

DISPOSABLE ABSORBENT ARTICLE HAVING DEPLOYABLE CHASSIS EARS

FIELD OF THE INVENTION

This invention relates to disposable absorbent articles such as disposable diapers and other articles intended for use on incontinent persons.

BACKGROUND OF THE INVENTION

Disposable absorbent articles are designed to absorb and contain bodily waste in order to prevent soiling of the body and clothing of the wearer, as well as bedding or other objects with which the wearer comes into contact.

As the usage of disposable absorbent articles has expanded, their complexity has increased with the incorporation of additional features serving to enhance their performance and appearance. The costs of the materials and the costs of the manufacturing processes have also increased in conjunction with the increase in complexity. As a result, the prices at which these articles are sold have risen to levels that many potential purchasers around the world cannot afford to pay. Thus, a need exists for a simple disposable absorbent article.

SUMMARY OF THE INVENTION

The present invention provides a simple disposable absorbent article including a chassis and an absorbent assembly. The chassis includes laterally opposing side flaps formed by laterally inwardly folded portions of the chassis and deployable chassis ears formed by other laterally inwardly folded portions of the chassis. Each chassis ear is held laterally inwardly folded until being deployed by being released and unfolded laterally outward so as to project laterally outward beyond the adjacent side flap. Fastening elements may be disposed on at least two of the chassis ears, the fastening elements being adapted for fastening the front waist region to the back waist region to encircle a waist and legs of a wearer. The absorbent assembly may be attached in a cruciform pattern to the chassis to allow portions of the chassis underlying the absorbent assembly and lying outside the cruciform attachment pattern to extend laterally.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawing figures, like reference numerals identify structurally corresponding elements, which may or may not be identical in the several exemplary embodiments that are depicted. Some of the figures may have been simplified by the omission

of selected elements for the purpose of more clearly showing other elements. Such omissions of elements in some figures are not necessarily indicative of the presence or absence of particular elements in any of the exemplary embodiments, except as may be explicitly delineated in the corresponding written description.

In the drawing figures and in the written description, lowercase letters appended to reference numerals indicate generally symmetric elements, *e.g.*, left and right symmetric elements may be respectively identified by the reference numerals **1a** and **1b**. A reference numeral without an appended lowercase letter identifies all of the elements to which that particular reference numeral applies, *e.g.*, the same elements as a group may be designated **1**.

Figure 1 is a plan view of an exemplary disposable absorbent article in the form of a diaper **20**, which is shown in its flat, uncontracted state, *i.e.*, without the contraction induced by elastic members. In this figure, the interior portion of the diaper **20** that faces inwardly toward the wearer and contacts the wearer is shown facing the viewer.

Figure 2 is a plan view of the diaper **20** of **Figure 1** with the exterior portion of the diaper **20** that faces outwardly away from the wearer shown facing the viewer.

Figure 3 is a section view of the diaper **20** of **Figures 1** and **2** taken at the section line 3-3.

Figure 4 is a section view of the diaper **20** of **Figures 1** and **2** taken at the section line 4-4.

Figure 5 is a plan view of the exemplary diaper **20** with two chassis ears extending laterally. In this figure, the interior portion of the diaper **20** is shown facing the viewer.

Figure 6 is a plan view of the diaper **20** of **Figure 5** with the exterior portion of the diaper **20** shown facing the viewer.

Figure 7 is a section view of the diaper **20** of **Figures 5** and **6** taken at the section line 7-7.

Figure 8 is a section view of the diaper **20** of **Figures 5** and **6** taken at the section line 8-8.

Figure 9 is a section view of the diaper **20** of **Figures 5** and **6** taken at the section line 9-9.

Figure 10 is a perspective view of an exemplary diaper **20**, which is shown in its relaxed, contracted state, *i.e.*, with the contraction induced by elastic members. In this figure, the interior portion of the diaper **20** is shown facing upward.

Figure 11 is plan view of another exemplary diaper **20** showing an alternative form of fasteners.

Figure 12 is a plan view of the diaper **20** of **Figure 11** with the exterior portion of the diaper **20** shown facing the viewer.

Figure 13 is a section view of the diaper **20** of **Figures 11** and **12** taken at the section line 13-13.

Figure 14 is a section view of the diaper **20** of **Figures 11** and **12** taken at the section line **14-14**.

Figure 15 is a section view of another exemplary diaper **20** taken at a section line similar to **13-13** and showing an alternative form of fasteners.

Figure 16 is a section view of the diaper **20** of **Figures 11** and **12** taken at the section line **16-16**.

Figure 17 is a plan view of an exemplary fragment of a formed web material.

Figure 18 is a simplified plan view of an exemplary diaper **20**, which is shown in its flat, uncontracted state, *i.e.*, without the contraction induced by elastic members, having the absorbent assembly attached to the chassis in a cruciform attachment pattern. In this figure, the exterior portion of the diaper **20** is shown facing the viewer.

Figure 19 is a plan view of an exemplary absorbent assembly **200**. In this figure, the absorbent assembly **200** is shown separately from a chassis **100** to which it is attached in an exemplary diaper **20** and the interior portion of the absorbent assembly **200** that faces inwardly toward the wearer and contacts the wearer is shown facing the viewer.

Figure 20 is a section view of the absorbent assembly **200** of **Figure 19** taken at the section line **20-20**.

Figure 21 is a section view of the absorbent assembly **200** of **Figure 19** taken at the section line **21-21**.

Figure 22 is a section view of another exemplary absorbent assembly **200** taken at a section line similar to **20-20**.

Figure 23 is a section view of an exemplary absorbent core **250**.

Figure 24 is a plan view of another exemplary diaper **20** with four chassis ears extending laterally. In this figure, the interior portion of the diaper **20** is shown facing the viewer.

DETAILED DESCRIPTION OF THE INVENTION

In this description, the following terms have the following meanings:

The term "absorbent article" refers to a device that absorbs and contains liquid, and more specifically, refers to a device that is placed against or in proximity to the body of a wearer to absorb and contain the various exudates discharged from the body.

The term "diaper" refers to an absorbent article that is generally worn by infants and incontinent persons about the lower torso so as to encircle the waist and the legs of the wearer and that is specifically adapted to receive and contain urinary and fecal waste.

The term “disposable” refers to the nature of absorbent articles that generally are not intended to be laundered or otherwise restored or reused as an absorbent article, *i.e.*, they are intended to be discarded after a single use and, preferably, to be recycled, composted or otherwise disposed of in an environmentally compatible manner. In this description, a disposable diaper is described as being representative of an exemplary disposable absorbent article.

The term “deploy” in all its forms refers to the manipulation of any disclosed deployable structural element from its initial configuration to a configuration in which it can be used for its intended purpose in the article on which it is provided.

The term “longitudinal” refers to a direction running from a waist edge to an opposing waist edge of the article and generally parallel to the maximum linear dimension of the article.

The term “lateral” refers to a direction running from a side edge to an opposing side edge of the article and generally at a right angle to the longitudinal direction.

The term “diagonal” refers to an orientation of a line extending obliquely relative to the longitudinal and lateral directions, *i.e.*, neither perpendicular nor parallel to either of the longitudinal or lateral directions.

The term “disposed” refers to an element being attached and positioned in a particular place or position in a unitary structure with other elements.

The term “attached” refers to elements being connected or united by fastening, adhering, bonding, *etc.* by any method suitable for the elements being attached together and their constituent materials. Many suitable methods for attaching elements together are well-known, including adhesive bonding, pressure bonding, thermal bonding, mechanical fastening, *etc.* Such attachment methods may be used to attach elements together over a particular area either continuously or intermittently.

The term “cohesive” refers to the property of a material that, once set, sticks to itself but does not to any significant degree stick to other materials.

The terms “water-permeable” and “water-impermeable” refer to the penetrability of materials in the context of the intended usage of disposable absorbent articles. Specifically, the term “water-permeable” refers to a layer or a layered structure having pores, openings, and/or interconnected void spaces that permit liquid water to pass through its thickness in the absence of a forcing pressure. Conversely, the term “water-impermeable” refers to a layer or a layered structure through the thickness of which liquid water cannot pass in the absence of a forcing pressure. A layer or a layered structure that is water-impermeable according to this definition

may be permeable to water vapor, *i.e.*, may be “water vapor-permeable”. Such a water vapor-permeable layer or layered structure is commonly known in the art as “breathable”. As is well known in the art, a common method for measuring the permeability to water of the materials typically used in absorbent articles is a hydrostatic pressure test, also called a hydrostatic head test or simply a “hydrohead” test. Suitable well known compendial methods for hydrohead testing are approved by INDA (formerly the International Nonwovens and Disposables Association, now The Association of the Nonwoven Fabrics Industry) and EDANA (European Disposables And Nonwovens Association).

The terms “proximal” and “distal” refer respectively to the location of an element relatively near to or far from the center of a structure, *e.g.*, the laterally proximal edge of a longitudinally extending element is located nearer to the longitudinal axis than the laterally distal edge of the same element is located relative to the same longitudinal axis. When used to describe relative locations with respect to the axes, synonyms include “inboard” and “outboard”, respectively.

The terms “interior” and “exterior” refer respectively to the location of an element that is intended to be placed against or toward the body of a wearer when an absorbent article is worn and the location of an element that is intended to be placed against or toward any clothing that is worn over the absorbent article. Synonyms for “interior” and “exterior” include, respectively, “inner” and “outer”, as well as “inside” and “outside”. Also, when the absorbent article is oriented such that its interior faces upward, *e.g.*, when it is laid out in preparation for setting the wearer on top of it, synonyms include “upper” and “lower”, “above” and “below”, “over” and “under”, and “top” and “bottom”, respectively.

As can be seen in the drawing figures, one end portion of the exemplary diaper **20** is configured as a front waist region **36**, the longitudinally opposing end portion is configured as a back waist region **38**, and an intermediate portion is configured as a crotch region **37**.

The basic structure of the diaper **20** includes a chassis **100**, which has a laterally extending front edge **136**, a longitudinally opposing back edge **138**, laterally opposing side edges **137**, an interior surface **102**, and an exterior surface **104**. A longitudinal axis **42** extends through the midpoints of the front edge **136** and the back edge **138** and a lateral axis **44** extends through the midpoints of the side edges **137**. The exemplary chassis **100** shown in **Figure 1** additionally has longitudinally extending and laterally opposing side flaps **147** as well as laterally opposing chassis ears **106** and/or **108**, which are described in more detail below.

The basic structure of the diaper **20** also includes an absorbent assembly **200** that is attached to the chassis **100**. The absorbent assembly **200** absorbs and retains liquid bodily waste

materials. The absorbent assembly **200** has a laterally extending front edge **236**, a longitudinally opposing back edge **238**, laterally opposing side edges **237**, an interior surface **202**, and an exterior surface **204**. The absorbent assembly **200** may be disposed either symmetrically or asymmetrically with respect to either or both of the longitudinal axis **42** and the lateral axis **44**. For example, the absorbent assembly **200** shown in **Figure 1** is disposed symmetrically with respect to the longitudinal axis **42** and asymmetrically offset toward the front waist region **36** with respect to the lateral axis **44**.

The edges of the absorbent assembly **200** may lie inward of the respective edges of the chassis **100**, as in the exemplary diaper **20** shown in **Figure 1**. Such a configuration in which one or more of the edges of the absorbent assembly **200** lies inward of the corresponding edges of the chassis **100** may be desirable, for example, in order to allow the relatively more flexible layer or layers adjacent to the edges of the chassis to conform to the body of the wearer and thereby form effective gasket-like seals against the skin of the wearer without being constrained by a relatively thicker and relatively less flexible absorbent assembly. Alternatively, one or more of the edges of the absorbent assembly **200** may coincide with the corresponding edge or edges of the chassis **100**.

When the diaper **20** is worn on the lower torso of a wearer, the front waist edge **136** and the back waist edge **138** encircle the waist of the wearer, while at the same time the chassis side edges **137** encircle the legs of the wearer, the crotch region **37** is generally positioned between the legs of the wearer, and the absorbent assembly **200** extends from the front waist region **36** through the crotch region **37** to the back waist region **38**.

The chassis **100** includes a water-impermeable backsheet **26**. The backsheet **26** forms an exterior surface that is intended to be placed toward any clothing that is worn over the diaper **20**. Many suitable materials for use as the backsheet **26** are well-known, including films of polyethylene and other polyolefins. Multi-layer backsheets, such as laminates of a film and a nonwoven, are also well-known and may be suitable for use as the backsheet **26**. Such a laminate backsheet may be oriented with the nonwoven **31** disposed exteriorly, as shown in **Figure 15** and **Figure 16**, to provide the feel and appearance of a more cloth-like outermost layer than would be provided by using the film **30** as the outermost layer.

The chassis **100** may, but need not, additionally include an inner liner **22** attached to the backsheet **26**. Such an inner liner **22** preferably is formed of a soft material that will not irritate the skin of the wearer. Many suitable materials for the inner liner **22** are well-known in the art, including rayon and synthetic nonwovens such as spunbonded or carded polypropylene or

polyester. An inner liner 22 may form a portion of the interior surface 102 of the chassis 100 that is intended to be placed against the body of the wearer and thereby serve to isolate the skin of the wearer from a portion of the backsheet 26 as may be desirable, for example, when the diaper 20 is worn under conditions in which contact between the skin and a backsheet film could be uncomfortable.

The inner liner 22 may extend to the same width and the same length as the backsheet 26. For example, in the exemplary chassis 100 shown in **Figure 1** and **Figure 2**, the edges of the inner liner 22 are not separately identified because the inner liner 22 has the same extent as the backsheet 26. Alternatively, one or more of the edges of the inner liner 22 may lie inward of the edges of the backsheet 26. For example, with reference to the exemplary diaper 20 shown in **Figure 1**, only the portions of the inner liner 22 lying in the gap 117 between the front edge 236 of the absorbent assembly 200 and the front waist edge 136 of the chassis 100 and the gap 118 between the back edge 238 of the absorbent assembly 200 and the back waist edge 138 of the chassis 100 are exposed, while the remainder of the inner liner 22 is covered by the absorbent assembly 200 and the side flaps 147. Therefore, a laterally extending strip of the inner liner 22 disposed in the gap in the front waist region 36 and a similar laterally extending strip of the inner liner 22 disposed in the gap in the back waist region 38 may suffice to isolate the skin of the wearer from the backsheet 26 in these two gaps.

As shown in the figures, the exemplary chassis 100 has longitudinally extending and laterally opposing side flaps 147 that are disposed on the interior portion of the diaper 20 that faces inwardly toward the wearer and contacts the wearer. The side flaps 147 are formed by folding portions of the chassis 100 laterally inward, *i.e.*, toward the longitudinal axis 42, to form both the respective side flaps 147 and the side edges 137 of the chassis 100, as shown in the figures. Each side flap 147 has a proximal edge 157.

Each side flap 147 is attached to the interior surface 102 of the chassis 100 in attachment zone 153 adjacent to the front waist edge 136 and in a longitudinally opposing attachment zone 154 adjacent to the back waist edge 138, as shown in **Figure 9**. Between the attachment zones, the proximal edge 157 of the side flap 147 remains free, *i.e.*, not attached to the interior surface 102 of the chassis 100 or to the absorbent assembly 200. Also between the attachment zones, an elastic strand 167 is attached adjacent to the proximal edge 157 of each side flap 147. Each elastic strand 167 is enclosed inside a hem 170 formed adjacent to the proximal edge 157 of each side flap 147. When stretched, the elastic strand 167 allows the adjacent side flap edge to extend to the flat uncontracted length of the chassis. When allowed to relax, the elastic strands

167 contract and lifts the proximal edges **157**, thereby lifting the side flaps **147** into position to serve as side barriers adjacent to the side edges **237** of the absorbent assembly **200**, as shown in **Figure 8**. This contraction gathers the adjacent side flap edges and thereby bends the diaper **20** into a "U" shape in which the interior of the "U" shape is formed by the portions of the diaper **20** that are intended to be placed toward the body of the wearer, as shown in **Figure 10**.

When the diaper **20** is worn, the relaxed "U" shape generally conforms to the body of the wearer such that the front waist region **36** and the back waist region **38** can be fastened together to encircle the waist and the legs of the wearer. When the diaper **20** is worn in this manner, the elastic strands **167** tend to hold the lifted proximal edges **157** of the side flaps **147** in contact with the body of the wearer and thereby form seals to help prevent the leakage of deposited bodily waste out of the diaper **20**. The lateral spacing of the lifted proximal edges **157** is selected to allow the deposit of bodily wastes from the lower torso of the wearer into the space between the lifted side flaps **147** and thereby directly onto the absorbent assembly **200**. The width of each of the side flaps **147** in effect becomes its height when the free portion of its proximal edge is lifted and the side flap serves as a side barrier to leakage. This height preferably is selected to allow the lifted proximal edges **157** to fit into the leg creases of the body of the wearer at the same time as the absorbent assembly **200** is held in contact with the body.

In the finished diaper, it is preferable that the chassis have side edges **137** that are not straight, but instead are notched, thereby giving an overall shape in plan view of a "T" or of an "I" to the diaper **20**. Such a non-rectangular configuration may impart a tailored appearance to the diaper **20** when it is worn and may also impart an impression that the diaper **20** will fit comfortably between the legs of a wearer. An exemplary non-rectangular configuration of the chassis is shown in **Figure 5** and **Figure 6**. As shown in these figures, laterally opposing portions **108** of the chassis **100** in the back waist region **138** may extend laterally outward while the adjacent side flaps **147** remain folded laterally inward. The laterally outwardly extending portions **108** form back chassis "ears" that impart a "T" shape to the diaper. Alternatively, laterally opposing portions **106** of the chassis **100** in the front waist region **136** may extend laterally outward to form front chassis ears and thereby impart a "T" shape to the diaper. As another alternative, both the front portions **106** and the back portions **108** may extend laterally outward to form four chassis ears while the adjacent side flaps **147** remain folded laterally inward, in which configuration an "I" shape is imparted to the diaper **20**, as shown in **Figure 24**.

For ease of manufacturing and packaging, it is preferable that the chassis ears **106** and/or **108** remain folded laterally inward until a user desires to deploy them for use when applying the diaper **20** onto the body of a wearer. For this purpose, as shown in **Figure 1**, one edge of each chassis ear may be defined by a frangible line of attachment **91** along which the chassis ear can be partially detached for deployment, *i.e.*, unfolding laterally outward. Such a frangible line of attachment may be formed in a layer or a laminate of layers by perforation, by the formation of a brittle area or areas at which the material will preferentially fracture when stressed, by the formation of a weaker area or areas at which the material will preferentially tear when stressed, by the formation of a friable area or areas at which the material will preferentially crumble when stressed and/or bent, or by any other method of providing frangibility that is suitable for the materials involved.

Alternatively, as shown in **Figure 2**, one edge of each chassis ear may be defined by a cut line **92** at which the chassis ear is severed from the adjacent side flap **147**. Because the formation of this cut line would allow the chassis ear to unfold prematurely, the chassis ear may be held laterally inwardly folded by a releasable attachment member **94** until being deployed by being released and unfolded laterally outward so as to project laterally outward beyond the adjacent side flap. As shown in **Figure 4**, the releasable attachment member **94** may include a releasable attachment element **95** disposed on the chassis ear and a complementary releasable attachment element **96** disposed on the interior surface **102** underlying the chassis ear when it is laterally inwardly folded. Such a releasable attachment member **94** may also be used in combination with a chassis ear that is defined by a frangible line of attachment **91** if additional assurance is desired that the chassis ear will not inadvertently be deployed prematurely, for example by handling that might rupture the frangible line of attachment.

The front waist region **36** and the back waist region **38** can be fastened together to encircle the waist and the legs of the wearer in many well-known ways. For example, separate fastening devices such as safety pins, separate tapes, a separate tie strap or straps, and/or a separate belt can be used for this purpose. Alternatively or in addition, fastening elements can be incorporated into the chassis **100** to enable a user to apply the diaper **20** to the body of the wearer without, or in conjunction with, any separate fastening devices. Many suitable types of such incorporated fastening elements are well-known, including, for example, tapes, adhesives, adhesive tape tabs, ties, buttons, hooks, loops, snap fasteners, other forms of mechanical fasteners, cohesive patches, *etc.* When configured for use, these incorporated fastening elements

may project laterally or longitudinally outward or they may lie entirely inside the edges of the diaper **20**.

For example, laterally opposing fastening elements may be attached to the chassis ears. The fastening elements **120** shown in the figures are disposed on the back chassis ears **108** and may be used to fasten the back waist region **38** to the front waist region **36** in a back-over-front manner. Alternatively, similar fastening elements may be disposed on front chassis ears **106** and used to fasten the front waist region **36** to the back waist region **38** in a front-over-back manner. As yet another alternative, similar fastening elements may be disposed on a waist region not having chassis ears extending from it and may be used to attach that waist region to chassis ears extending from the opposing waist region.

The fastening elements **120** shown in **Figure 5** and **Figure 6** project laterally outward from the chassis ears **108** in the form of tapes. Such tapes may be coated with an adhesive. Suitable adhesive tapes are available from the 3M Corporation of St. Paul, Minnesota, U.S.A., under the designation of XMF99121. In order to prevent their premature adhesion to a surface, such adhesive tape fastening elements are typically folded over to prevent exposure of the adhesive and subsequently unfolded to expose the adhesive for use. For example, in **Figure 3**, both fastening elements **120** are shown folded, while in **Figure 5**, **Figure 6**, and **Figure 7**, the left fastening element **120a** is shown still folded and the right fastening element **120b** is shown unfolded and thereby configured for use.

Optionally, a fastening sheet (not shown) may be attached onto the exterior surface **104** of the chassis **100**, as described in U.S. Patent Application Publication No. 2005/0171499A1, published on 4 August 2005. When a fastening sheet is provided, adhesive tape fastening elements may be adhered to the fastening sheet to fasten the back waist region **38** and the front waist region **36** together. The incorporation of such a fastening sheet may be desirable, for example, in order to make it possible to use a relatively inexpensive and relatively weak material for the backsheet **26**.

Several configurations of cohesive fastening patches are described in U.S. Patent Application Publication No. 2005/0171499A1. In the present invention, it is preferable that such cohesive fastening patches be disposed on the chassis ears. For example, the back fastening elements **120** shown in **Figure 11**, **Figure 12**, **Figure 13**, and **Figure 14**, may be formed by cohesive fastening patches and the complementary front fastening elements **110** in the front waist region **36** may be formed by compatible cohesive fastening patches.

Alternatively, when a laminate backsheet is used and is oriented with the nonwoven disposed exteriorly, some forms of mechanical fasteners that typically require specific mating fastener elements, such as hooks that typically mate with loops, may be configured to engage with the nonwoven and thereby make the inclusion of the specific mating fastener element unnecessary. For example, as shown in **Figure 15**, the fastening elements **120** may be formed by hook fastening patches configured to engage with the nonwoven layer **31** of the laminate backsheet **26**. Such hook fastening elements may be disposed similarly to the cohesive fastening patch fastening elements shown in **Figure 13**.

As described in U.S. Patent Application Publication No. 2005/0171499A1, a portion or the whole of the chassis **100** may be made extensible to a degree greater than the inherent extensibility of the material or materials from which the chassis is made, *e.g.*, the backsheet **26**, the inner liner **22**, or both. The additional extensibility may be desirable in order to allow the chassis **100** to conform to the body of a wearer during movement by the wearer. The additional extensibility may also be desirable, for example, in order to allow the user of a diaper **20** including a chassis **100** having a particular size before extension to extend the front waist region **36**, the back waist region **38**, or both waist regions of the chassis **100** to encircle the waist of an individual wearer whose waist circumference falls within a predefined range, *i.e.*, to tailor the diaper to the individual wearer. Such extension of the waist region or regions may give the diaper a generally hourglass shape, so long as the crotch region **37** is extended to a relatively lesser degree than the waist region or regions, and may impart a tailored appearance to the diaper **20** when it is worn. In addition, the additional extensibility may be desirable in order to minimize the cost of the diaper. For example, an amount of material that would otherwise be sufficient only to make a relatively smaller diaper lacking this extensibility can be used to make a diaper capable of being extended to fit a wearer larger than the smaller diaper would fit. In other words, a lesser amount of material is needed in order to make a diaper capable of being properly fitted onto a given size of a wearer when the material is made extensible as described.

Additional extensibility in the chassis **100** in the lateral direction is relatively more useful than additional extensibility in the longitudinal direction. The abdomen of the wearer is likely to expand when the wearer changes posture from standing to sitting and the corresponding abdominal expansion increases the circumference that is encircled by the waist edges of the chassis **100**, necessitating the lateral extension of the waist region or regions.

Additional lateral extensibility in the chassis **100** may be provided in a variety of ways. For example, a material or materials from which the chassis **100** is made may be pleated by any of

many known methods. Alternatively, all or a portion of the chassis may be made of a formed web material or a formed laminate of web materials like those described in U.S. Patent No. 5,518,801 issued on 21 May 1996. An exemplary fragment **300** of such a formed web material **305** is shown in **Figure 17**. This formed web material **305** includes distinct laterally extending regions **310** in which the original material has been altered by embossing or another method of deformation to create a pattern of generally longitudinally oriented alternating ridges **312** and valleys **314** in the web. The formed web material **305** also includes laterally extending unaltered regions **316** located between the laterally extending altered regions **310**.

Such a formed web material **305** can be laterally extended beyond its original dimension with the application of relatively less force than that required to extend the same material to the same extent when undeformed. In particular, the effects of an application of opposing divergent forces directed generally perpendicular to the ridges **312** and valleys **314** include an extension of such a formed web material along an axis between the opposing forces and the generation of a resistive contractive force, primarily in the unaltered regions **316**. This resistive force is relatively smaller than the resistive force that is generated by the same material in its unaltered form when extended to the same extent, at least up to an extension at which the ridges and valleys in the altered regions flatten and begin to contribute to the resistive force. Thus, such formed web materials exhibit an extensible behavior resembling that of traditional elastic materials in the range of extensibility that is useful for the type of lateral extension desired for use in absorbent articles. However, such formed web materials may be made of relatively less expensive materials that are not inherently elastic and, thus, their use may provide an advantage in terms of the cost of manufacturing the absorbent articles.

As shown in **Figure 19**, **Figure 20**, **Figure 21**, and **Figure 22**, the absorbent assembly **200** includes an absorbent core **250**. The absorbent core **250** has a laterally extending front edge **256**, a longitudinally opposing back edge **258**, a left side edge **257a**, and a laterally opposing right side edge **257b**. Any or all of the edges of the absorbent core **250** may lie inward of, or may coincide with, the respective edges of the absorbent assembly **200**. For example, in the exemplary absorbent assembly **200** shown in **Figure 19**, the side edges **257** of the absorbent core **250** are located laterally inward of the side edges **237** of the absorbent assembly **200**, while the front edge **256** and back edge **258** of the absorbent core **250** coincide with the respective front edge **236** and back edge **238** of the absorbent assembly **200**.

The absorbent assembly **200** may be attached to the chassis **100** over any part or the whole of the area of the absorbent assembly **200**. Preferably, the absorbent assembly **200** is attached

on its exterior surface **204** to the chassis **100** in a cruciform attachment pattern, *i.e.*, in an attachment pattern that forms or is arranged in a cross or "+" shape. The cruciform attachment pattern may be contiguous, *i.e.*, all of its portions may be touching or connected throughout the pattern in an unbroken sequence. Alternatively, the cruciform attachment pattern may include detached portions and thereby lack contiguity but still be arranged such that the shape of the overall pattern is a cruciform. For example, a discontinuous cruciform attachment pattern may include a longitudinally extending portion disposed along the longitudinal axis and separate left and right laterally distal portions disposed along or adjacent to the lateral axis and thereby form a cruciform as the shape of the overall pattern. Within the extent of the cruciform attachment pattern **210**, the absorbent assembly **200** may be attached to the chassis **100** continuously or intermittently. For example, a film of an adhesive may be applied continuously over the entire area of the cruciform attachment pattern and then used to continuously attach the absorbent assembly to the chassis. As an alternative example, an adhesive may be applied discontinuously at and inside the boundaries of the cruciform attachment pattern, such as in the form of dots, stripes, beads, spirals, *etc.*, and then used to attach the absorbent assembly to the chassis.

An exemplary contiguous cruciform attachment pattern **210** is shown in **Figure 18**, **Figure 19**, **Figure 20**, **Figure 21**, and **Figure 22**. The portions **190** of the chassis **100** that lie outside such a cruciform attachment pattern are not restrained by attachment to the absorbent assembly **200** and therefore remain extensible. In particular, a relatively narrow longitudinally extending portion **212** of a cruciform attachment pattern **210** like that shown in **Figure 18**, **Figure 19**, and **Figure 21** leaves the majority of the width of the chassis **100** in the front waist region **36** and in the back waist region **38** freely extensible and thereby allows extension of the chassis **100** in the lateral direction in these regions. A relatively wide laterally extending portion **214** of a cruciform attachment pattern **210** like that shown in **Figure 18**, **Figure 19**, **Figure 20**, and **Figure 22** prevents the portion of the chassis **100** in the crotch region **37** to which the absorbent assembly **200** is attached from shifting relative to the absorbent assembly **200** in that region. A relatively wide laterally extending portion **214** of a cruciform attachment pattern **210** may also contribute to the effectiveness of the side flaps **147** when the elastic strands **167** lift the proximal edges **157** into contact with the body of the wearer. For example, if the chassis **100** in the crotch region **37** were free to shift laterally inward, *i.e.*, toward the longitudinal axis **42** such that the left side edge **137a** and/or the right side edge **137b** moved toward the longitudinal axis **42**, the side flaps **147** might easily distort and fail to maintain contact with the body. However, because the relatively wide laterally extending portion **214** of the cruciform attachment pattern **210**

restrains the chassis **100** over a relatively wide portion of the width of the crotch region **37**, the side flaps **147** are better supported at their bases while being lifted by the elastic strands **167**

The cruciform attachment pattern **210** may be disposed either symmetrically or asymmetrically with respect to either or both of the longitudinal axis **42** and the lateral axis **44** of the chassis **100**. For example, the cruciform attachment pattern **210** shown in **Figure 19** is disposed symmetrically with respect to the longitudinal axis **42** and asymmetrically offset toward the front waist region **36** relative to the lateral axis **44**.

The absorbent core **250** may be disposed between a lower covering sheet that is disposed on the exterior face of the absorbent core **250** in a face-to-face arrangement with the interior surface **102** of the chassis and an upper covering sheet that is disposed on the interior face of the absorbent core **250**. Such an upper covering sheet and lower covering sheet may be attached together to contain the absorbent core **250** between them and thereby form the absorbent assembly **200**. For example, in the exemplary absorbent assembly **200** shown in the figures, an upper covering sheet **24** and a lower covering sheet **25** are attached together at or adjacent to the side edges **237** of the absorbent assembly **200** in adhesive attachment zones **29**. Alternatively, the upper covering sheet **24** and the lower covering sheet **25** may be attached together in places other than the side edges **237** of the absorbent assembly **200**, *e.g.*, at or adjacent to the end edges **236** and **238**, or at or adjacent to both the end edges **236** and **238** and the side edges **237**.

The upper covering sheet **24** is water-permeable and allows liquid waste to pass through to the absorbent core **250**, where the liquid waste is absorbed. The lower covering sheet **25** may be water-impermeable. However, the lower covering sheet **25** preferably is water-permeable. In embodiments in which both the upper covering sheet **24** and the lower covering sheet **25** are water-permeable, any liquid waste that is deposited onto the upper covering sheet **24** but does not pass through the upper covering sheet **24** to the absorbent core **250** can flow around an edge of the absorbent assembly **200** to reach the lower covering sheet **25** and then pass through the lower covering sheet **25** to the absorbent core **250**. The upper covering sheet **24** may form the interior surface **202** of the absorbent assembly **200** that is intended to be placed against the body of the wearer. The upper covering sheet **24** preferably is formed of a soft material that will not irritate the skin of the wearer. Many materials that are suitable for a water-permeable covering sheet are well-known in the art, including synthetic nonwovens such as spunbonded or carded polypropylene, polyester, or rayon. Likewise, many materials that are suitable for a covering sheet that is water-impermeable are well-known in the art, including the materials that are suitable for the backsheet **26**.

The absorbent core may include an acquisition component in addition to one or more storage components. The absorbent core acquisition component serves to acquire deposited liquid bodily waste material and transfer it to the absorbent core storage component. Any porous absorbent material which will imbibe and partition liquid bodily waste material to the storage component or components may be used to form the acquisition component. Preferred materials for the acquisition component include synthetic fiber materials, open celled polymeric foam materials, fibrous nonwoven materials, cellulosic nonwoven materials, and various combination synthetic/cellulosic nonwoven materials. Examples of such acquisition materials are more fully described in U.S. Patent No. 4,950,264 issued on August 21, 1990. High loft nonwoven acquisition materials suitable for the acquisition component of the present invention can be obtained from Polymer Group, Inc., (PGI), 450 N.E. Blvd, Landisville, New Jersey 08326, U.S.A., under the material code designation of 98920. Such an absorbent core **250** including an acquisition component **290** overlying an absorbent core storage component **272** is shown in **Figure 25**. A separation sheet **292** of, e.g., a tissue or a nonwoven material, may be disposed between the absorbent core storage component **272** and the absorbent core acquisition component **290** to help ensure that none of the gel formed by a superabsorbent polymer that may be included in the absorbent core storage component reaches the skin of the wearer.

Suitable well-known absorbent materials for the absorbent core include cellulose fibers in the form of comminuted wood pulp, which is commonly known as "airfelt", layers or sheets of natural or synthetic fibrous material, superabsorbent polymer, *etc.* These absorbent materials may be used separately or in combination and many may be used in a discrete form, *i.e.*, in the form of fibers, granules, particles, layers and the like.

The discrete form of an absorbent material may be immobilized in pockets formed by a layer of a thermoplastic material, such as a hot melt adhesive, that intermittently contacts and adheres to a substrate, such as a covering sheet, while diverging away from the substrate at the pockets. Absorbent assemblies having such pocket structures are described in detail in U.S. Patent Application Publications Nos. 2004/0167486 of 26 August 2004 and 2004/0162536 of 19 August 2004. An exemplary absorbent assembly **200** having such a structure is shown in **Figure 23**. In this absorbent assembly **200**, the absorbent core **250** includes particles of superabsorbent polymer **270** that are contained inside pockets **280** formed by a layer **275** of a thermoplastic material. This absorbent core **250** contains no cellulose fibers. Alternatively, the absorbent core **250** may include both particles of superabsorbent polymer and airfelt and both materials may be contained inside the pockets. As shown in **Figure 23**, the layer **275** of the

thermoplastic material intermittently contacts and adheres to the lower covering sheet **25** at the areas of attachment **282**. Between the areas of attachment **282**, the layer **275** diverges away from the lower covering sheet **25** to form the pockets **280**. The layer **275** may have the form of a sheet of fibers of the thermoplastic material through which the liquid waste may pass to the particles of superabsorbent polymer **270** to be absorbed. In **Figure 23**, a separate upper covering sheet **24** is shown overlying the layer **275** of the thermoplastic material. Alternatively, the separate upper covering sheet **24** may be omitted and the layer **275** in the form of a fibrous sheet may serve as the upper covering sheet **24**.

The disclosures of all patents, patent applications and any patents which issue thereon, as well as any corresponding published foreign patent applications, and all publications listed and/or referenced in this description, are hereby incorporated in their entireties herein by reference. It is expressly not admitted that any of the documents or any combination of the documents incorporated herein by reference teaches or discloses the present invention. In the case of any conflict between the definitions of terms, the usage in this description overrides the conflicting usage in any incorporated reference.

CLAIMS

What is claimed is:

1. A disposable diaper comprising:

a chassis having a front waist region, a back waist region, and a crotch region between the waist regions, a longitudinal axis and a lateral axis, laterally opposing side edges, longitudinally opposing front and back waist end edges, an interior surface and an exterior surface;

the chassis including a water-impermeable backsheet;

the chassis also including laterally opposing side flaps formed by laterally inwardly folded portions of the chassis in at least the crotch region, each side flap having longitudinally distal ends and a proximal edge, each side flap being attached to the interior surface adjacent to the longitudinally distal ends and having a longitudinally extending elastic gathering member attached adjacent to the proximal edge;

the chassis also including laterally opposing deployable chassis ears formed by portions of the side flaps in at least one of the waist regions, each chassis ear being held laterally inwardly folded by a frangible line of attachment until being deployed by being detached at the frangible line and each side flap portion, in its entirety, being unfolded laterally outward so as to form the chassis ears projecting laterally outward beyond the respective side flap;

an absorbent assembly attached to the interior surface of the chassis;

wherein the absorbent assembly is attached to the chassis in a cruciform pattern of attachment having a longitudinally extending portion intersecting a laterally extending portion;

wherein a portion of the chassis underlying the absorbent assembly and lying outside the cruciform pattern is laterally extensible; and

wherein the extensible portion of the chassis comprises a formed web material including at least two distinct laterally extending embossed regions each containing a pattern of generally longitudinally oriented alternating ridges and valleys created by an embossment

and also containing an unembossed region located between the embossed regions, such that the portion of the chassis can be laterally extended to a given extent with the application of relatively less force than that required to laterally extend the same portion of the chassis to the same given extent before the embossment.

2. The disposable diaper of claim 1 wherein the chassis includes the chassis ears in both of the waist regions.
3. The disposable diaper of claim 1 wherein the chassis includes fastening elements disposed on at least two of the chassis ears and adapted for fastening the front waist region to the back waist region to encircle a waist and legs of a wearer.
4. The disposable diaper of claim 3 wherein the fastening elements comprise adhesive tapes.
5. The disposable diaper of claim 1 wherein the chassis includes a nonwoven inner liner attached to the backsheet and forming a portion of the interior surface.
6. The disposable diaper of claim 1 wherein the backsheet is a laminate of a film and a nonwoven, the nonwoven being disposed exteriorly of the film.
7. The disposable diaper of claim 6 wherein the fastening elements comprise hooks adapted to engage with the backsheet nonwoven.
8. The disposable diaper of claim 1 wherein the longitudinally extending portion is disposed symmetrically with respect to the longitudinal axis and the laterally extending portion is disposed asymmetrically with respect to the lateral axis.
9. The disposable diaper of claim 8 wherein the laterally extending portion is longitudinally offset toward the front waist region.

10. The disposable diaper of claim 1 wherein the frangible line of attachment comprises perforations.

11. A disposable diaper comprising:

a chassis having a front waist region, a back waist region, and a crotch region between the waist regions, a longitudinal axis and a lateral axis, laterally opposing side edges, longitudinally opposing front and back waist end edges, an interior surface and an exterior surface;

the chassis comprising a water-impermeable backsheet;

comprising laterally opposing side flaps formed by laterally inwardly folded portions of the backsheet in at least the crotch region, each side flap comprising longitudinally distal ends and a proximal edge;

the backsheet also comprising laterally opposing deployable first and second ears formed by portions of the side flaps in at least one of the waist regions, fastening elements being disposed on the first and second ears and adapted for fastening the front waist region to the back waist region to encircle a waist and legs of a wearer, the first and second ears being held laterally inwardly folded by a releasable attachment member until being deployed by being released at the attachment member and each side flap portion, in its entirety, being unfolded laterally outward so as to form the chassis ears projecting laterally outward beyond the respective side flap;

an absorbent assembly attached to the interior surface of the chassis;

wherein the absorbent assembly is attached to the chassis in a cruciform pattern of attachment having a longitudinally extending portion intersecting a laterally extending portion;

wherein a portion of the chassis underlying the absorbent assembly and lying outside the cruciform pattern is laterally extensible; and

wherein the extensible portion of the chassis comprises a formed web material including at least two distinct laterally extending embossed regions each containing a pattern of generally longitudinally oriented alternating ridges and valleys created by an embossment and also containing an unembossed region located between the embossed regions, such

that the portion of the chassis can be laterally extended to a given extent with the application of relatively less force than that required to laterally extend the same portion of the chassis to the same given extent before the embossment.

12. The disposable diaper of claim 11 wherein the releasable attachment member comprises an adhesive.

13. The disposable diaper of claim 11 wherein the releasable attachment member comprises complementary releasable attachment elements disposed on the first and second ears and on the interior surface underlying the laterally inwardly folded first and second ears.

14. The disposable diaper of claim 11 wherein the absorbent assembly comprises a plurality of discrete pockets of absorbent material.

15. A disposable diaper comprising:

a chassis having a front waist region, a back waist region, and a crotch region between the waist regions, a longitudinal axis and a lateral axis, laterally opposing side edges, longitudinally opposing front and back waist end edges, an interior surface and an exterior surface;

the chassis including a water-impermeable backsheet and a nonwoven inner liner attached to the backsheet and forming a portion of the interior surface;

the chassis also including laterally opposing side flaps formed by laterally inwardly folded portions of the chassis in at least the crotch region, each side flap having longitudinally distal ends and a proximal edge, each side flap being attached to the interior surface adjacent to the longitudinally distal ends and having a longitudinally extending elastic gathering member attached adjacent to the proximal edges;

the chassis also including laterally opposing deployable chassis ears formed by portions of the side flaps in each of the waist regions, fastening elements being disposed on at least two of the chassis ears, the fastening elements comprising adhesive tapes and being adapted for fastening the front waist region to the back waist region to encircle a waist

and legs of a wearer, each chassis ear being held laterally inwardly folded by a frangible line of attachment until being deployed by being detached at the frangible line and each side flap portion, in its entirety, being unfolded laterally outward so as to form the chassis ears projecting laterally outward beyond the respective side flap;

an absorbent assembly attached to the interior surface of the chassis;

wherein the absorbent assembly is attached to the chassis in a cruciform pattern of attachment having a longitudinally extending portion intersecting a laterally extending portion;

wherein a portion of the chassis underlying the absorbent assembly and lying outside the cruciform pattern is laterally extensible; and

wherein the extensible portion of the chassis comprises a formed web material including at least two distinct laterally extending embossed regions each containing a pattern of generally longitudinally oriented alternating ridges and valleys created by an embossment and also containing an unembossed region located between the embossed regions, such that the portion of the chassis can be laterally extended to a given extent with the application of relatively less force than that required to laterally extend the same portion of the chassis to the same given extent before the embossment.