim 5 or 6, further comprising a step of providing at least one of the polymer film and the nonwoven with a second colored region by a second coloration technique carried out prior to step c), wherein the first colored region and the second colored region differ in color from the background region.

8. The method according to any one of the preceding claims, wherein the plurality of first discrete features formed in step a) is apertures and formed by a method comprising the steps of:

1) weakening the layered composite at a plurality of locations to create a plurality of weakened, melt-stabilized locations; and

2) applying a tensioning force to the layered composite to cause the layered composite to rupture at the plurality of weakened, melt-stabilized locations creating a plurality of apertures in the layered composite coincident with the plurality of weakened, melt-stabilized locations.

9. The method of claim 8, wherein the layered composite is weakened by at least one means selected from heat, pressure and a combination thereof.

10. A method for fabricating an absorbent article, the absorbent article comprising a liquid permeable topsheet comprising a polymer film, a nonwoven, and a plurality of first discrete features; a colored sheet comprising a precursor sheet having a first colored region; and a liquid impermeable backsheet comprising a precursor backsheet, the absorbent article having a body-facing surface comprising the polymer film and a garment-facing surface positioned opposite to the body-facing surface, the method comprising the steps of:
    a) forming the plurality of first discrete features on a laminate comprising the polymer film and the nonwoven to form a first deformed laminate;
    b) supplying the precursor sheet having the first colored region onto the nonwoven side of the deformed laminate, and integrating the deformed laminate and the precursor sheet to form an integrated laminate;
    c) supplying the precursor backsheet onto the precursor sheet side of the integrated laminate, and integrating the integrated laminate and the precursor backsheet to form an absorbent article assembly; and
    d) severing the absorbent article assembly into individual absorbent articles,
    wherein the absorbent article has a background region, wherein the background region and the first colored region are viewable from the body facing surface, and wherein the first colored region differs in color from the background region.

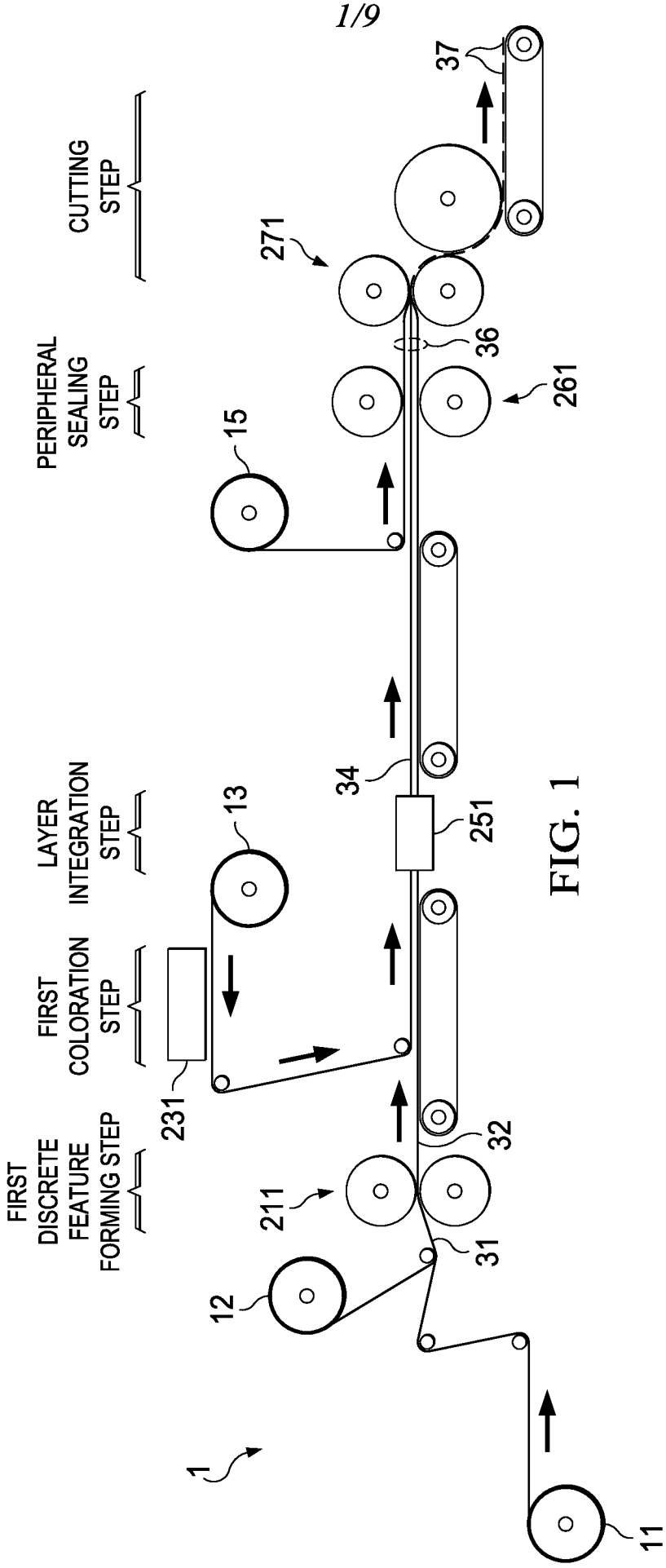
11. The method according to claim 10, further comprising a step of forming a plurality of second discrete features on the precursor web between step a) and step b).

12. The method according to claim 10 or 11, wherein the step 1) and the step of forming a plurality of second discrete features on the precursor are carried out simultaneously further comprising a step of forming a plurality of second discrete features on the precursor web between step a) and step b).

13. The method according to any one of claims 10-12, further comprising a step of providing the polymer film with a second colored region by a second coloration technique carried out prior to step a) or step b), wherein the first colored region and the second colored region differ in color from the background region.

14. The method according to any one of claims 10-13, wherein the plurality of first discrete features formed in step a) is formed by a method comprising the steps of:
    1) weakening the laminate comprising the polymer film and the nonwoven at a plurality of locations to create a plurality of weakened, melt-stabilized locations; and
    2) applying a tensioning force to the laminate to cause the laminate to rupture at the plurality of weakened, melt-stabilized locations creating a plurality of apertures in the laminate coincident with the plurality of weakened, melt-stabilized locations.

15. The method of claim 25, wherein the laminate is weakened by at least one means selected from heat, pressure and a combination thereof.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FIRST COLORATION STEP
LAYER INTEGRATION STEP
PERIPHERAL SEALING STEP
CUTTING STEP
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13
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211
231
251
261
271
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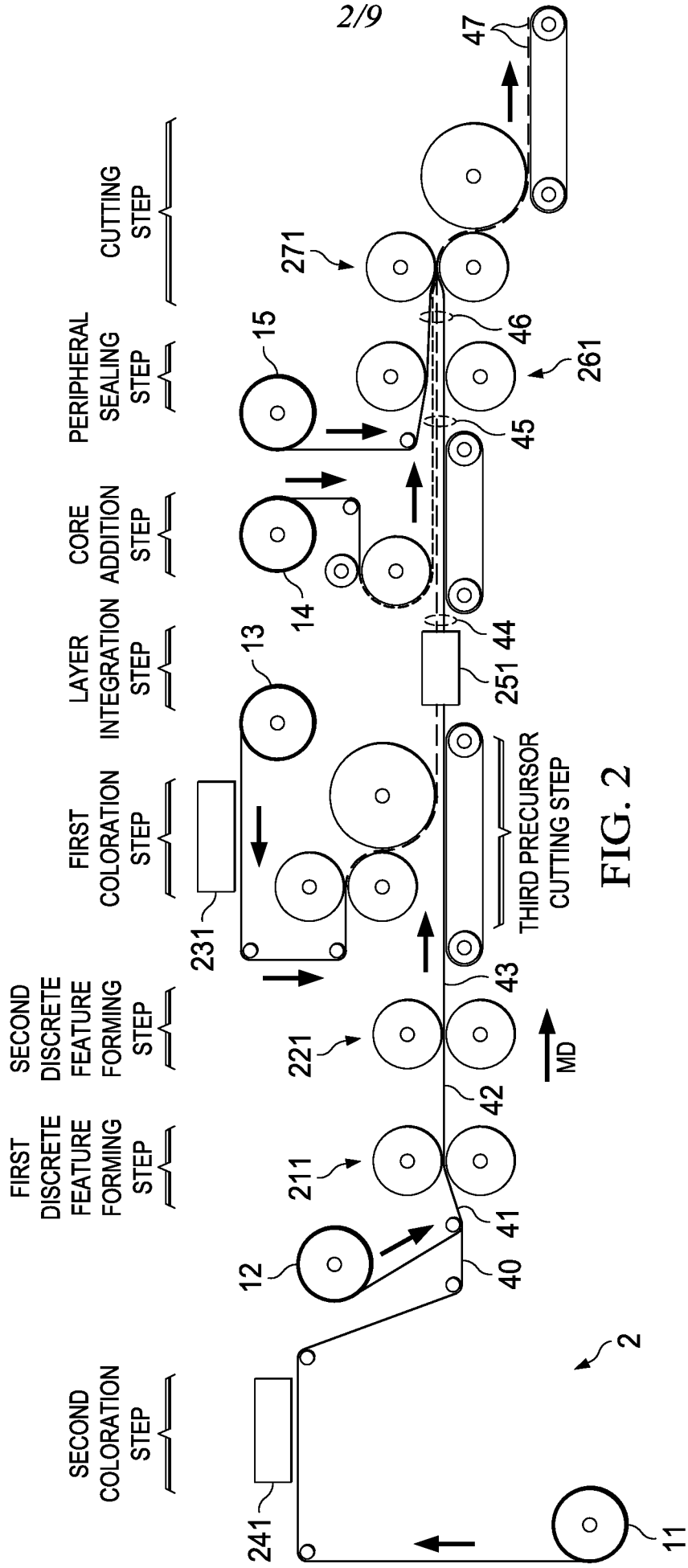
36
37

FIG. 1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FIRST DISCRETE FEATURE FORMING STEP
SECOND DISCRETE FEATURE FORMING STEP
FIRST COLORATION STEP
LAYER INTEGRATION STEP
CORE ADDITION STEP
PERIPHERAL SEALING STEP
CUTTING STEP
THIRD PRECURSOR CUTTING STEP
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FIG. 2

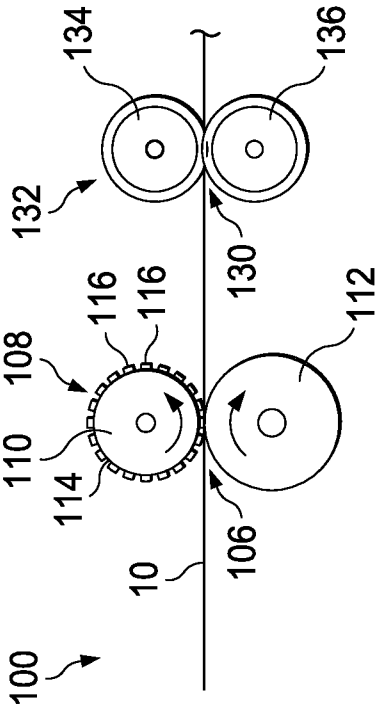
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FIG. 4

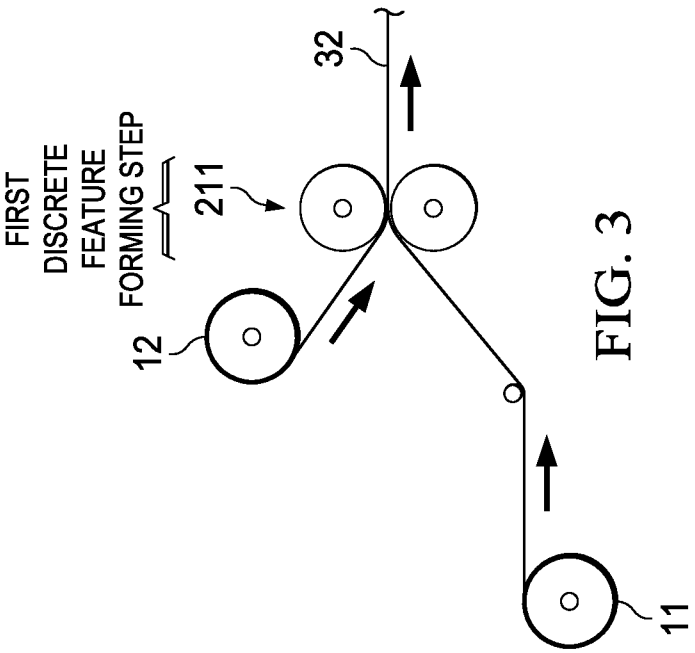
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FIG. 3

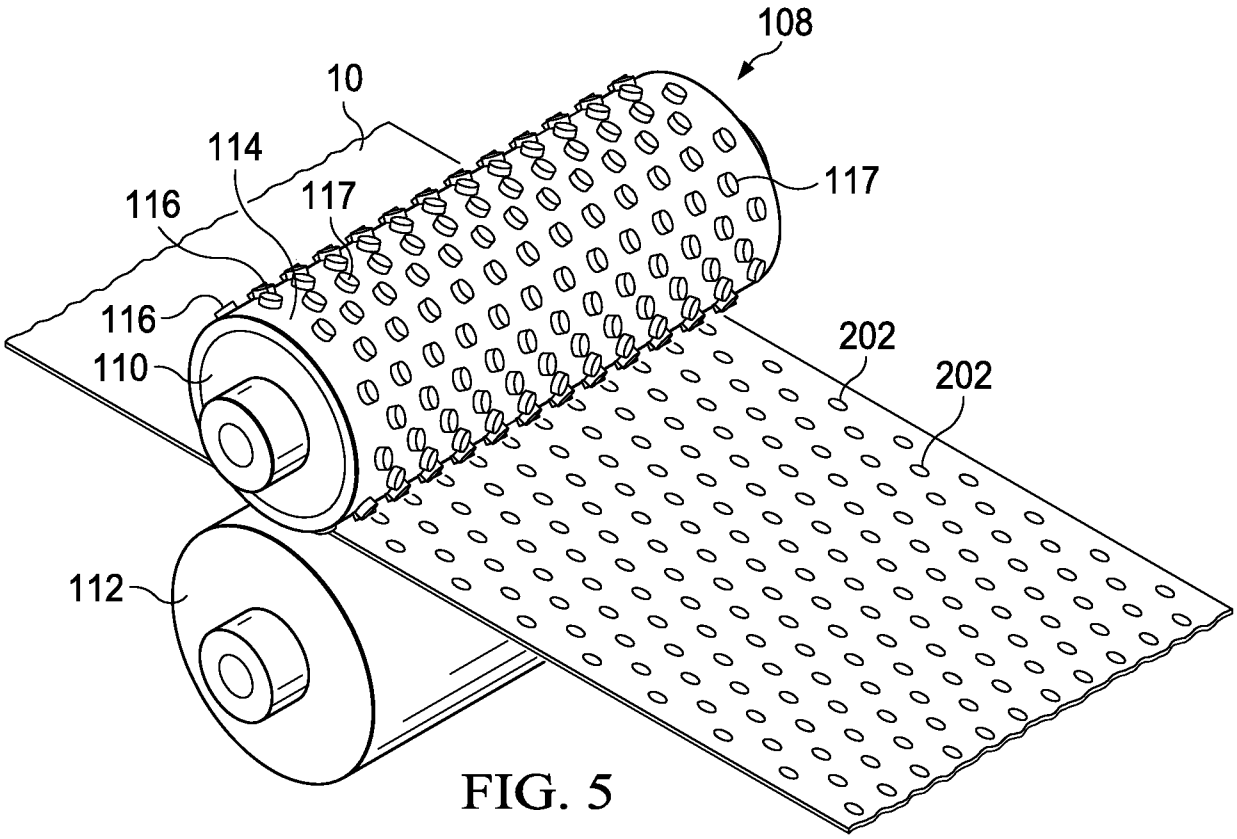
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FIG. 5

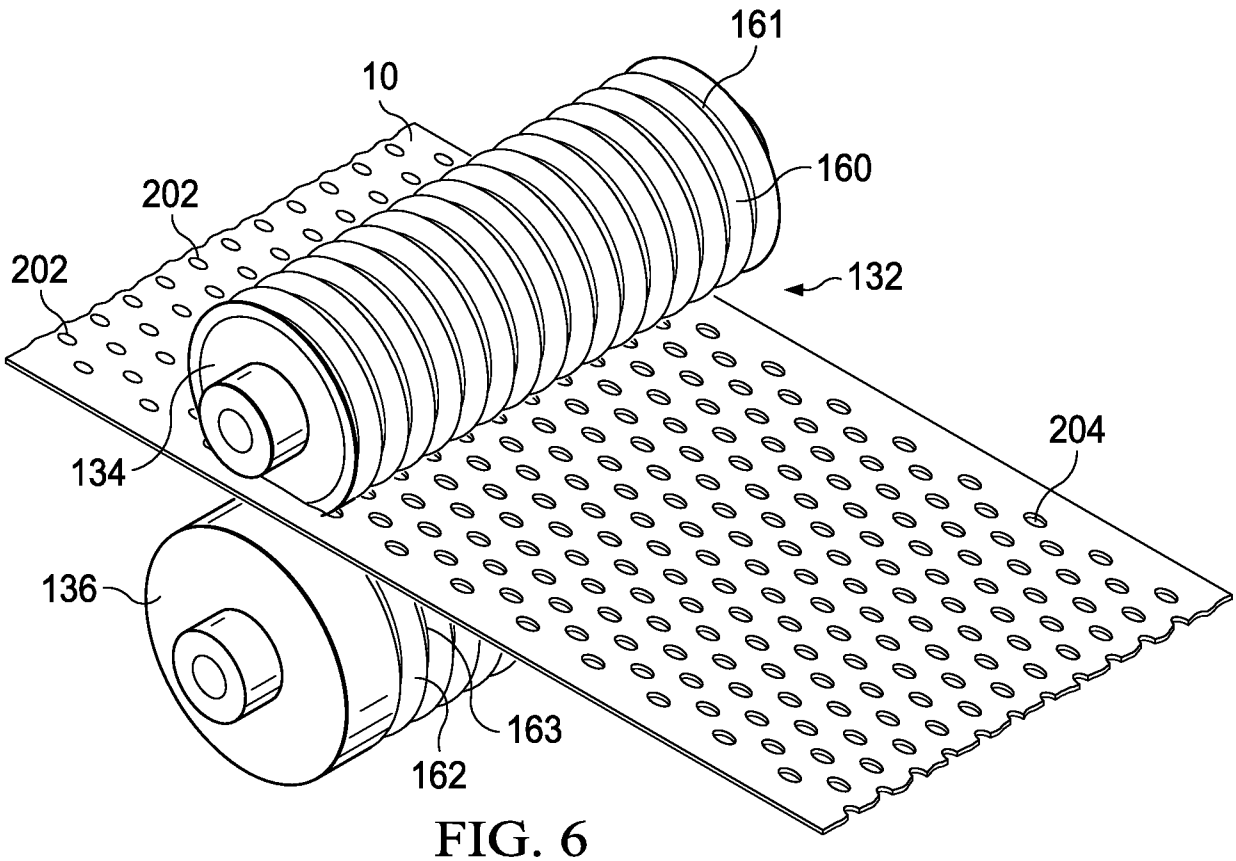
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FIG. 6

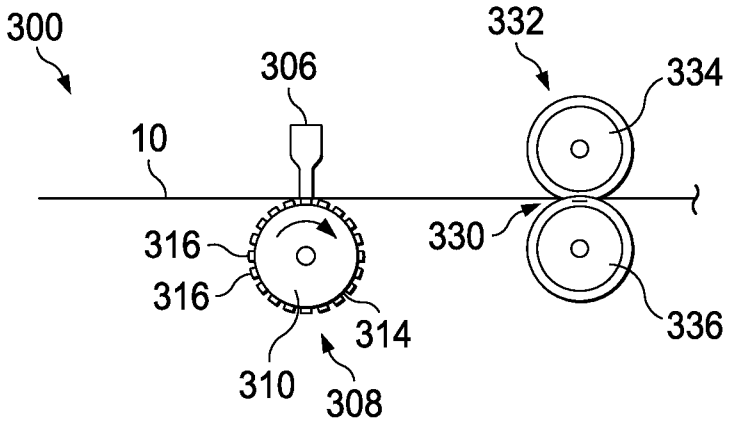
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FIG. 7

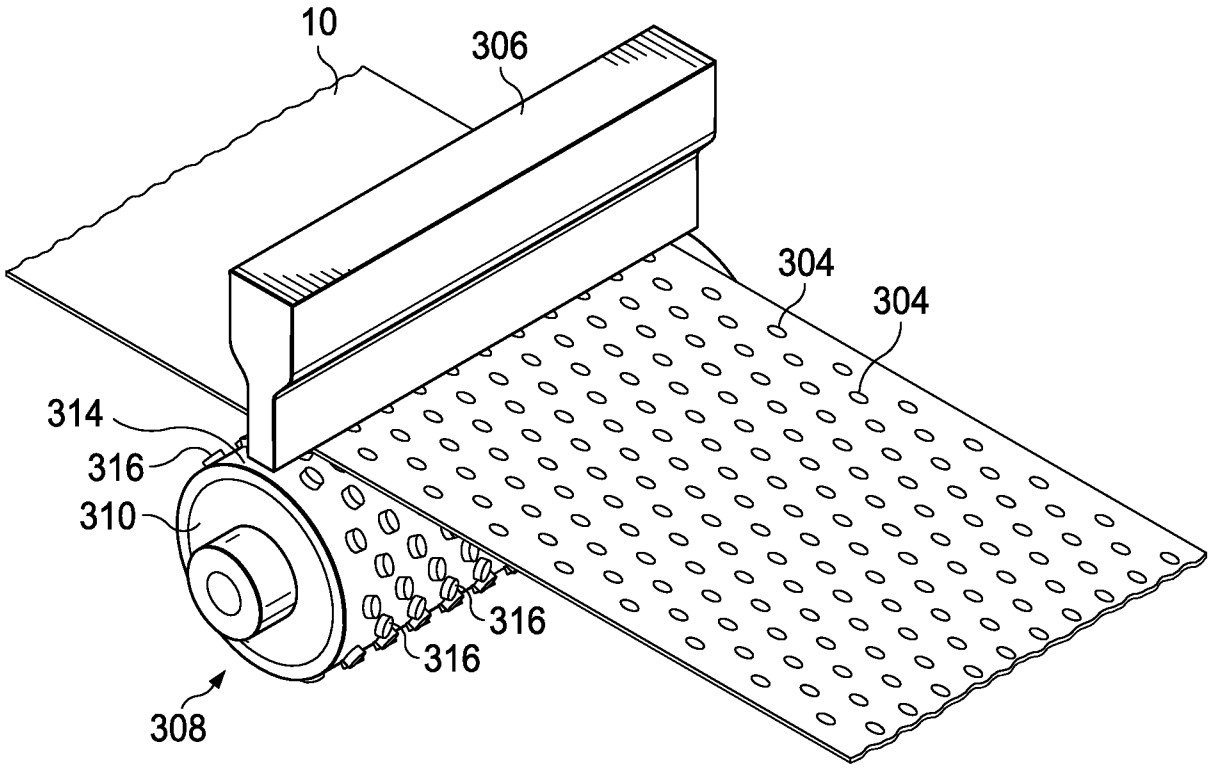
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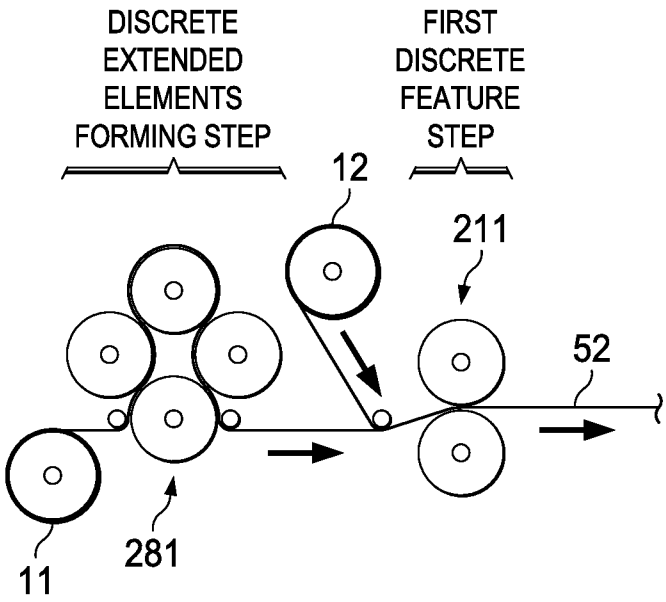
FIG. 8


DISCRETE EXTENDED ELEMENTS FORMING STEP
FIRST DISCRETE FEATURE STEP
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281
11

FIG. 9

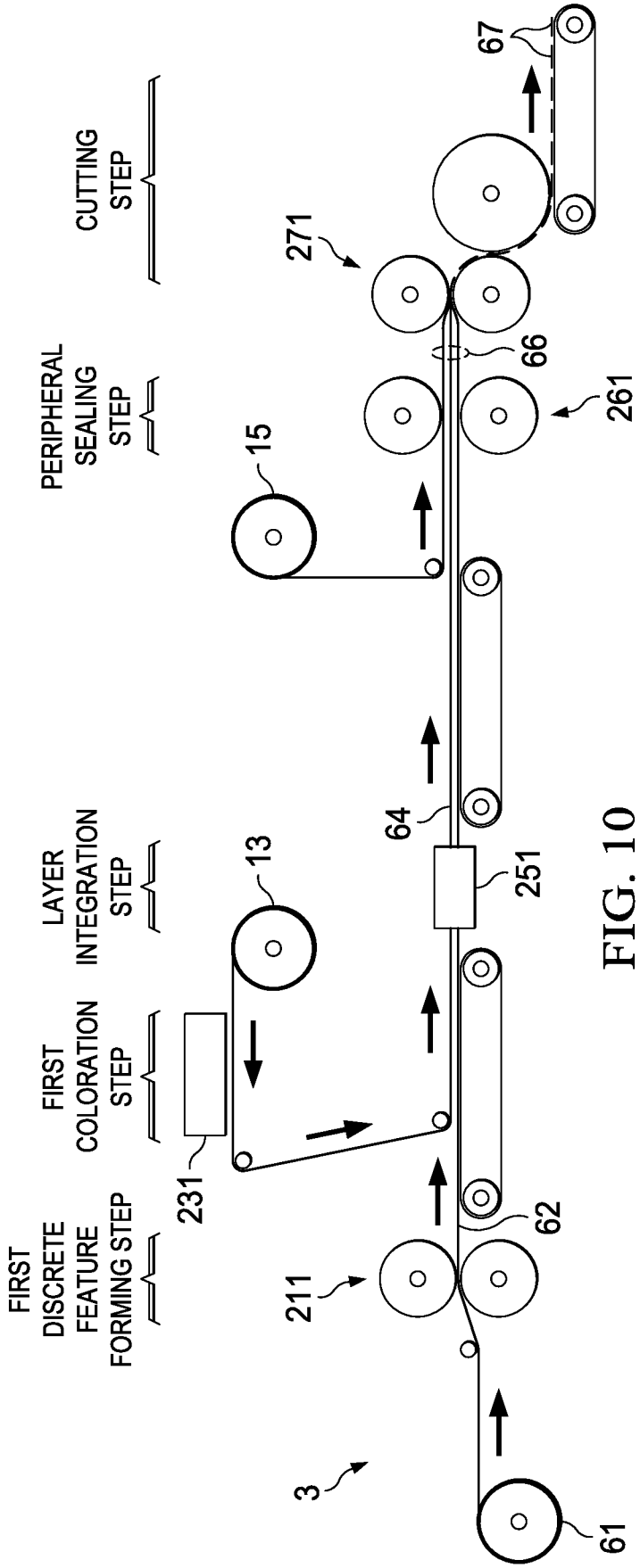
FIRST DISCRETE FEATURE FORMING STEP
FIRST COLORATION STEP
LAYER INTEGRATION STEP
PERIPHERAL SEALING STEP
CUTTING STEP
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FIG. 10

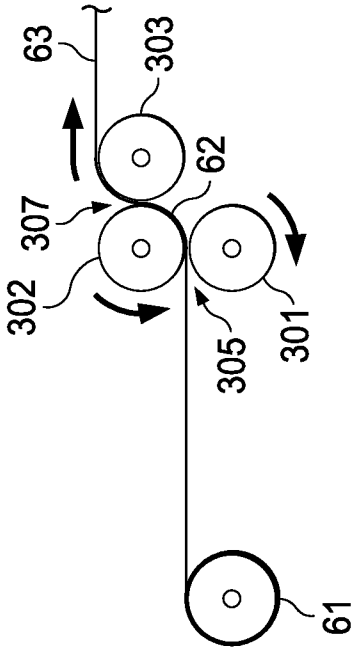

FIG. 11B

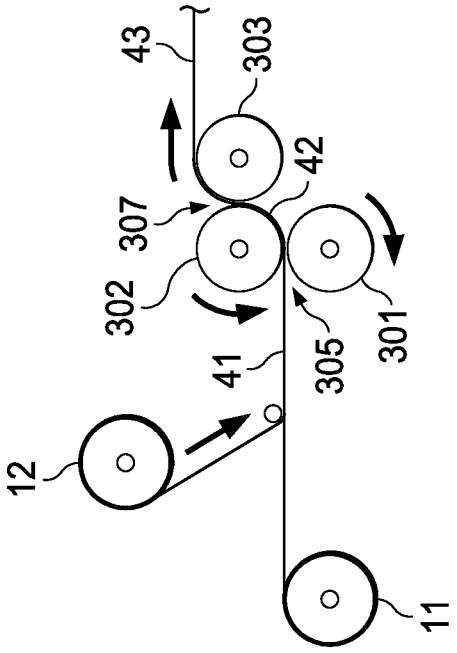

FIG. 11A

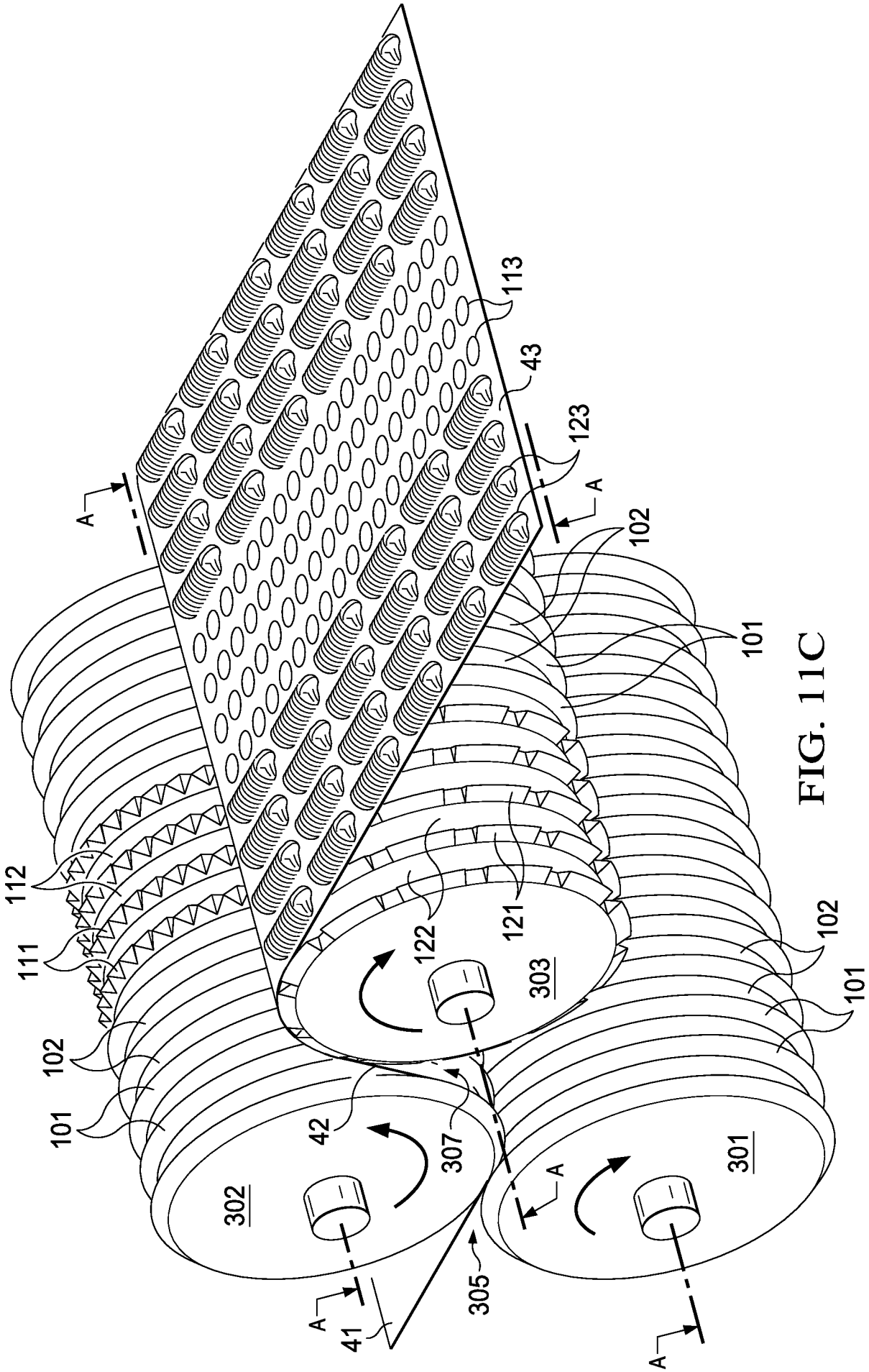
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FIG. 11C

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/060214

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61F13/511 A61F13/512 A61F13/513 A61F13/15 A61F13/472
B32B5/14 B32B27/12 B32B38/04 B32B38/06 B32B38/14
B32B38/00 B32B3/26

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61F B32B

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2011/094669 A1 (OETJEN DAVID CHRISTOPHER [US]) 28 April 2011 (2011-04-28) * figures; title; abstract; paragraphs 4, 5, 10, 11, 22, 29, 34-38, 41, 43, 52, 60; claims 1-8 *	1,4-9 2,3
Y	US 2004/122395 A1 (STONE KEITH JOSEPH [US] ET AL) 24 June 2004 (2004-06-24) * figures 3-5, 15-18; paragraphs 39, 48, 53, 54, 60, 61 *	2,3
A	US 2010/036346 A1 (HAMMONS JOHN LEE [US] ET AL) 11 February 2010 (2010-02-11) * paragraphs 95, 96, 99, 104, 107, 108, 110, 116 *	8,9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 January 2015	14/04/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Barenbrug, Theo

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2014/060214

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011094669 A1	28-04-2011	CN 103180143 A	26-06-2013
		EP 2629974 A1	28-08-2013
		US 2011094669 A1	28-04-2011
		US 2014174648 A1	26-06-2014
		US 2014174651 A1	26-06-2014
		WO 2012054662 A1	26-04-2012
US 2004122395 A1	24-06-2004	US 2004122395 A1	24-06-2004
		US 2005209575 A1	22-09-2005
US 2010036346 A1	11-02-2010	CN 102112083 A	29-06-2011
		EP 2309964 A1	20-04-2011
		JP 2011530340 A	22-12-2011
		US 2010036346 A1	11-02-2010
		WO 2010017352 A1	11-02-2010

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/060214

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-9

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9

A method for fabricating a sanitary napkin having coloured regions, an apertured topsheet laminate, an acquisition layer and a backsheet. In the process the topsheet is prepared by combining a film having particular discrete features ("discrete extended elements"), for exhibiting an improved soft and silky tactile impression, with a nonwoven.

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2. claims: 10-15

A method for fabricating a sanitary napkin having coloured regions, an apertured topsheet laminate, an acquisition layer and a backsheet. In the process the acquisition layer receives a plurality of discrete features, to improve its fluid handling characteristics.
