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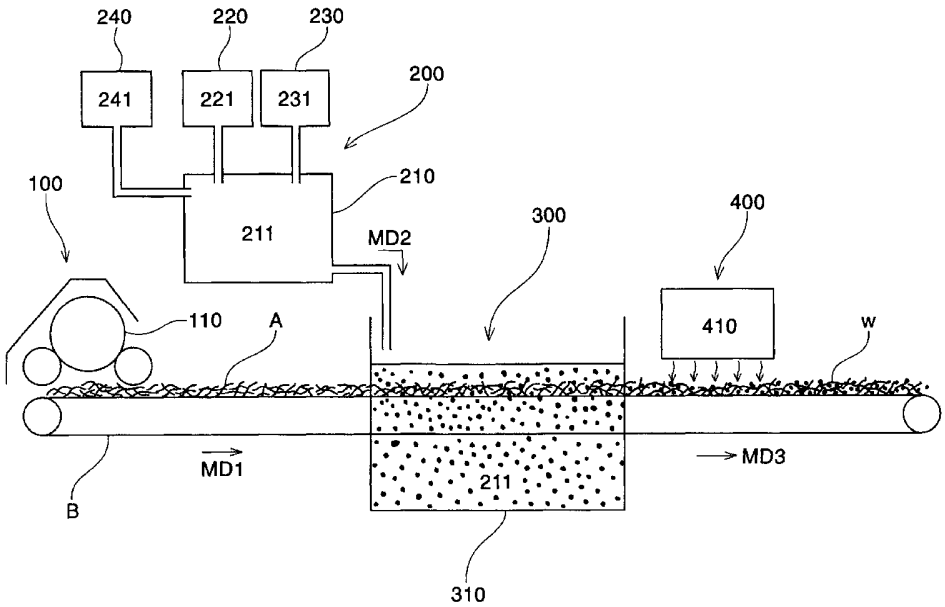
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(54) **Title:** A PROCESS FOR MAKING A FIBROUS WEB CONTAINING A FUNCTIONAL MATERIAL



(57) **Abstract:** The present invention is directed to a process for making a fibrous web. The fibrous web comprises fibers and a functional material. The fibers are bonded by a binder and the functional material is immobilized by the binder. The process of the present invention comprises the steps of: forming a fiber aggregation comprising fibers, preparing a solution comprising the binder and the functional material uniformly dispersed together with the binder in the solution, immersing the fiber aggregation into the solution to disperse the functional material into the fiber aggregation, and drying the fiber aggregation to form the fibrous web.

WO 02/091976 A1

A PROCESS FOR MAKING A FIBROUS WEB CONTAINING A FUNCTIONAL MATERIAL

FIELD

The present invention relates to a process for making a fibrous web comprising fibers and a functional material, such as an odor control material, and/or an antimicrobial material. Furthermore, the present invention relates to disposable absorbent articles comprising an odor control and/or antimicrobial layer containing an odor control material and/or an antimicrobial material.

BACKGROUND

Functional material may be incorporated into a fibrous structure for a variety of reasons. For example, disposable absorbent articles for infants and/or other incontinent individuals may contain antimicrobial materials and/or bactericides to remove foul odors of body fluids such as urine, feces and/or sweat and the like.

A wide variety of disposable absorbent articles which are designed not only to be efficient in the absorption of body fluids such as urine, blood, menses and the like, but also to be sanitary and comfortable in-use, are known in literature. Disposable absorbent products of this type generally comprise a fluid-permeable topsheet material, an absorbent core (or a fluid storage layer), and a fluid-impermeable backsheet material.

Recently, research has been focused on the removal of foul odors and the prevention of skin diseases such as dermatitis, rash and redness caused by wearing a disposable absorbent article for a relatively long time. Many body fluids have an unpleasant odor (or an malodor), or develop such an odor when in contact

with air and/or bacteria for prolonged periods. Additionally, urine and/or other exudates absorbed into the absorbent article are converted to ammonia by urease produced by skin-flora, i.e., a group of normal microorganisms on the skin. This ammonia, in turn, may cause dermatitis, rash and/or other forms of skin irritation. Such disease of the skin in infants can be a serious medical matter which, in extreme cases, can result in death.

Antimicrobial materials and bactericides in general are chemical compositions that are used to prevent microbiological contamination and deterioration of products, materials, and systems. Such antimicrobial materials and bactericides can also effectively work for the removal or reduction of foul odors developed from disposable absorbent articles which have already absorbed body fluids. For example, Japanese Patent (Kokoku) Publication No. H4-17058 discloses a disposable diaper which includes an absorbent layer containing a super-absorbent material and a antimicrobial material included in the super-absorbent material. Japanese Patent (Kokai) Publication No. H5-277143 discloses a disposable diaper which includes a super-absorbent material containing an odor reduction material. Further, Japanese Patent (Kokai) Publication No. S64-25856 discloses a sanitary napkin which includes an absorbent sheet including a super-absorbent material and a metalphthalocyanine derivative as an odor reduction material.

There are a variety of methods to incorporate a functional material such as antimicrobial materials and/or bactericides. For example, Groeger et al. U.S. Pat. No. 6,024,813 discloses thermoplastic manufactured fibers that can be thermally bonded to entrap the particulate matter within the web structure and to which the particulate matter can be fused. The thermally bonded web structure substantially limits migration of particulate matter within the structure or abrasive loss of particles from the structure. However, the process for manufacturing the fibers disclosed in Groeger et al. patent suffers from the drawback that heat must be applied to bond the fibers. Therefore, the particulate matter having a low melting point is not

applicable to the process disclosed in Groeger et al. patent. This is because the particulate matter having a low melting point may melt with heat when heat is applied to bond the fibers. The drawback leads to the limited and few option regarding a material of the particulate matter. In addition, the fibers disclosed in Groeger et al. patent should be composite thermoplastic fibers in which one component has a relatively low melting point and the other component has a relatively high melting point. Therefore, the fibers disclosed in Groeger et al. patent also suffers from the drawback that the cost of the fiber material is high.

Based on the foregoing, there is a need for a process making a fibrous web capable of containing various functional materials efficiently. Further, there is also a need for a simple and inexpensive process for making a fibrous web containing a functional material such as antimicrobial material and/or bactericide.

SUMMARY

The present invention is directed to a process for making a fibrous web. The fibrous web comprises fibers and a functional material. The fibers are bonded by a binder and the functional material is immobilized by the binder. The process of the present invention comprises the steps of: forming a fiber aggregation comprising fibers, preparing a solution comprising the binder and the functional material uniformly dispersed together with the binder in the solution, immersing the fiber aggregation into the solution to disperse the functional material into the fiber aggregation, and drying the fiber aggregation to form the fibrous web.

These and other features, aspects, and advantages of the present invention will become evident to those skilled in the art from reading of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWING

While the specification concludes with claims particularly pointing out and distinctly claiming the invention, it is believed that the invention will be better

understood from the following description of preferred embodiments which is taken in conjunction with the accompanying a drawing and which like designations are used to designate substantially identical elements, and in which:

Figure 1 a schematic side elevational view of an exemplary embodiment of the process of the present invention;

Figure 2 is a greatly enlarged representation of a sectional view of the fibrous web;

Figure 3 is a simplified plan view of one embodiment of the disposable absorbent article in its flat uncontracted condition; and

Figure 4 is a cross-sectional view taken along line IV-IV of Figure 3.

DETAILED DESCRIPTION

All cited references are incorporated herein by reference in their entireties. Citation of any reference is not an admission regarding any determination as to its availability as prior art to the claimed invention.

Herein, "comprise" and "include" mean that other element(s) and step(s) which do not affect the end result can be added. These terms encompass the terms "consisting of" and "consisting essentially of". Herein, "layer" does not necessarily limit the element to a single strata of material in that a layer may actually comprise laminates or combinations of sheets or webs of the requisite types of materials. Herein, "bonded" or "bonding" encompasses configurations whereby an element is directly secured to another by affixing the element directly to the other element, and configurations whereby the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element. Herein, "fibrous web" means a web made of fibers autogenously bonded by means of various bonding substances. Such a

fibrous web may or may not be continuous. Herein, "fiber aggregation" means a mass comprising a number of fibers which are not bonded each other by physical or chemical bonds. Such a fiber aggregation may take a form of a sheet, a bundle, and the like. In addition, the fiber aggregation may or may not be continuous. Herein, "functional material" encompasses any material which provides an substance with various functions and is held in the substance. Furthermore, such a functional material includes any material to improve functions which the substance originally has or to add functions which the substance does not originally have. For example, functions which such a functional material provides with the substance may include an odor reduction function, an antimicrobial function, a sterilizing function, an aromatic function, a medicinal function, a function for removing poisonous matters to humans, and the like. In addition, such a functional material may be in the form of particle, fiber, fluid and/or combinations thereof. Herein, "odor control material (hereinafter referred to as "OCM")" is one kind of the foregoing "functional material", and encompasses any material which can reduce or remove odors developed from an object and/or an article, such as a disposable underwear, a disposable diaper (adult and baby) including a pull-on diaper and a training pant, a disposable panty for menstrual use, and a disposable absorbent pad including a sanitary napkin. Furthermore, herein, OCM also includes any material, such as antimicrobial materials and bactericides which can provide an antimicrobial reduction/removal function because such materials can also effectively work for the reduction or removal of foul odors developed from disposable absorbent articles which have already absorbed body fluids. Herein, "metalphthalocyanine material" encompasses a metalphthalocyanine, its derivatives, and any mixture materials thereof. Herein, "odor control layer" encompasses a layer which includes an odor control material that can provide an odor reduction/removal function and/or an antimicrobial reduction/removal function. Herein, "immobilize" means minimizing and/or eliminating migration of an object existing into another object. Herein, "immerse" means putting an object (or a substance) under the surface of liquid, dipping an object (or a substance) into liquid or making an object(or a substance) pass through static liquid or a flow of liquid.

The term "machine direction" (hereinafter "MD") refers to that direction which is parallel to the flow of the materials (e.g. a fiber aggregation (A) of the present invention). The direction MD is indicated by arrows in Figure 1. The term "cross-machine direction" (hereinafter "CD") is perpendicular to the machine direction.

The process for making a fibrous web of the present invention is described herein below.

An example of the process making a fibrous web of the present invention is shown in Figure 1. The process comprises four major sections, a fiber aggregation forming section 100, a solution preparing section 200, an immersing section 300 and a drying section 400.

The fiber aggregation forming section 100 forms a fiber aggregation (A). There are a number of manufacturing techniques which may be used to form the fiber aggregation (A). For example, the fiber aggregation (A) as a preferred starting material for a fibrous web according to the present invention may be formed by a variety of methods, including wet-laying methods, air-laying methods, carding, and other methods, of which carding methods are presently preferred. This section 100 comprises a carding unit 110 as shown in Figure 1. The carding unit 110 cards fibers (not shown in Figures) and forms the fiber aggregation (A) on an endless moving belt (B). For carding, the fibers typically will have been crimped. Techniques for carding fibrous material to form sheets such as nonwovens are well known and described in the art, such as in "Nonwovens: Theory, process, performance and testing", TAPPI Press, Atlanta, GA, USA, edited by Turbak. A fiber aggregation (A) may include fibers such as synthetic fibers or natural fibers such as cellulose fibers, and the like. In a preferred embodiment, the fiber aggregation (A) comprises polyethylene terephthalate (PET) fibers. In an alternative preferred embodiment, the fiber aggregation (A) is formed by a natural fibrous material such as cellulose fibers in the form of fluff, which is conventionally

utilized and generally referred to as "airfelt" in absorbent cores (or fluid storage layers). The fiber aggregation (A) is then fed toward the immersing section 300 along MD 1.

The solution preparing section 200 comprises a solution preparing unit 210, a binder feeding unit 220, a functional material feeding unit 230 and a solvent feeding unit 240 as shown in Figure 1. This section prepares a solution 211 comprising a binder 221, a functional material 231 and a solvent 241. The binder feeding unit 220 feeds a binder 221 to the solution feeding unit 210. After having formed the fiber aggregation (A), the fiber aggregation (A) has to be consolidated. In contrast to a number of conventional heat-bonded webs, a fibrous web finally manufactured by the process of the present invention comprises a binder 221 to consolidate the fiber aggregation (A) into a fibrous web without melt-bonding the fibers. Such binders for increasing physical integrity of the fibrous web can be resinous binders, latex, styrene-butadiene-rubber (SBR), Ethylene-vinyl-acetate (EVA), Ethylene-vinyl-alcohols (EVOH), Acrylic based resins, and starch known in the art for providing increased integrity to fibrous webs. Any materials known in the art can be used as the binder 221 as long as it can bond individual fibers each other to form a fibrous web. Preferred chemical binders are of the Styrene-Butadiene type, such as supplied by GenCorp, Mogadore, Ohio, USA or by BASF AG, Ludwigshafen, FRG. Preferred other binders may include polyurethane, polyallylamine and the like. The functional material feeding unit 230 feeds a functional material 231 to the solution feeding unit 210. Any materials known in the art can be used as the functional material 231 as long as it can add any function to a fibrous web. Preferred functional material may include an odor reduction material, an antimicrobial material, a sterilizing material, an aromatic material, a medicinal material and the like. The solvent feeding unit 240 feeds a solvent 241 to the solution feeding unit 210. Any materials known in the art can be used as the solvent 241 as long as it is applicable to the binder 221 and/or the functional material 231 to prepare the

solution 211. Preferred solvent may include water, deionized water and the like. The binder 221, the functional material 231 and the solvent 241 are blended with each other at the solution preparing section 210. The solvent 241 may blend with the binder 221 and/or the functional material 231 in advance of the solution preparing section 210. In a preferred embodiment to achieve a desired function developed by the functional material 231, the solution 211 may contain from about 0.1 % to about 99.998 % by weight of the binder 221, from about 0.001 % to about 99.8 % by weight of the functional material 231 and from about 0.001 % to about 99.8 % by weight of the solvent 241, preferably from about 0.1 % to about 90 % by weight of the binder 221, from about 0.001 % to about 50 % by weight of the functional material 231 and from about 0.001 % to about 70 % by weight of the solvent 241, more preferably from about 30 % to about 80 % by weight of the binder 221, from about 0.001 % to about 20 % by weight of the functional material 231 and from about 0.001 % to about 50 % by weight of the solvent 241. The PH of the solution 211 needs to be controlled (or chosen) depending on the type of the functional material 231. The solution 211 is then fed toward the immersing section 300 along MD 2.

The immersing section 300 comprises an immersing bath 310 as shown in Figure 1 to immerse the fiber aggregation (A) fed from the fiber aggregation forming section 100 into the solution 211 fed to the immersing bath 310. Because the functional material 231 has been already dispersed uniformly into the solution 211 at the solution preparing unit 210 in advance of the immersing bath 310, the functional material 231 is uniformly dispersed into the fiber aggregation (A). Alternatively, the functional material 231 may be fed to the immersing section 300 such that the functional material 231 is dispersed uniformly into the solution 211 at the immersing bath 310 as long as the functional material 231 is dispersed uniformly the immersing bath 310 finally. In the embodiment shown in Figure 1, the fiber aggregation (A) passes through under the surface of the solution 211 which is a static liquid. Alternatively, the fiber aggregation (A) may directly pass through a flow of the solution 211 which

is fed from the solution preparing section 200. In that case, it is possible to omit the immersing bath 310. The fiber aggregation (A) immersed into the solution 211 comprising the binder 221, the functional material 231 and the solvent 241 is then fed toward the drying section 400 along MD 3.

The drying section 400 comprises a drying unit 410. After the solution 211 is applied to the fiber aggregation (A), the fiber aggregation (A) containing the binder 221, the functional material 231 and the solvent 241 has to be cured and dried. This referes to the following effects, namely to provide a certain curing of the resin thus bonding both to itself but also to the fibers and also to remove moisuture such as water or other carrier fluid for the resin. This can be achieved by a number of techniques, generally aiming at providing energy to the fiber aggregation (A), such as running the fiber aggregation over heated rolls, through a heated oven, or treating it with infra-red energy beams. It is preferred that the fiber aggragation (A) is not compressed in its thickness dimension during the process. Therefore, a simple drying oven can be more suitable than the often called "can-drying" process. The drying unit 410 removes moisuture from the fiber aggregation (A) immersed into the solution 211 to form a fibrous web (W). By removing moisuture from the fiber aggregation (A) at the drying section 400, the indivdual fibers of the fiber aggregation (A) are bonded and the functional material 231 is immobilized. Preferably, through-air heat is supplied from the drying unit 410 to dry the fiber aggregation (A). The temperature in the drying unit 410 normally averages about 80 degrees centigrade, preferably 90 degrees centigrade, more preferably 100 degrees centigrade. In another embodiment, the drying unit 410 may be divided into two drying units, one is a primary drying unit and the other is a secondary drying unit. Preferably, the primary drying unit comprises a heated oven and the secondary drying unit comprises steaming rolls.

Figure 2 schematically shows a greatly enlarged representation of a sectional view of the fibrous web (W) formed by the foregoing process of the present invention. The fibrous web (W) comprises a plurality of individual fibers

(F), the binder 221 and the functional material 231. The fibrous web (W) has a void space (W3) between the individual fibers (F) which define an upper surface (W1) and a lower surface (W2) for the fibrous web (W). The functional material 231 is dispersed uniformly throughout the void space (W3) within the fibrous web (W). The void space (W3) is sufficiently open such that the individual functional materials 231 are dispersed uniformly between the upper surface (W1) and the lower surface (W2). The individual fibers (F) forming the void space (W3) are bonded by the binder 221 and entrap the individual functional materials 231 so as to substantially preclude their migration out of the open web (W3).

The individual fibers (F) of the fiber aggregation (A) substantially functions as a substance to hold or keep the functional material 231 within the fibrous web (W) through physical or chemical bonds. Any materials known in the art can be used as individual fibers (F) as long as it can hold or keep the functional material 231 therein. In addition, any materials known in the art can be used as the fibrous web (W) as long as the functional material 231 can be dispersed in the fibrous web (W). The fibrous web (W) may be typically in the form of nonwoven webs or tissue webs. Preferably, at least 95%, more preferably at least 99% by weight of the functional material is physically bonded to the fibrous web (W) by means of, e.g., binder, while the rest of the functional material may remain unbonded. Alternatively, the rest of the functional material may be chemically bonded to some of the fibrous web (W) by means of, e.g., covalent bond between molecules. The individual functional material 231 may have a variety of shapes. For example, the individual functional material 231 may be typically in the form of particle, fiber, and/or combinations thereof. In a preferred embodiment, the particles of the functional material 231 are dispersed uniformly throughout the fibrous web (W). Such a fibrous web comprising the particles of the functional material 231 can be manufactured by the foregoing process of the present invention.

Preferably, the basis weight of the fibrous web (W) are uniform throughout the web. Typically the basis weight of the fibrous web (W) can range from about 1

to about 80 g/cm^2, more preferably from about 10 to about 70 g/cm^2, and yet more preferably from about 20 to about 60 g/cm^2. The density values for the fibrous web (W) are calculated from basis weight and layer caliper measured under a confining pressure of 0.2 psi (1.43 kPa). The density and basis weight values include the weight of the functional material 231.

Other materials or agents can be used with the functional material 231 as an aid in producing the fibrous material (W). In a preferred embodiment, water is used in conjunction with the functional material 231. The water functions to promote uniform dispersion of the functional material 231 within the fibrous web (W) and permeation of the functional material 231 into the surface region of the fibrous web (W). The actual amount of water to be used will vary depending upon the kind of the fibrous web (W). In a more preferred embodiment, a viscosity control agent is additionally used in conjunction with the functional material 231. The viscosity control agent functions to further promote uniform dispersion of the functional material 231 within the fibrous web (W) and permeation of the functional material 231 into the surface region of the fibrous web (W). The actual amounts and kinds of the viscosity control agent to be used vary depending upon the kinds of the functional material and the fibrous web in the odor control material.

According to the foregoing process for making the fibrous web (W) containing the functional material 231, the functional material 231 is uniformly dispersed within the fibrous web (W) because the fibrous web (W) is manufactured by immersing the fiber aggregation (A) into the solution 211 in which the functional material 231 has already been dispersed uniformly. A fibrous web comprising a functional material is conventionally made by applying a mixture comprising a functional material and a binder to a fibrous web which has been already boded by another binder. However, this requires to prepare two distinct binders to form a nonwoven web and to fix a functional material into the fibrous web separately in the conventional process. In contrast, the present invention requires only one binder

because the binder 211 serves as a binder not only to bond the fiber aggregation (A) but also to immobilize the functional material 231. Thus, the present invention provides a simple and inexpensive process for making a fibrous web containing a functional material. Furthermore, a wide variety of materials for the functional material 231 are applicable to the process of the present invention regardless of melting points of materials because heat does not have to be applied in order to bond the individual fibers (F) and to immobilize the functional material 231 in the process of the present invention.

A functional material may be selected from a wide variety of materials having some function that is desirably incorporated into a fibrous web. Examples of such functional materials include activated carbon adsorbent, silica, zeolite, molecular sieve, clay, alumina, ion exchange resin, organic metal catalyst, metal oxide, biocide, fungicide and virucide. For example, a fungicidal material may be incorporated into a filter structure, such as an automobile climate control system, to remove mildew and mildew odors from the circulate air. Biocides and virucides may be incorporated into chemical defensefabrics for protection against biological warfare. Other type of a functional material includes an odor control material to reduce or remove a wide variety of odors.

The odor control material (hereinafter "OCM") useful in the process of the present invention includes any chemical capable of controlling or reducing an unpleasant odor (or an malodor) contained in body fluids or developed when such body fluids are in contact with air and/or bacteria for prolonged periods. The OCM useful in the process of the present invention also includes any chemical capable of preventing the growth of or killing microorganisms.

Preferred OCMs include, but are not limited to, a quaternary ammonium, a phenolic, an amide, an acid, a nitro compounds, and a metalphthalocyanine material, and mixtures thereof. In a preferred embodiment, the OCM is a metalphthalocyanine material.

Preferred quaternary ammonium compounds include 2-(3-anilinovinylul)3,4-dimethyl-oxazolinium iodide, alkylisoquinolium bromide, benzalkonium chloride, benzethonium chloride, cetylpyridium chloride, chlorhexidine gluconate, chlorhexidine hydrochloride, lauryl trimethyl ammonium, methylbenzethonium chloride, stearltrimethylammonium chloride, 2,4,5-trichloro phenoxide, and mixtures thereof.

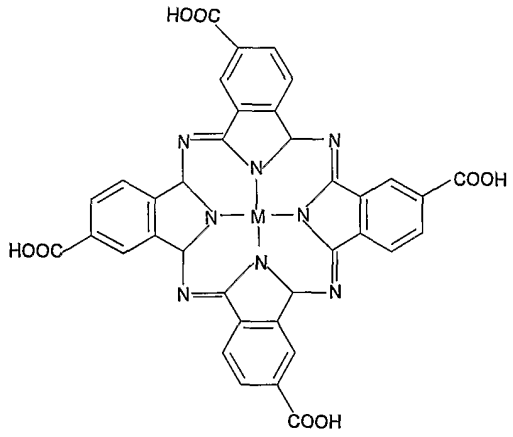
Preferred phenolic compounds include benzyl alcohol, p-chlorophenol, chloreocresol, chloroxylenol, cresol, o-cymene-5-ol (BIOSOL), hexachlorophene, hinokitiol, isopropylmethylphenol, parabens (having methyl, ethyl, propyl, butyl, isobutyl, isopropyl, and/or sodium methyl substituents), phenethyl alcohol, phenol, phenoxyethanol, o-phynylphenol, resorcin, resorcin monoacetate, sodium parabens, sodium phenolsulfonate, thioxolone, 2,4,4'-trichloro-2'-hydroxydiphenyl ether, zinc phenolsulfonate, and mixtures thereof; more preferably sodium parabens.

Preferred amides include diazolidinyl urea, 2,4-imidazolidinedione (HYDATOIN), 3,4,4'-trichlorocarbanilide, 3-trifluoromethyl-4-4'-dichlorocarbanilide, undecylenic acid monoethanolamide, and mixtures thereof; more preferably diazolidinyl urea and 2,4-imidazolidinedione; more preferably still 2,4-imidazolidinedione.

Preferred acids include benzoate, benzoic acid, citric acide, dehydroacetic acid, potassium sorbate, sodium citrate, sodium dehydroacetate, sodium salicylate, sodium salicylic acid, sorbic acid, undecylenic acid, zinc undecylenate, and mixtures thereof; more preferably benzoic acid, citric acid, salicylic acid and sorbic acid, more preferably still citric acid and sorbic acid.

Preferred nitro compounds include 2-bromo-2-nitro-2,3-propanediol (BRONOPOL), and methyldibromo glutaronitrile and propyulene glycol (MERGUARD), and mixtures thereof.

In a preferred embodiment, the OCM includes a metalphthalocyanine material. A preferred metalphthalocyanine material may have the following chemical structure:



The metalphthalocyanine material has the central metal (indicated by "M" in the above chemical structure) selected from the transition elements. In a preferred embodiment, the central metal of the metalphthalocyanine material is Ni(II), Fe(III), Co(II), or Mn(II). In a more preferred embodiment for use of disposable diapers, the central metal of the metalphthalocyanine material is Fe(III) or Co(II).

Preferred metalphthalocyanine derivatives have -COOH as the functional group. Such preferred metalphthalocyanine derivatives can have either di, tetra or octa forms of -COOH. Alternatively, the metalphthalocyanine derivatives can have either di, tetra or octa forms of $-SO_3Na$.

In a preferred embodiment for use of disposable diapers, the OCM may include maleic anhydride methyl vinyl ether copolymer, zinc oxide, copper (II) sulfate, potassium permanganate, and mixtures thereof.

In another preferred embodiment for use of disposable diapers, the OCM may include a mixture of metalphthalocyanine, maleic anhydride methyl vinyl ether copolymer, zinc oxide, copper (II) sulfate and potassium permanganate, preferably a mixture of metalphthalocyanine, maleic anhydride methyl vinyl ether copolymer, zinc oxide and copper (II) sulfate, more preferably maleic anhydride methyl vinyl ether copolymer, zinc oxide and copper (II) sulfate.

The foregoing absorbent and the odor control materials may be employed as a functional material in the process of the present invention as illustrated above. Such absorbent and the odor control materials are typically utilized for disposable absorbent articles which are capable of absorbing significant quantities of body fluids, such as urine and water in body wastes. Examples of such disposable absorbent articles include disposable underwears, disposable diapers (adult and baby) including pull-on diapers and training pants, disposable panties for menstrual use, and disposable absorbent pads including sanitary napkins.

Such a disposable absorbent article generally comprises the following basic structural components: a topsheet, a backsheet combined with the topsheet, a fluid storage layer disposed between the topsheet and backsheet. Preferably, the fluid storage layer contains a super-absorbent material.

The topsheet can be either liquid pervious or liquid impervious. In a preferred embodiment, the topsheet is liquid pervious. Similarly, the backsheet can be either liquid pervious or liquid impervious. In a preferred embodiment, the backsheet is liquid impervious. The liquid pervious topsheet and backsheet can be formed by treating them with a finishing oil or a surfactant well known in the art. Further, the liquid impervious backsheet can be formed by employing an

impervious thin plastic film. In a preferred embodiment, the disposable absorbent article further includes; a liquid pervious topsheet, and a liquid impervious backsheet combined with the topsheet.

The fluid storage layer can include a single layer of essentially 100% super-absorbent material as a absorbent material. Alternatively, the fluid storage layer can include a single layer of essentially 100% non-super-absorbent material such as the material(s) described below. Preferably, the fluid storage layer includes a super-absorbent material and a carrier means for the super-absorbent material. The carrier means may be manufactured from a wide variety of liquid-absorbent materials commonly used in disposable diapers and other absorbent articles such as comminuted wood pulp which is generally referred to as airfelt. Examples of other carrier means include creped cellulose wadding; meltblown polymers including coform; chemically stiffened, modified or cross-linked cellulosic fibers; tissue including tissue wraps and tissue laminates; absorbent foams; absorbent sponges; or any equivalent material or combinations of materials.

The fluid storage layer preferably includes at least 15%, by weight, preferably at least 25%, of super-absorbent material (defined more fully hereafter), and from 0% to about 85%, preferably less than about 75%, of the carrier means. However, the fluid storage layer may include about 0% by weight of super-absorbent material and about 100% of the carrier means. The principal function of the fluid storage layer is to absorb discharged body fluid and retain such fluid under the pressures encountered as a result of the wearer's movements.

As indicated hereinbefore, the fluid storage layer preferably includes super-absorbent material such as, but not necessarily limited to, discrete particles of absorbent gelling material and super-absorbent fibrous material such as acrylate grafted fibers and super-absorbent modified cellulosic fibers. The super-absorbent material can be in any form which can be incorporated into the fibrous material of the carrier means to form the fluid storage layer.

Super-absorbent materials are described in more detail below. The super-absorbent material, upon contact with fluids such as water or body fluids, absorb such fluids. The fluid discharged into the disposable absorbent article and transported to the fluid storage layer can be acquired and held by the super-absorbent material, thereby providing the articles herein with enhanced absorbent capacity and/or improved fluid retention performance.

The super-absorbent materials are those which are capable of absorbing at least about 10 g, preferably at least about 15 g, more preferably at least about 20 g, of Synthetic Urine (1.0% NaCl aqueous solution) per gram of super-absorbent material, as determined according to the hereinafter described Absorbent Capacity procedure.

The super-absorbent material utilized herein is typically in the form of discrete particles of absorbent gelling material. These particles are preferably dispersed within a fibrous material of the carrier means. The fluid storage layer which has particles of the absorbent gelling material distributed in fibrous materials of the carrier means is typically made by airlaying, wherein an airstream of the particles of the absorbent gelling material is metered into an airstream of the fibrous materials of the carrier means. The super-absorbent fibrous material can include synthetic or natural fibers. Suitable natural fibrous material for the carrier means are cellulose fibers, in the form of fluff, such as is conventionally utilized and generally referred to as "airfelt" in absorbent cores (or fluid storage layers).

The average dry density of the fluid storage layer is generally in the range of from about 0.06 to about 0.5 g/cm^3, more preferably within the range of from about 0.10 to about 0.4 g/cm^3, yet more preferably from about 0.15 to about 0.3 g/cm^3, and still more preferably from about 0.15 to about 0.25 g/cm^3. Typically the basis weight of the fluid storage layer can range from about 0.02 to about 0.12 g/cm^2,

more preferably from about 0.04 to about 0.08 g/cm^2, and yet more preferably from about 0.05 to about 0.07 g/cm^2. The density values for the fluid storage layer are calculated from basis weight and layer caliper measured under a confining pressure of 0.2 psi (1.43 kPa). The density and basis weight values include the weight of the super-absorbent material.

Preferably, the super-absorbent material which is employed in the fluid storage layer is a substantially water-insoluble, slightly cross-linked, partially neutralized, polymeric absorbent gelling material. This material forms a hydrogel upon contact with water. Such polymer materials can be prepared from polymerizable, unsaturated, acid-containing monomers. Suitable unsaturated acidic monomers for use in preparing the polymeric gelling material include those disclosed in U.S. Patent No. 4,654,039 issued to Brandt et al. on March 31, 1987 and reissued as U.S. Patent No. RE 32,649 on April 19, 1988. Preferred monomers include acrylic acid, methacrylic acid, and 2-acrylamido-2-methyl propane sulfonic acid. Acrylic acid is especially preferred for preparation of the polymeric gelling agent material.

The polymeric component formed from unsaturated, acid-containing monomers may be grafted on to other types of polymer moieties such as starch or cellulose. Polyacrylate grafted starch materials of this type are also especially preferred.

Preferred polymeric absorbent gelling materials which can be prepared from conventional types of monomers include hydrolyzed acrylonitrile grafted starch, polyacrylate grafted starch, polyacrylates, maleic anhydride-based copolymers and combinations thereof. Especially preferred are the polyacrylates and polyacrylate grafted starch.

Whatever the nature of the basic polymer components of the hydrogel-forming polymeric absorbent gelling material particles, such materials will in general be slightly cross-linked. Cross-linking agents serves to render the hydrogel-forming polymer gelling materials substantially water-insoluble, and cross-linking thus in part determines the gel volume and extractable polymer characteristics of the hydrogels formed from the polymeric gelling agents employed. Suitable cross-linking agents are well known in the art and include, for example, those described in greater detail in U.S. Patent No. 4,076,663 issued to Masuda et al. on February 28, 1978. Preferred cross-linking agents are the di- or polyesters of unsaturated mono- or polycarboxylic acids with polyols, the bisacrylamides and the di-or triallyl amines. Other preferred cross-linking agents are N,N'-methylenebisacrylamide, trimethylol propane triacrylate and triallyl amine. The cross-linking agent can generally constitute from about 0.001 mole percent to 5 mole percent of the resulting hydrogel-forming polymer material. More preferably, the cross-linking agent will constitute from about 0.01 mole percent to 3 mole percent of the hydrogel-forming polymeric gelling material particles used herein.

The slightly cross-linked, hydrogel-forming polymeric gelling material particles are generally employed in their partially neutralized form. Such materials are considered partially neutralized when at least 25 mole percent, and preferably at least 50 mole percent of monomers used to form the polymer are acid group-containing monomers which have been neutralized with a salt-forming cation. Suitable salt-forming cations include alkali metal, ammonium, substituted ammonium and amines. This percentage of the total monomers utilized which are neutralized acid group-containing monomers is referred to herein as the "degree of neutralization."

Alternatively, the particles of absorbent gelling material can be laminated between two or more webs of fibrous material to form the fluid storage layer, such

as exemplified in U.S. Patent No. 4,578,068 issued to Kramer et al. on March 25, 1986.

The foregoing OCMs in general are chemical compositions that are used to prevent microbiological contamintion and deterioration of products or materials. Such OCMs can also effectively work for the removal or reduction of foul odors developed from the products such as disposable absorbent articles which have already absorbed body fluids. However, depending on the manner of the application of an OCM in disposable absorbent articles, it is found that such an OCM tends to affect the absorptive capacity of a disposable absorbent article. This is because the OCM is in contact with the super-absorbent material, as a result, the absorptive capacity of the super-absorbent material tends to be decreased because of the existence of the OCM. To prevent the OCM from affecting the absorptive capacity of the super-absorbent material, it is preferred that the OCM is provided in a layer which is isolated from the super-absorbent material. Such a layer (hereinafter referred to as "an odor control layer") could be conventionally manufactured by applying a mixture comprising a binder and an OCM to a nonwoven web having been bonded by another binder. In that case, at least two distinct binders are needed in order to manufacture such an odor control layer containing the OCM. By following the foregoing process of the present invention, it is possible to manufacture an odor control layer comprising an OCM and only one binder because the binder serves as a binder to bond not only the nonwoven web but also the OCM in the process. Thus, in a preferred embodiment, a disposable absorbent article may comprises an odor control layer disposed somewhere in the absorbent article. Such an odor control layer contains an OCM to reduce or remove foul odors developed from the disposable absorbent article which has already absorbed body fluids.

The odor control layer is preferably disposed between the topsheet and the fluid storage layer. Alternatively, the odor control layer may be disposed between the backsheet and the fluid storage layer. Preferably, the odor control layer is

disposed adjacent to either the body-facing surface or the garment-facing surface of the fluid storage layer such that it can be in contact with the fluid storage layer.

The percentage of the OCM to the odor control layer to achieve a desired odor reduction/removal function and the desired liquid handling properties of the odor control layer will be dictated largely by the characteristics of the OCM (in particular the OCM's contents and its relative hydrophobicity/hydrophilicy properties). One skilled in the art will appreciate that the desired percentage of OCM to the odor control layer will be readily determined through routine experimentation.

In a preferred embodiment, the OCM is dispersed within the odor control layer in an average basis weight ranging from about 1 to about 12 g/m^2, more preferably from about 3 to about 8 g/m^2, still more preferably about 2 to about 5 g/m^2.

Many body fluids have an unpleasant odor (or an malodor), or develop such an odor when in contact with air and/or bacteria for prolonged periods. Additionally, urine and/or other exudates absorbed into the fluid storage layer are converted to ammonia by urease produced by skin-flora, i.e., a group of normal microorganisms on the skin. This ammonia, in turn, may cause dermatitis, rash and/or other forms of skin irritation. The principal function of the odor control layer is to reduce such an unpleasant odor which is contained in and/or may be developed from the body fluid absorbed and retained in the fluid storage layer. The OCM contained in the odor control layer, upon contact with a body fluid, neutralizes the ammonia components contained in the absorbed body fluid through the neutralization. In a preferred embodiment, such an OCM contained within the odor control material may be selected from the group consisting of a quaternary ammonium, a phenolic, an amide, an acid, a nitro compound, a metalphthalocyanine material, and mixtures thereof. Preferably, the OCM is a

metalphthalocyanine material which has the central metal selected from the transition elements. More preferably, the central metal is Ni(II), Fe(III), Co(II), or Mn(II). In addition, embodiment, the OCM may include a mixture of metalphthalocyanine, maleic anhydride methyl vinyl ether copolymer, zinc oxide, copper (II) sulfate and potassium permanganate, preferably a mixture of metalphthalocyanine, maleic anhydride methyl vinyl ether copolymer, zinc oxide and copper (II) sulfate, more preferably maleic anhydride methyl vinyl ether copolymer, zinc oxide and copper (II) sulfate.

The odor control layer can preferably comprise a single layer of essentially 100% OCM, or can also include a fibrous web. Preferably, the odor control layer contains at least from about 0.001% to about 10% by weight of the OCM, and from about 90% to about 99.999% of the fibrous web. More preferably, the odor control layer contains at least from about 0.002% to about 0.2% by weight of the OCM, and from about 99.998% to about 99.8% of the fibrous web. In a preferred embodiment, the odor control layer contains about 0.003% of the OCM, and about 99.997% of the fibrous web. Preferably, the odor control layer in which the OCM is dispersed uniformly can be made from a fibrous web manufactured by the foregoing process of the present invention.

The OCM is uniformly dispersed /distributed into the fibrous web and is anchored in the fibrous web. Any materials known in the art can be used as the fibrous web as long as the OCM can be dispersed/distributed in the fibrous web. A preferred fibrous web includes fibrous materials such as nonwoven webs, tissue webs, and fluffs of synthetic fibers or natural fibers such as cellulose fibers; and the like. Preferably, at least 95%, more preferably at least 99% by weight of the OCM is physically bonded to the fibrous web (W) by means of, e.g., binder, while the rest of the OCM may remain unbonded. Alternatively, the rest of the OCM may be chemically bonded to some of the fibrous web (W) by means of, e.g., covalent bond between molecules. Such a fibrous web holding the OCM within the odor control layer is applicable to the foregoing process of the present invention.

In a preferred embodiment, the fibrous web is a nonwoven material. More preferably, the nonwoven material is a web material formed by polyethylene terephthalate (PET) fibers. A preferred nonwoven material which can be used as the fibrous web is commercially available from PGI Nonwovens, USA, under Code No. 68500. In an alternative preferred embodiment, the fibrous web is formed by a natural fibrous material such as cellulose fibers in the form of fluff, which is conventionally utilized and generally referred to as "airfelt" in absorbent cores (or fluid storage layers).

The odor control layer may have a number of shapes and sizes. For example, the odor control layer is typically in the form of rectangular, hourglass, or asymmetrical. The odor control layer generally has a thickness or diameter between about 0.25 mm and about 10.0 mm. Preferably for use in absorbent products, the odor control layer are in the form of rectangular having a thickness of greater than about 250 microns. The odor control layer preferably has a thickness between about 0.5 mm and about 3 mm, typically about 1 mm.

In a preferred embodiment, the basis weight of the odor control layer can range from about 0.002 to about 0.012 g/cm^2, more preferably from about 0.003 to about 0.008 g/cm^2, and yet more preferably from about 0.004 to about 0.007 g/cm^2.

In a preferred embodiment, the density and basis weight of the odor control layer are uniform throughout the layer. The density values for the odor control layer are calculated from basis weight and layer caliper measured under a confining pressure of 0.2 psi (1.43 kPa).

In a preferred embodiment, the odor control layer may comprise a fibrous web in which the metalphthalocyanine material as an OCM is immobilized through

physical or chemical bonds. Any materials known in the art can be used as the fibrous web as long as the OCM can be dispersed/distributed in the fibrous web. A preferred fibrous web includes fibrous materials such as nonwoven webs, tissue webs, and fluffs of synthetic fibers or natural fibers such as cellulose fibers; and the like. Preferably, at least 95%, more preferably at least 99% by weight of the metalphthalocyanine material is physically bonded to the fibrous web (W) by means of, e.g., binder, while the rest of the metalphthalocyanine material may remain unbonded. Alternatively, the rest of the metalphthalocyanine material may be chemically bonded to some of the fibrous web (W) by means of, e.g., covalent bond between molecules. Preferably, the metalphthalocyanine material is dispersed uniformly throughout the fibrous web. By following the foregoing process of the present invention, it is possible to disperse uniformly the metalphthalocyanine material within (and throughout) the fibrous web. In one embodiment, the metalphthalocyanine material is in the form of discrete particles. In a preferred embodiment, the particles of the metalphthalocyanine material are dispersed uniformly throughout the fibrous web to form the odor control layer. Such an odor control layer comprising the particles of the metalphthalocyanine material and the fibrous web can be manufactured by the foregoing process of the present invention.

Other materials or agents can be used with the metalphthalocyanine material as an aid in producing the odor control layer. In a preferred embodiment, water is used in conjunction with the metalphthalocyanine material. The water functions to promote uniform dispersion of the metalphthalocyanine material within the fibrous web and permeation of the metalphthalocyanine material into the surface region of the fibrous web. The water is used in a proportion of less than about 20 parts by weight (i.e., 0 parts to about 20 parts by weight), preferably in the range of from about 0.01 parts to about 20 parts by weight, more preferably in the range of from about 0.1 parts to about 10 parts by weight, per 100 parts by weight of the fibrous web. The actual amount of water to be used will vary depending upon the kind of the fibrous web.

In a more preferred embodiment, a viscosity control agent and/or a binding agent is additionally used in conjunction with the metalphthalocyanine material. The viscosity control agent functions to further promote uniform dispersion of the metalphthalocyanine material within the fibrous web and permeation of the metalphthalocyanine material into the surface region of the fibrous web. The binding agent further promotes stronger physical bond between the metalphthalocyanine material and the fibrous web.

In a preferred embodiment wherein the odor control layer is a resin bonded nonwoven material formed by polypropylene fibers, a methlose and a carboxy methyl cellulose are used as the viscosity control agent and the binding agent, respectively. The viscosity control agent is used in a proportion of less than about 40 parts by weight (i.e., 0 parts to about 40 parts by weight), preferably in the range of from about 0.01 parts to about 40 parts by weight, more preferably in the range of from about 0.1 parts to about 30 parts by weight, per 100 parts by weight of the odor control layer. The binding agent is used in a proportion of less than about 40 parts by weight (i.e., 0 parts to about 40 parts by weight), preferably in the range of from about 0.01 parts to about 30 parts by weight, more preferably in the range of from about 0.1 parts to about 20 parts by weight, per 100 parts by weight of the odor control layer. The actual amounts and kinds of the viscosity control agent and the binding agent to be used vary depending upon the kinds of the metalphthalocyanine material and the fibrous web in the odor control material.

In a preferred embodiment wherein the odor control layer is a resin bonded nonwoven material formed by polyethylene terephthalate (PET) fibers, the metalphthalocyanine material is contained in a mixture with water, a viscosity control agent (e.g., a methlose) and a binding agent (e.g., a carboxy methyl cellulose). The use of the water can provide the preferred penetration of the metalphthalocyanine material into the fibrous web while also providing a necessary uniformity of dispersion of the metalphthalocyanine material. However, a mixture

of all three agents is more preferred in order to control the amount of the penetration of the metalphthalocyanine material into the fibrous web.

The PH of the metalphthalocyanine material solution needs to be controlled (or chosen) depending on the type of the metalphthalocyanine material and the functional group bonded therein. For example, in a preferred embodiment wherein the metalphthalocyanine material has a tetra -COOH as the functional group, the PH of the metalphthalocyanine material solution is controlled between about 3 and 6, more preferably between about 4 and 5.

In a preferred embodiment, a disposable absorbent article may comprise an isolation means to prevent the OCM (e.g. the metalphthalocyanine material) in the odor control layer from contacting with the super-absorbent material in the fluid storage layer directly and affecting the absorptive capacity of the super-absorbent material. The isolation means can be formed by any structure which can work for the isolation of the OCM from the super-absorbent material. Such a structure for the isolation can be any structure which spaces the OCM in the odor control layer away from contacting the super-absorbent material. In a preferred embodiment, the isolation means is an interposed material disposed between the fluid storage layer and the odor control layer. Preferred interposed materials for the isolation means (hereinafter referred to as "an isolation layer") include fibrous materials such as nonwoven webs, tissue webs, and fluffs of synthetic fibers or natural fibers such as cellulose fibers; foams, apertured polymeric webs or films; and the like. In a preferred embodiment, the isolation layer is a tissue layer or a nonwoven layer which is disposed between the fluid storage layer and the odor control layer. In a more preferred embodiment, such a tissue or nonwoven layer is also used for enveloping at least a part of, more preferably the entire portion of the fluid storage layer.

The basis weight of the isolation layer can range from about 0.001 to about 0.008 g/cm^2, more preferably from about 0.0012 to about 0.006 g/cm^2, and yet more preferably from about 0.0013 to about 0.005 g/cm^2. In a preferred embodiment wherein the isolation layer is a nonwoven material, the basis weight of the tissue material is about 0.0049 g/cm^2.

The density and basis weight of the isolation layer does not need to be uniform throughout the material. The isolation layer can contain regions of relatively higher and relatively lower density and basis weight. The density values for the isolation layer are calculated from basis weight and material caliper measured under a confining pressure of 0.2 psi (1.43 kPa). A preferred tissue material to be used as the interposed material is available from Fripa Co., Ltd., under Code No. 1110000.

Particularly preferred embodiments of the disposable absorbent article comprising a fibrous web manufactured by the foregoing process of the present invention are disclosed hereinafter by referring to Figures 3 and 4.

Herein, "absorbent article" refers to devices which absorb and contain body exudates, and, more specifically, refers to devices which are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. Herein, "disposable" is used herein to describe absorbent articles which 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). A preferred embodiment of the disposable absorbent article of the present invention is a unitary disposable diaper 20, shown in Figures 3 and 4. Herein, "unitary" absorbent article refers to absorbent articles which are formed of separate parts united together to form a coordinated entity so that they do not require separate manipulative parts like a separate holder and liner.

Herein, "diaper" refers to an absorbent article generally worn by infants and incontinent persons that is worn about the lower torso of the wearer. It should be understood, however, that the present invention is also applicable to other disposable absorbent articles such as disposable underwears, disposable diapers (adult and baby) including pull-on diapers and training pants, disposable panties for menstrual use, and disposable absorbent pads including sanitary napkins.

Figure 3 is a plan view of the disposable diaper 20 in its flat-out, uncontracted state (i.e., with elastic induced contraction pulled out) with portions of the structure being cut-away to more clearly show the construction of the diaper 20 and with the portion of the diaper 20 which faces the wearer, the body-facing surface 40, facing the viewer. As shown in Figure 3, the diaper 20 preferably comprises a chassis 22 comprising a liquid pervious topsheet 24; a liquid impervious backsheet 26 joined to the topsheet 24; and a fluid storage layer 28 positioned between the topsheet 24 and the backsheet 26. The fluid storage layer 28 has a pair of opposing longitudinal edges 60. The diaper preferably further comprises side panels 30; elasticized leg cuffs 32; elasticized waistbands 34; and a fastening system 36 preferably comprising a pair of securement members 37 and a landing member 38.

The diaper 20 is shown in Figure 3 to have a body-facing surface 40 (facing the viewer in Figure 3), a garment-facing surface 42 opposed to the body-facing surface 40, a back region 44, a front region 46 opposed to the back region 44, a crotch region 48 positioned between the back region 44 and the front region 46, and a periphery which is defined by the outer perimeter or edges of the diaper 20 in which the side edges are designated 50 and the end edges are designated 52. The body-facing surface 40 of the diaper 20 comprises that portion of the diaper 20 which is positioned adjacent to the wearer's body during use (i.e., the body-facing surface 40 generally is formed by at least a portion of the topsheet 24 and other components joined to the topsheet 24). The garment-facing surface 42 comprises that portion of the diaper 20 which is positioned away from the wearer's body (i.e.,

the garment-facing surface 42 is generally formed by at least a portion of the backsheet 26 and other components joined to the backsheet 26). The back region 44 and the front region 46 extend from the end edges 52 of the periphery to the crotch region 48.

The diaper 20 also has two centerlines, a longitudinal centerline Y and a transverse centerline X. The term "longitudinal", as used herein, refers to a line, axis, or direction in the plane of the diaper 20 that is generally aligned with (e.g. approximately parallel with) a vertical plane which bisects a standing wearer into left and right halves when the diaper 20 is worn. The terms "transverse" and "lateral", as used herein, are interchangeable and refer to a line, axis or direction which lies within the plane of the diaper that is generally perpendicular to the longitudinal direction (which divides the wearer into front and back body halves).

The chassis 22 comprises the topsheet 24, the backsheet 26 and the fluid storage layer 28 having the pair of opposing longitudinal edges 60, the body-facing surface, and the garment-facing surface. The body-facing surface generally faces the body of the wearer while the garment-facing surface generally faces away from the body of the wearer (and the garment of the wearer). For unitary absorbent articles, the chassis 22 preferably comprises the topsheet 24, the backsheet 26 and the fluid storage layer 28 of the diaper with other features added to form the composite diaper structure.

In the embodiment shown in Figure 3, the topsheet 24 and the backsheet 26 have length and width dimensions generally larger than those of the fluid storage layer 28. The topsheet 24 and the backsheet 26 extend beyond the edges of the fluid storage layer 28 to thereby form the periphery of the diaper 20. While the topsheet 24, the backsheet 26, and the fluid storage layer 28 may be assembled in a variety of well known configurations, exemplary chassis configurations are described generally in U.S. Patent No. 3,860,003 entitled "Contractible Side Portions for Disposable Diaper" which issued to Kenneth B. Buell on January 14,

1975; and U.S. Patent No. 5,151,092 entitled "Absorbent Article With Dynamic Elastic Waist Feature Having A Predisposed Resilient Flexural Hinge" which issued to Kenneth B. Buell et al., on September 29, 1992.

The fluid storage layer 28 may be any absorbent member which is generally compressible, conformable, non-irritating to the wearer's skin, and capable of absorbing and retaining liquids such as urine and other certain body exudates. As shown in Figures 3 and 4, the fluid storage layer 28 has a garment-facing side, a body-facing side, a pair of side edges, and a pair of waist edges. The fluid storage layer 28 may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, hourglass, "T"-shaped, asymmetric, etc.). Preferably, the fluid storage layer 28 includes a super-absorbent material and a carrier means for the super-absorbent material. In this embodiment, the carrier means is preferably formed from comminuted wood pulp which is generally referred to as airfelt.

The configuration and construction of the fluid storage layer 28 may vary (e.g., the fluid storage layer may have varying caliper zones, a hydrophilic gradient, a super-absorbent gradient, or lower average density and lower average basis weight acquisition zones; or may comprise one or more layers or structures). Further, the size and absorbent capacity of the fluid storage layer 28 may also be varied to accommodate wearers ranging from infants through adults. However, the total absorbent capacity of the fluid storage layer 28 should be compatible with the design loading and the intended use of the diaper 20.

One embodiment of the diaper 20 has an asymmetric, modified T-shaped fluid storage layer 28 having ears in the front region but a generally rectangular shape in the back region. Exemplary absorbent structures for use as the fluid storage layer 28 that have achieved wide acceptance and commercial success are described in U.S. Patent No. 4,610,678 entitled "High-Density Absorbent Structures" issued to Weisman et al. on September 9, 1986; U.S. Patent No. 4,673,402 entitled "Absorbent Articles With Dual-Layered Cores" issued to

Weisman et al. on June 16, 1987; U.S. Patent No. 4,888,231 entitled "Absorbent Core Having A Dusting Layer" issued to Angstadt on December 19, 1989; and U.S. Patent No. 4,834,735, entitled "High Density Absorbent Members Having Lower Density and Lower Basis Weight Acquisition Zones", issued to Alemany et al. on May 30, 1989. The fluid storage layer may further comprise the dual core system containing an acquisition/distribution core of chemically stiffened fibers positioned over a fluid storage layer as detailed in U.S. Patent No. 5,234,423, entitled "Absorbent Article With Elastic Waist Feature and Enhanced Absorbency" issued to Alemany et al., on August 10, 1993; and in U.S. Patent No. 5,147,345, entitled "High Efficiency Absorbent Articles For Incontinence Management" issued to Young, LaVon and Taylor on September 15, 1992.

In a preferred embodiment, the diaper 20 further comprises an odor control layer 80 as shown in Figure 4 (not shown in Figure 3) which is disposed on the either the body-facing surface or the garment-facing surface of the fluid storage layer 28. Preferably, the odor control layer 80 is disposed between the topsheet 24 and the fluid storage layer 28. Alternatively, the odor control layer 80 may be disposed between the backsheet 26 and the fluid storage layer 28. The odor control layer 80 contains an OCM to reduce or remove foul odors developed from the disposable diaper 20 which has already absorbed body fluids. Such an odor control layer in which the OCM dispersed uniformly can be manufactured by the foregoing process of the present invention. In a preferred embodiment, the OCM contained within the odor control material 80 is selected from the group consisting of a quaternary ammonium, a phenolic, an amide, an acid, a nitro compound, a metalphthalocyanine material, and mixtures thereof. Preferably, the OCM is a metalphthalocyanine material which has the central metal selected from the transition elements. More preferably, the central metal is Ni(II), Fe(III), Co(II), or Mn(II). In addition, the OCM may include a mixture of metalphthalocyanine, maleic anhydride methyl vinyl ether copolymer, zinc oxide, copper (II) sulfate and potassium permanganate, preferably a mixture of metalphthalocyanine, maleic anhydride methyl vinyl ether copolymer, zinc oxide and copper (II) sulfate, more

preferably maleic anhydride methyl vinyl ether copolymer, zinc oxide and copper (II) sulfate.

In another preferred embodiment, an isolation layer (not shown in Figures) made of a tissue or nonwoven material may be disposed between the fluid storage layer 28 and the odor control layer 80 to isolate the metalphthalocyanine material contained in the odor control layer 80 from contacting the super-absorbent material contained in the fluid storage layer 28.

The topsheet 24 is preferably positioned adjacent the body-facing surface of the fluid storage layer 28 and is preferably joined thereto and to the backsheet 26 by attachment means (not shown) such as those well known in the art. Suitable attachment means are described with respect to joining the backsheet 26 to the fluid storage layer 28. In a preferred embodiment, the topsheet 24 and the backsheet 26 are joined directly to each other in the diaper periphery and are indirectly joined together by directly joining them to the fluid storage layer 28 by any suitable attachment means.

The topsheet 24 is preferably compliant, soft feeling, and non-irritating to the wearer's skin. Further, the topsheet 24 is preferably liquid pervious permitting liquids (e.g., urine) to readily penetrate through its thickness. A suitable topsheet 24 may be manufactured from a wide range of materials such as woven and nonwoven materials; polymeric materials such as apertured formed thermoplastic films, apertured plastic films, and hydroformed thermoplastic films; porous foams; reticulated foams; reticulated thermoplastic films; and thermoplastic scrims. Suitable woven and nonwoven materials can be comprised of natural fibers (e.g., wood or cotton fibers), synthetic fibers (e.g., polymeric fibers such as polyester, polypropylene, or polyethylene fibers) or from a combination of natural and synthetic fibers. A preferred nonwoven material for the topsheet 24 is a carded nonwoven material of polypropylene which available from Amoco Fabrics, under Code No. Soft P-10, 23 Stly 007.

The topsheet 24 is preferably made of a hydrophobic material to isolate the wearer's skin from liquids which have passed through the topsheet 24 and are contained in the fluid storage layer 28 (i.e. to prevent rewet). If the topsheet 24 is made of a hydrophobic material, at least the body-facing surface of the topsheet 24 is treated to be hydrophilic so that liquids will transfer through the topsheet more rapidly. This diminishes the likelihood that body exudates will flow off the topsheet 24 rather than being drawn through the topsheet 24 and being absorbed by the fluid storage layer 28. The topsheet 24 can be rendered hydrophilic by treating it with a surfactant. Suitable methods for treating the topsheet 24 with a surfactant include spraying the topsheet 24 material with the surfactant and immersing the material into the surfactant. A more detailed discussion of such a treatment and hydrophilicity is contained in U.S. Patent No. 4,988,344 entitled "Absorbent Articles with Multiple Layer Absorbent Layers" issued to Reising, et al on January 29, 1991 and U.S. Patent No. 4,988,345 entitled "Absorbent Articles with Rapid Acquiring Absorbent Cores" issued to Reising on January 29, 1991.

An alternative preferred topsheet 24 comprises an apertured formed film. Apertured formed films are preferred for the topsheet because they are pervious to body exudates and yet non-absorbent and have a reduced tendency to allow liquids to pass back through and rewet the wearer's skin. Thus, the surface of the formed film which is in contact with the body remains dry, thereby reducing body soiling and creating a more comfortable feel for the wearer. Suitable formed films are described in U.S. Patent No. 3,929,135, entitled "Absorptive Structures Having Tapered Capillaries", which issued to Thompson on December 30, 1975; U.S. Patent No. 4,324,246 entitled "Disposable Absorbent Article Having A Stain Resistant Topsheet", which issued to Mullane, et al. on April 13, 1982; U.S. Patent No. 4,342,314 entitled "Resilient Plastic Web Exhibiting Fiber-Like Properties", which issued to Radel. et al. on August 3, 1982; U.S. Patent No. 4,463,045 entitled "Macroscopically Expanded Three-Dimensional Plastic Web Exhibiting Non-Glossy Visible Surface and Cloth-Like Tactile Impression", which issued to Ahr et al. on

July 31, 1984; and U.S. 5,006,394 "Multilayer Polymeric Film" issued to Baird on April 9, 1991.

The backsheet 26 is that portion of the diaper 20 which is generally positioned away from the wearer's skin and which prevents the exudates absorbed and contained in the fluid storage layer 28 from wetting articles which contact the diaper 20 such as bedsheets and undergarments. Thus, the backsheet 26 is preferably impervious to liquids (e.g., urine) and is preferably manufactured from a thin plastic film, although other flexible liquid impervious materials may also be used. (As used herein, the term "flexible" refers to materials which are compliant and will readily conform to the general shape and contours of the human body.) However, the backsheet 26 permits vapors to escape from the diaper 20. A suitable material for the backsheet 26 is a thermoplastic film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils), preferably comprising polyethylene or polypropylene.

The backsheet 26 is preferably positioned adjacent the garment-facing surface of the fluid storage layer 28 and is preferably joined thereto by any suitable attachment means known in the art. For example, the backsheet 26 may be secured to the fluid storage layer 28 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Adhesives which have been found to be satisfactory are manufactured by H. B. Fuller Company of St. Paul, Minnesota and marketed as HL-1258. An example of a suitable attachment means comprising an open pattern network of filaments of adhesive is disclosed in U.S. Patent No. 4,573,986 entitled "Disposable Waste-Containment Garment", which issued to Minetola et al. on March 4, 1986. Another suitable attachment means comprising several lines of adhesive filaments swirled into a spiral pattern is illustrated by the apparatus and methods shown in U.S. Patent No. 3,911,173 issued to Sprague, Jr. on October 7, 1975; U.S. Patent No. 4,785,996 issued to Ziecker, et al. on November 22, 1978; and U.S. Patent No. 4,842,666 issued to Werenicz on June 27, 1989.

Alternatively, the attachment means may comprise heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or any other suitable attachment means or combinations of these attachment means as are known in the art.

Embodiments are also contemplated wherein the fluid storage layer 28 is not joined to the backsheet 26, and/or the topsheet 24 in order to provide greater extensibility in the front region 46 and the back region 44. Alternative embodiments are contemplated wherein an additional member, such as a liquid impervious barrier material(s) (not shown), is positioned between the garment-facing surface of the fluid storage layer 28 and the backsheet 28. Any such barrier member may or may not be joined to the fluid storage layer 28. Further, the backsheet 26 may or may not be joined to any barrier material(s) that are positioned between the backsheet 26 and the fluid storage layer 28.

The diaper 20 preferably further comprises an outer cover (not shown in Figures) joined with at least a portion of the garment-facing surface of the backsheet 26 forming a laminate. The outer cover preferably comprises a nonwoven material. (However, embodiments are contemplated wherein the outer cover comprises materials such as woven webs, foams, scrims, films, loose fibers, or any other material or combination of materials known in the art that will give the diaper a cloth-like look and/or feel and is at a minimum air permeable.) The outer cover may cover all or substantially all of the garment-facing surface of the backsheet 26, or may cover only discrete predetermined portions. In a preferred embodiment, the nonwoven material of the outer cover covers all or substantially all of the backsheet 26 in order to provide the diaper with a cloth-like look and feel. Further, the outer cover may provide the diaper with a low cost landing zone capable of engaging the hooks of a hook and loop type fastener. (Such a landing zone could be utilized as a portion of a primary fastening system or as a means for disposing of a soiled diaper.) Alternatively, the outer cover may cover only specific portions of the backsheet 26, such as the garment-facing surface of the side panels 30. In one such embodiment, the outer cover is comprised in the

breathable side panels 30. Thus, the outer cover may provide extra strength, bulk, aesthetic appeal or other characteristics desired in the breathable side panels 30.

The nonwoven material comprised in the outer cover is preferably liquid and air pervious. The nonwoven material may comprise natural fibers (e.g. cotton or wood fibers), or may comprise fibers of polyethylene, polypropylene, polyester, or any combination of such fibers. Further, the nonwoven may be carded, spunmelt, meltblown or air-through bonded or have any other characteristic or be manufactured in any manner known in the art. Preferably, the nonwoven is comprised of sufficient thermoplastic material to allow for thermal bonding of the material to other components of the diaper.

The diaper 20 preferably further comprises elasticized leg cuffs 32 for providing improved containment of liquids and other body exudates. Each elasticized leg cuff 32 may comprise several different embodiments for reducing the leakage of body exudates in the leg regions. (The leg cuff can be and is sometimes also referred to as leg bands, side flaps, barrier cuffs, or elastic cuffs.) U.S. Patent No. 3,860,003 describes a disposable diaper which provides a contractible leg opening having a side flap and one or more elastic members to provide an elasticized leg cuff (gasketing cuff). U.S. Patent No. 4,909,803 entitled "Disposable Absorbent Article Having Elasticized Flaps" issued to Aziz et al. on March 20, 1990, describes a disposable diaper having "stand-up" elasticized flaps (barrier cuffs) to improve the containment of the leg regions. U.S. Patent No. 4,695,278 entitled "Absorbent Article Having Dual Cuffs" issued to Lawson on September 22, 1987; and U.S. Patent No. 4,795,454 entitled "Absorbent Article Having Leakage-Resistant Dual Cuffs" issued to Dragoo on January 3, 1989, describe disposable diapers having dual cuffs including a gasketing cuff and a barrier cuff. U.S. Patent No. 4,704,115 entitled "Disposable Waist Containment Garment" issued to Buell on November 3, 1987, discloses a disposable diaper or incontinence garment having side-edge-leakage-guard gutters configured to contain free liquids within the garment.

It is preferred that each elasticized leg cuff 32 comprise at least an inner barrier cuff 70 comprising a barrier flap 68 and a spacing element 69 such as described in the above-referenced U.S. Patent No. 4,909,803. In a preferred embodiment, the elasticized leg cuff 32 additionally comprises an elastic gasketing cuff 63 with one or more elastic strands 65, positioned outboard of the barrier cuff such as described in the above-referred U.S. Patent No. 4,695,278. Further, the elasticized leg cuff 32 preferably has a proximal edge 33 and a distal edge 35. The distal edge 35 of the elasticized leg cuff 32 is that part of the elasticized leg cuff 32 which is spaced away from the chassis 22 of the diaper when the diaper 20 is being worn. The proximal edge 33 is that part of the elasticized leg cuff 32 which is joined to the chassis 22 of the diaper 20. The proximal edge 33 is generally located laterally inboard of the periphery of the diaper 20.

It may also be desirable to provide the diaper 20 with extensibility or elasticity in all or a portion of the side panels 30. (Herein, "extensible" refers to materials that are capable of extending in at least one direction to a certain degree without undue rupture. Herein, "elasticity" and "elastically extensible" refer to extensible materials that have the ability to return to approximately their original dimensions after the force that extended the material is removed. As used herein, any material or element described as "extensible" may also be elastically extensible unless otherwise provided.) Extensible side panels 30 provide a more comfortable and contouring fit by initially conformably fitting the diaper to the wearer and sustaining this fit throughout the time of wear well passed when the diaper has been loaded with exudates since the side panels allow the sides of the diaper to expand and contract. Extensible side panels 30 further provide more effective application of the diaper 20 since even if the diaperer pulls one side panel 30 farther than the other during the application (asymmetrically), the diaper 20 will "self-adjust" during wear. While the extensible side panels 30 may be constructed in a number of configurations, examples of diapers with extensible side panels are disclosed in U.S. Patent No. 4,857,067, entitled "Disposable Diaper Having Shirred

Ears" issued to Wood, et al. on August 15, 1989; U.S. Patent No. 4,381,781 issued to Sciaraffa, et al. on May 3, 1983; U.S. Patent No. 4,938,753 issued to Van Gompel, et al. on July 3, 1990; and in U.S. Patent No. 5,151,092 issued to Buell et al. on September 29, 1992.

The diaper 20 preferably further comprises an elasticized waistband 34 that provides improved fit and containment. The elasticized waistband 34 is that portion or zone of the diaper 20 which is intended to elastically expand and contract to dynamically fit the wearer's waist. The elasticized waistband 34 preferably extends longitudinally outwardly from at least one of the waist edges of the fluid storage layer 28 and generally forms at least a portion of the end edge of the diaper 20. Disposable diapers are generally constructed so as to have two elasticized waistbands, one positioned in the back region and one positioned in the front region, although diapers can be constructed with a single elasticized waistband. Further, while the elasticized waistband 34 or any of its constituent elements can comprise a separate element affixed to the diaper 20, the elasticized waistband 34 may be constructed as an extension of other elements of the diaper such as the backsheet 26 or the topsheet 24, preferably both the backsheet 26 and the topsheet 24. The elasticized waistband 34 may be constructed in a number of different configurations including those described in U.S. 4,515,595 entitled "Disposable Diapers With Elastically Contractible Waistbands" issued to Kievit & Osterhage on May 7, 1985, and in U.S. 5,151,092 entitled "Absorbent Article With Dynamic Elastic Waist Feature Having A Predisposed Resilient Flexural Hinge" issued to Buell, Clear & Falcone on September 29, 1992; and elasticized waistbands made from a structural elastic-like film (SELF) web as described in the previously referenced WO 95/03765.

In a preferred embodiment, the elasticized waistband 34 includes a laminate of a first nonwoven coverstock layer, an elastomeric layer, and more preferably a second nonwoven coverstock layer. The elastomeric layer can be formed by any elastomeric materials known in the art. The elasticized waistband 34 is preferably

disposed on the body-facing surface or the garment-facing surface of the topsheet 24 and operatively joined in an elastically contractible condition with the topsheet 24 to gather the elasticized waistband 34.

The diaper 20 also comprises a fastening system 36 which forms a side closure which maintains the back region 44 and the front region 46 in an overlapping configuration such that lateral tensions are maintained around the circumference of the diaper to maintain the diaper on the wearer. Exemplary fastening systems are disclosed in U.S. Patent No. 3,848,594 issued to Buell on November 19, 1974; U.S. Patent No. 4,662,875 issued to Hirotsu and Robertson on May 5, 1987; U.S. Patent No. 4,869,724 issued to Scripps on September 26, 1989; U.S. Patent No. 4,846,815 issued to Scripps on July 11, 1989; U.S. Patent No. 4,894,060 issued to Nestegard on January 16, 1990; U.S. Patent No. 4,946,527 issued to Battrell on August 7, 1990; and U.S. Patent No. 5,326,612 entitled "Nonwoven Female Component For Refastenable Fastening Device And Method of Making the Same" issued to David J. K. Goulait on July 5, 1994.

In the embodiments as stated above, the disposable diaper 20 comprises the odor control layer 80 containing the metalphthalocyanine material as an OCM between the topsheet 24 and the fluid storage layer 28 to reduce or remove foul odors developed from the disposable diaper 20 which has already absorbed body fluids as shown in Figure 4. Alternatively, such an OCM may be dispersed uniformly within the topsheet 24, the back sheet 26, the fluid storage layer 28 the side panels 30 and/or the elasticized leg cuffs 37 and the like. Such components (i.e. the topsheet 24, the back sheet 26, the fluid storage layer 28 the side panels 30 and/or the elasticized leg cuffs 37) can be typically made of a fibrous web manufactured by the foregoing process of the present invention. In such embodiments, the odor control layer 80 may be omitted from the components of the disposable diaper 20 to reduce the number of components of the disposable diaper 20.

It is understood that the examples and embodiments described herein are for illustrative purpose only and that various modifications or changes will be suggested to one skilled in the art without departing from the scope of the present invention.

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WHAT IS CLAIMED IS:

1. A process for making a fibrous web comprising fibers and a functional material, the fibers bonded by a binder and the functional material immobilized by the binder, the process comprising the step of:
(a) forming a fiber aggregation comprising fibers,
(b) preparing a solution comprising the binder and the functional material uniformly dispersed together with the binder in the solution,
(c) immersing the fiber aggregation into the solution to disperse the functional material into the fiber aggregation, and
(d) drying the fiber aggregation to form the fibrous web.

2. The process of claim 1 wherein the functional material is an odor control material.

3. The process of claim 2 wherein the odor control material is selected from the group consisting of a quaternary ammonium, a phenolic, an amide, an acid, a nitro compound, a metalphthalocyanine material, and mixtures thereof.

4. The process of claim 2 wherein the odor control material is a metalphthalocyanine material which has the central metal selected from the transition elements.

5. The process of claim 2 wherein the odor control material includes a mixture of maleic anhydride methyl vinyl ether copolymer, zinc oxide and copper (II) sulfate.

6. A disposable absorbent article, comprising:
a topsheet,
a backsheet combined with the topsheet,
elasticized leg cuffs, and

a fluid storage layer disposed between the topsheet and backsheet and having a body-facing surface and a garment-facing surface opposing the body-facing surface,

wherein at least one of the topsheet, the backsheet, the elasticized leggcuffs and the fluid storage layer is made of a fibrous web comprising fibers and an odor control material, the fibers bonded by a binder and the odor control material immobilized by the binder, the fibrous web according to the process comprising the step of:

(a) forming a fiber aggregation comprising fibers,

(b) preparing a solution comprising the binder and the odor control material uniformly dispersed together with the binder in the solution,

(c) immersing the fiber aggregation into the solution to disperse the odor control material into the fiber aggregation, and

(d) drying the fiber aggregation to form the fibrous web.

7. A disposable absorbent article, comprising:

a topsheet,

a backsheet combined with the topsheet,

a fluid storage layer disposed between the topsheet and backsheet and having a body-facing surface and a garment-facing surface opposing the body-facing surface, and

an odor control layer disposed either between the topsheet and the fluid storage layer or between the backsheet and the fluid storage layer,

wherein the odor control layer is made of a fibrous web comprising fibers and an odor control material, the fibers bonded by a binder and the odor control material immobilized by the binder, the fibrous web according to the process comprising the step of:

(a) forming a fiber aggregation comprising fibers,

(b) preparing a solution comprising the binder and the odor control material uniformly dispersed together with the binder in the solution,

(c) immersing the fiber aggregation into the solution to disperse the odor control material into the fiber aggregation, and
(d) drying the fiber aggregation to form the fibrous web.

8. The disposable absorbent article of claim 6 or 7 wherein the odor control material is selected from the group consisting of a quaternary ammonium, a phenolic, an amide, an acid, a nitro compound, a metalphthalocyanine material, and mixtures thereof.

9. The disposable absorbent article of claim 6 or 7 wherein the odor control material is a metalphthalocyanine material which has the central metal selected from the transition elements.

10. The disposable absorbent article of claim 6 or 7 wherein the odor control material includes a mixture of maleic anhydride methyl vinyl ether copolymer, zinc oxide and copper (II) sulfate.

Figure 1

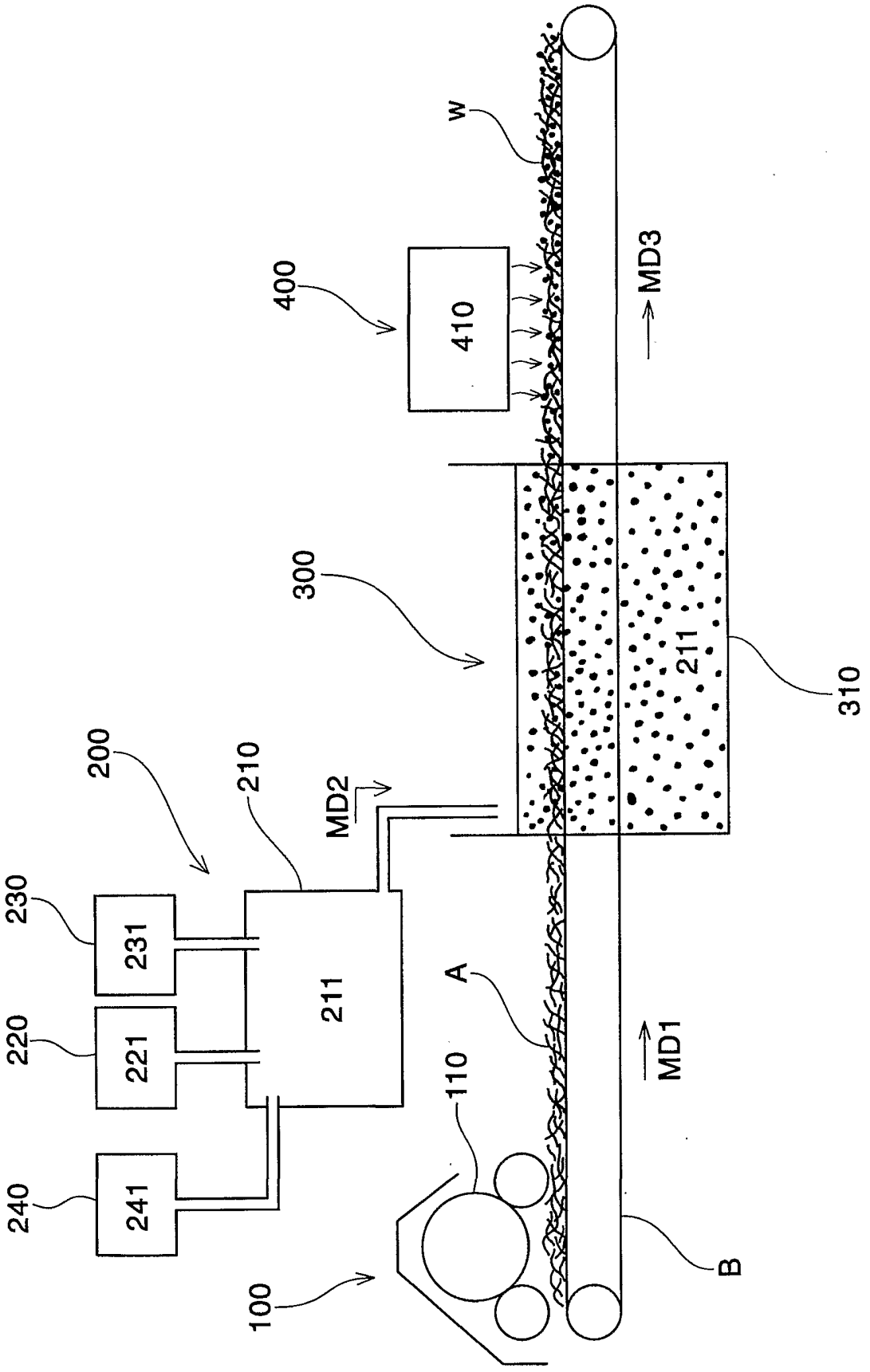

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Figure 2

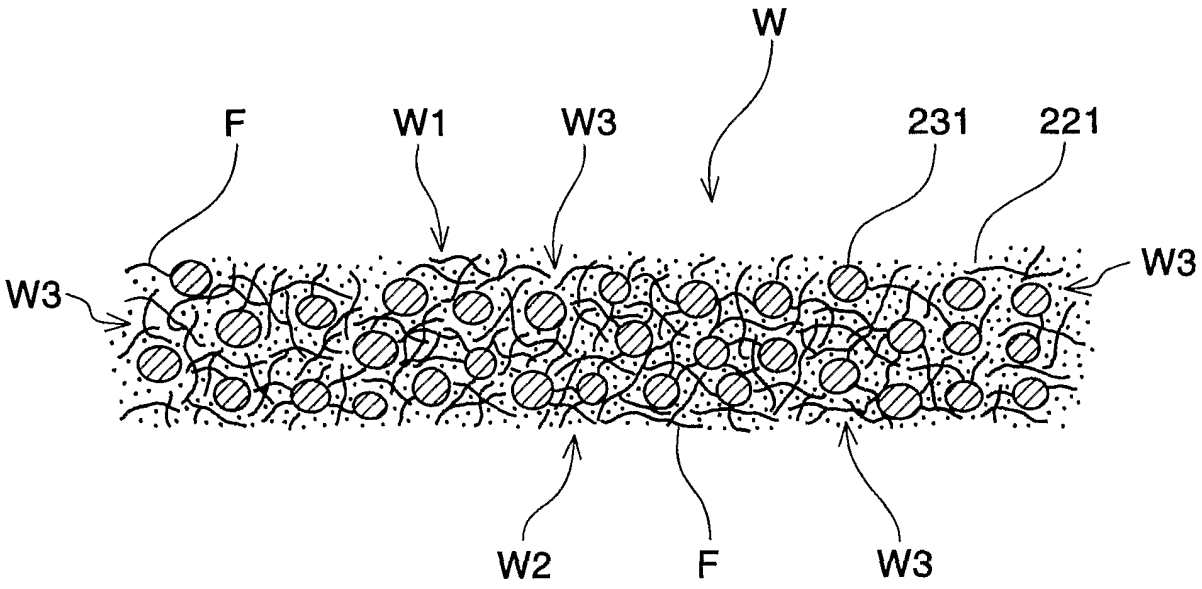


Figure 3

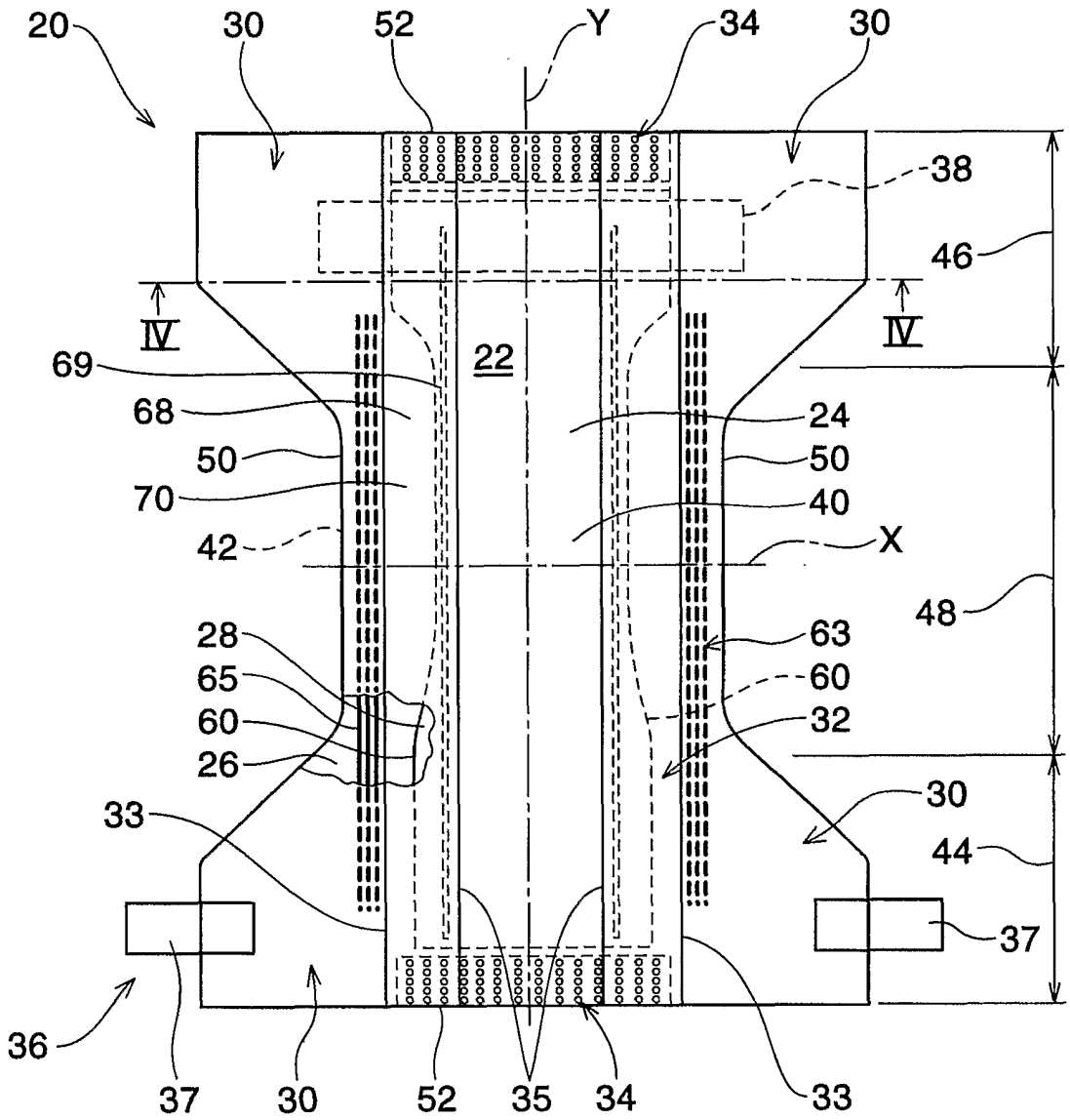
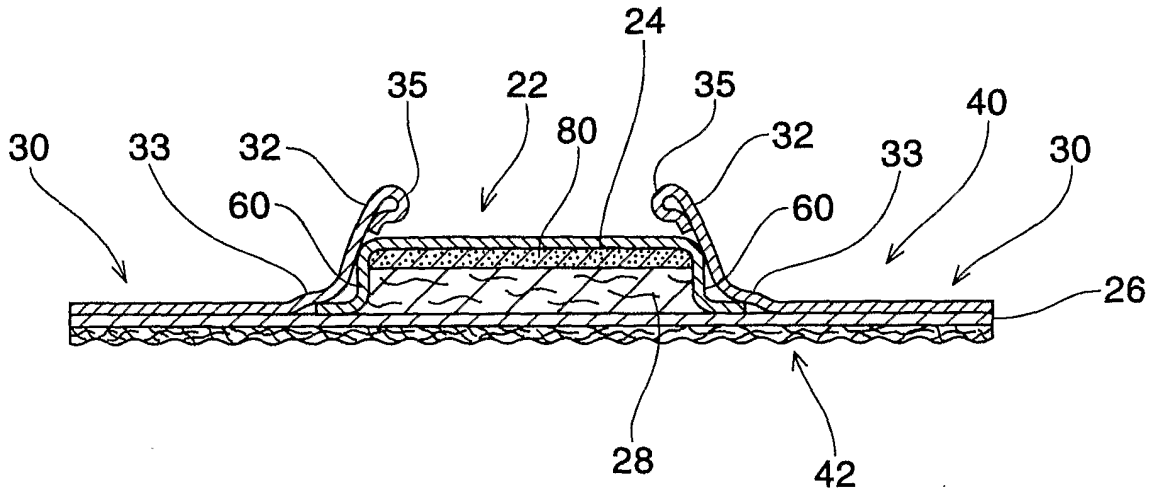

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Figure 4



INTERNATIONAL SEARCH REPORT

Inte ial Application No
PCT/US 01/15907

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61F13/84

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)
IPC 7 A61F A61L D04H

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 practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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

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"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.

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Date of the actual completion of the international search	Date of mailing of the international search report
18 January 2002	01/02/2002

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, Tx. 31 651 epo.nl, Fax: (+31–70) 340–3016	Seabra, L

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INTERNATIONAL SEARCH REPORT

Ir ıal Application No
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