

[54] DISPOSABLE DIAPER

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[51] Int. Cl. **A41b 13/02**

[58] Field of Search..... 128/284, 287, 290, 128/296

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[57] **ABSTRACT**

A disposable multi-layer diaper of high absorptive capacity is provided which comprises as a first layer, to be brought into contact with an infant's skin, a porous, fibrous, non-woven bonded facing web of controlled wettability made of mixed long and short fibers. A second layer, in juxtaposition to the facing layer, is a highly porous, loosely compacted cellulosic batt having greater wettability than that of the facing web. Beyond the cellulosic batt is an impervious backing sheet adhered to the batt over a widely distributed area of adhesion. The final or outermost layer is a fibrous material which is adhered to the backing sheet, and which enables the diaper to have the feel and handle of a cloth diaper. The outermost layer, preferably, is a non-woven web made of mixed long and short fibers that are bonded together with a water-repellent bonding agent.

6 Claims, 12 Drawing Figures

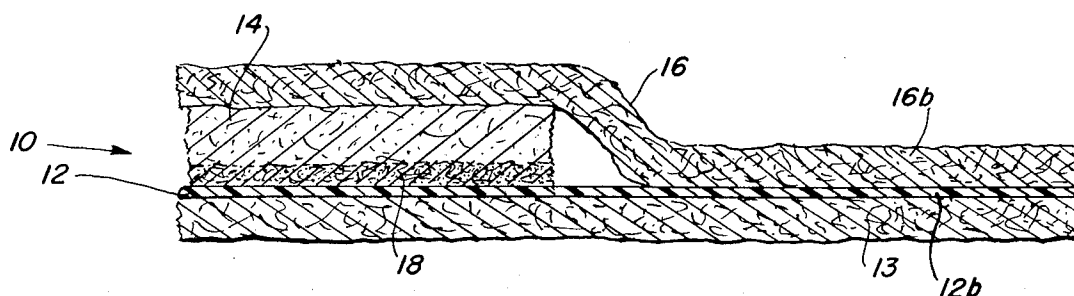


FIG. 1

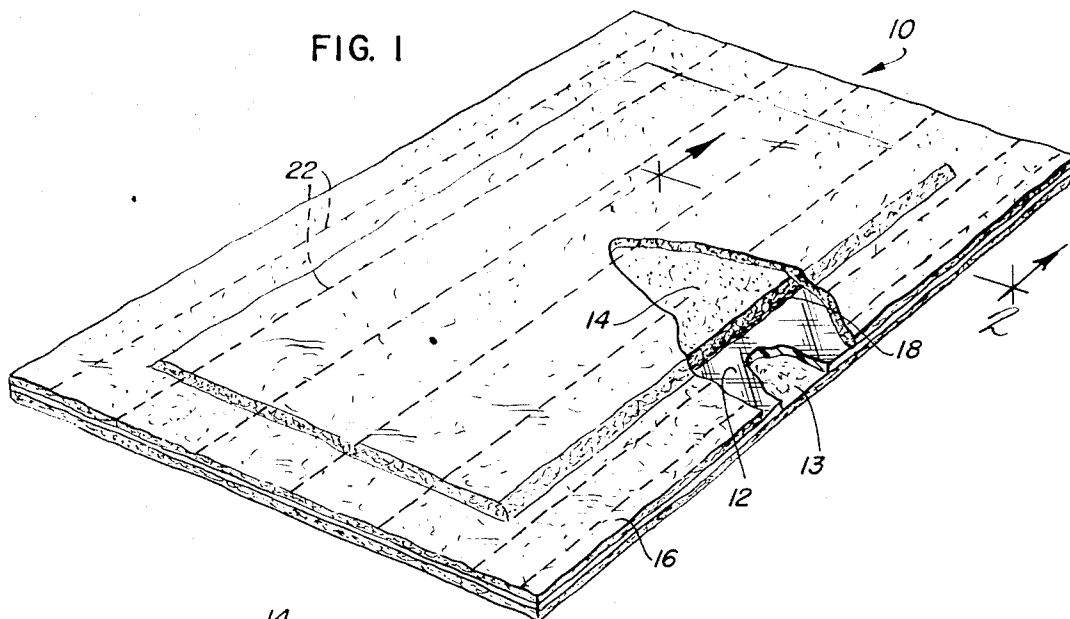


FIG. 2

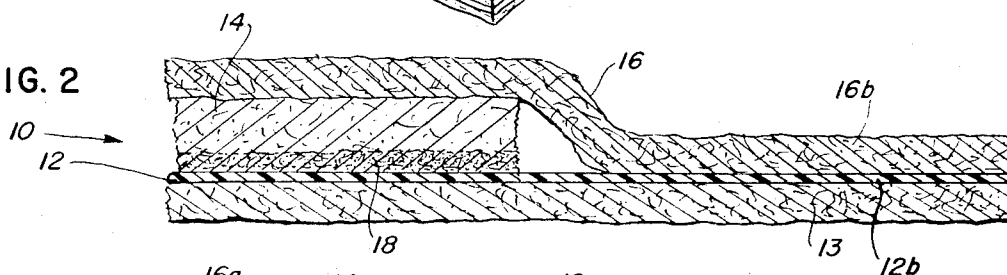


FIG. 3

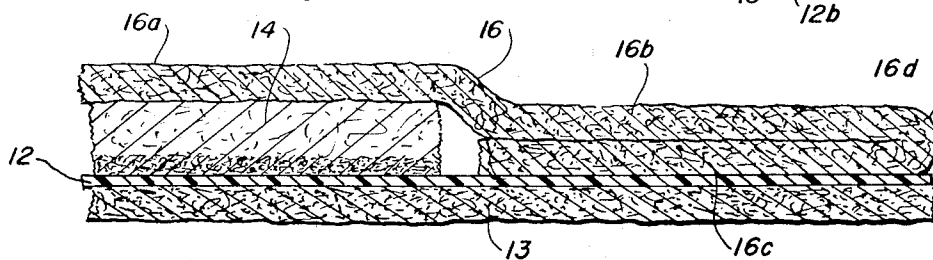


FIG. 4

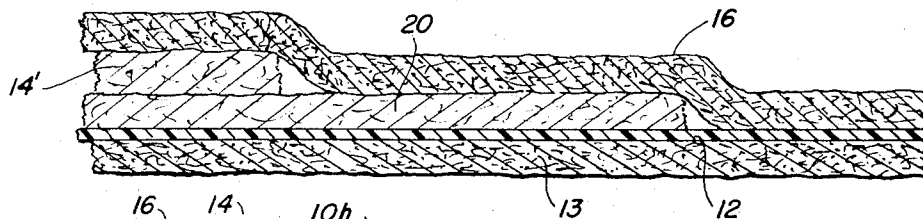
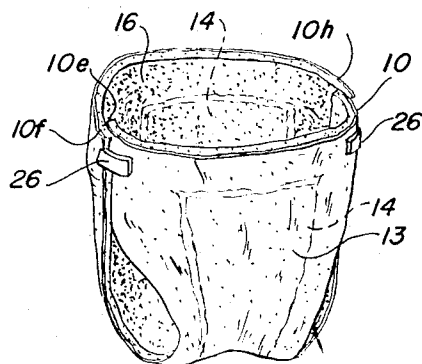


FIG. 5



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FIG. 9

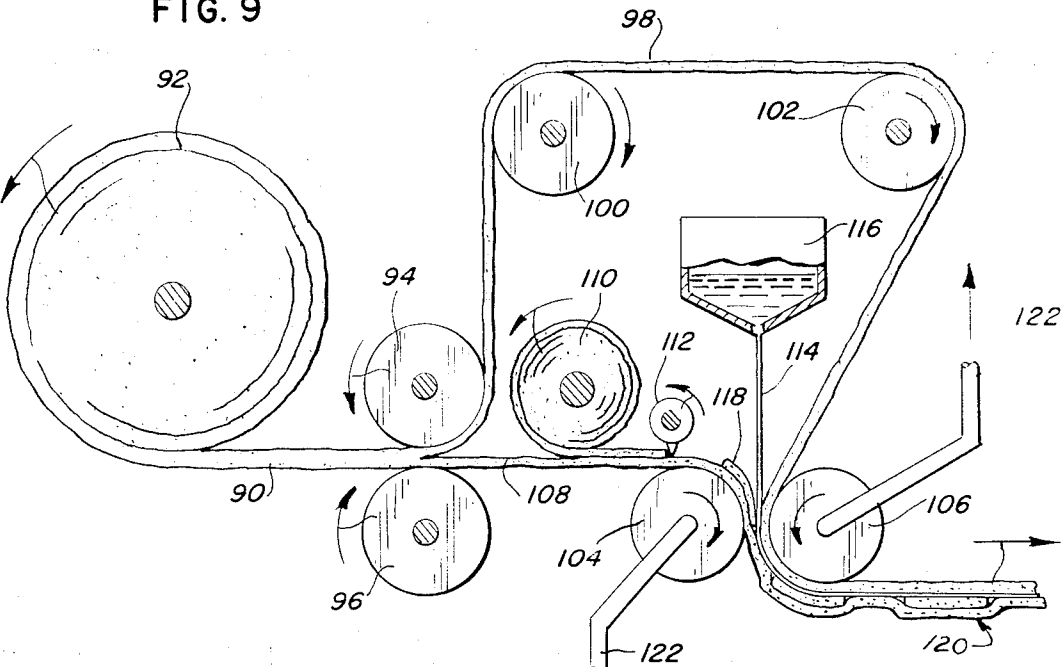


FIG. 10

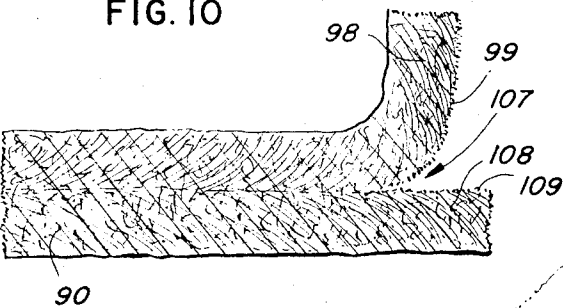


FIG. II

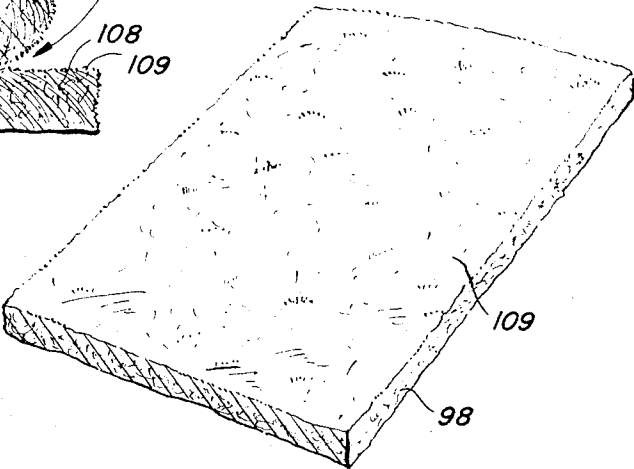
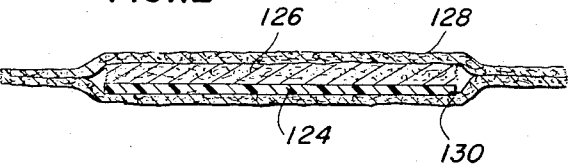


FIG. 12



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DISPOSABLE DIAPER

BACKGROUND OF THE INVENTION

Disposable diapers provide substantial advantages in convenience over diapers intended to be laundered and re-used, particularly when they are used away from home. In recent years, many different disposable diapers have been proposed and some have been successful in the marketplace. However, even the successful diapers are inadequate in functioning properties and appearance, and their success has come because consumers are resigned to accepting inadequate performance and less than satisfactory feel and appearance, as part of the price for convenience.

A common form of disposable diaper comprises a facing layer, an absorbent layer and a moisture-impervious backing material, such as a polyethylene film, the facing layer being innermost and the backing material outermost when the diaper is worn. One of the obstacles that manufacturers of such diapers must overcome is that a certain number of mothers object to the feel and handle of the diaper, and particularly object to the feel of the polyethylene film. Even though improved diaper structures, such as those disclosed in U.S. Pat. No. 3,612,055, dated Oct. 12, 1971, minimize and effectively eliminate contact between the backing sheet and the infant's skin, many mothers remain convinced that plastic materials are not comfortable to an infant, and hence are reluctant to even try, let alone use, disposable diapers that include an exposed plastic backing sheet. To meet this concern, single use diaper manufacturers have devoted substantial time and effort to improve the feel and appearance of their products.

A solution to the above problem that has been proposed is to completely eliminate the backing member, and replace it with a woven or non-woven fabric that has been treated to be water repellent. However, it has been found that it has not been possible to make a fibrous web sufficiently water repellent to hold a voluminous quantity of liquid within the diaper, without sacrificing the sought after soft feel. Because such webs of necessity have limited water repellency, it has been conventional to also use an auxiliary outer garment, such as moisture-proof pants, particularly at night when several voidings might occur.

Another solution to the above problem that has been proposed is to deeply emboss the polyethylene backing sheet to improve its drape and feel. A diaper with a deeply embossed backing sheet has substantially improved drape and feel characteristics over a diaper wherein the backing sheet is not embossed, or even lightly embossed, but such a backing sheet is still relatively slippery and difficult to grasp, particularly when moistened. Furthermore, while a deeply embossed polyethylene backing sheet has functional advantages, it has practical disadvantages, since special manufacturing techniques are required, which adds to the cost of the diaper.

It has also been proposed to improve the feel of a plastic backing sheet by adding a plasticizer to the plastic material. While this expedient has given the backing sheet a softer feel, it also reduces the structural integrity of the sheet and increases the possibility that the backing sheet might be punctured even during normal handling.

SUMMARY OF THE INVENTION

In accordance with the present invention, an improved diaper is provided which, in its optimum embodiment, has all of the advantages of the diaper disclosed in our above-mentioned patent, while at the same time having the added advantage that the impervious polyethylene backing sheet is disposed within the interior of the diaper, as a result of the provision of a fibrous outer layer adhered to the backing sheet. The resulting diaper not only has a pleasant external feel, but also enables a thinner gauge, less costly material to be used for the backing sheet, thereby making the diaper less stiff and more conformable. Furthermore, since the moisture-impervious layer is disposed within the diaper, other cost savings are realized, since it is no longer necessary to add pigmentation to the polyethylene or to deeply emboss the same.

An additional advantage is that the fibrous outer layer increases the stability and functionality of the diaper. In this regard, the fibrous outer layer provides increased frictional resistance and greater resistance to slippage, which facilitates the handling and manipulation of the diaper when it is initially applied, and which, because of the increased purchase, minimizes the possibility that a carried infant might be dropped. In a preferred embodiment, where the outer layer is a self-sustaining fabric that is bonded to the impervious backing member, the overall strength and dimensional stability of the diaper is significantly improved. The outer layer is coextensive with the backing sheet and the facing layer to provide increased pinning strength at the marginal portion of the diaper. Because of the increased strength, plasticizers can be added to the plastic material from which the backing sheet is made to increase the pliability and conformability of the composite diaper structure.

The outer fibrous layer is also preferably hydrophobic in nature, so as to repel any liquid that might wick around the edges of the backing sheet when the diaper becomes saturated, or which might tend to escape from a pin hole or other aperture in the backing sheet.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the invention, reference will now be made to the accompanying drawings wherein:

FIG. 1 is a perspective view, with certain portions broken away for clarity, of an open unfolded diaper in accordance with one embodiment of the invention;

FIG. 2 is a partial cross section of the diaper of FIG. 1 taken on the line 2—2, illustrating the internal configuration of the embodiment of FIG. 1;

FIGS. 3 and 4 are partial cross sections similar to FIG. 2, illustrating alternate embodiments of the invention;

FIG. 5 is a perspective view on a reduced scale of the diaper of FIGS. 1 and 2 in its configuration after being put on an infant;

FIG. 6 is a perspective view, partially in phantom, illustrating one manner in which the diaper of FIGS. 1 and 2 may be folded and the manner of partially opening the diaper for use;

FIG. 7 is an enlarged fragmentary cross section illustrating a preferred absorbent assembly;

FIG. 8 is a simplified schematic view of a production line illustrating the manner in which the diaper is made;

FIG. 9 is a further simplified schematic view of a modified production line illustrating another manner in which the diaper can be made;

FIG. 10 is an enlarged sectional view of the split web that is formed by the process of FIG. 9;

FIG. 11 is a fragmentary perspective view of one portion of the split web of FIG. 10; and

FIG. 12 is a sectional view, on a reduced scale, of an alternate embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings, and particularly to FIGS. 1 and 2, diaper assembly 10, when fully opened and laid out flat, comprises, in order, fibrous facing layer 16 adapted to be positioned adjacent the skin of an infant, absorbent fibrous pad, or batt 14, water-impervious sheet 12, and final or outermost layer 13 of fibrous material. Fibrous layers 13 and 16 are rectangular in shape, equal in dimension, and coterminous with backing sheet 12. Batt 14 is also rectangular in shape, but smaller than sheet 12 and layer 16, and disposed centrally thereof. The marginal portions 12b and 16b (i.e., the portions extending beyond batt 14) of sheet 12 and facing layer 16, respectively, are in face-to-face engagement with one another, and outermost layer 13 is in face-to-face engagement with sheet 12 throughout the interface therebetween.

Batt 14, preferably although not necessarily, has a paper-like densified, highly compacted lowermost fibrous layer 18 which is adhered to sheet 12 by bead lines of adhesive 22 (FIGS. 1 and 7) substantially throughout the interface therebetween. Marginal portions 12b and 16b are also adhered to each other by bead lines 22, and this mode of securement may also be used to adhere outermost layer 13 to sheet 12.

Sheet 12 is formed of a flexible, moisture-impervious material, preferably thermoplastic, and since sheet 12 is enclosed within the interior of the diaper, it may be formed of a thinner gauge material than is necessary in other constructions when the sheet is relied upon as the main component to provide strength and stability to a diaper. The thickness of sheet 12 may vary from about 0.00025 to 0.003 inch and the preferred material is polyethylene which may be utilized with a thickness as small as 0.00075 inch, although a thickness of 0.001 inch is also satisfactory. Sheet 12 may be embossed to increase its flexibility and conformability, although with thinner gauge materials embossing is not necessary. Other suitable flexible moisture-impervious sheets may be used in accordance with the invention, such as, for example, polyvinyl chloride or polyethylene terephthalate sheets having a thickness of about 0.0005 inch, for example. Since the moisture-impervious sheet is disposed within the interior of the diaper, it is not necessary to add pigmentation to the plastic material. Furthermore, plasticizers may be added to increase the flexibility and conformability of sheet 12.

Batt 14 is formed of loosely compacted short cellulose fibers, such as wood pulp fibers, or cotton linters, or mixtures thereof, which are primarily held together by interfiber bonds requiring no added adhesive, as is known in the art. Briefly, this batt is a low bulk density coherent web of loosely compacted cellulose fibers, preferably comminuted wood pulp fibers in the form of so-called "fluff".

The term "short fibers," as used herein, refers to fibers less than about one-fourth inch in length, in con-

trast to "long fibers," or "textile length fibers," which are longer than about one-fourth inch in length, and generally are between about $\frac{1}{2}$ and $2\frac{1}{2}$ inches in length. The former are substantially less costly than the latter.

The classification of fibers by length may be carried out by the Clark Classification procedure described in the test manual of The Technical Association of Pulp and Paper Industry (TAPPI-T233 SU64).

Paper-like densified layer 18 of batt 14 is formed by a slight moistening of one surface of the batt followed by the application of pressure thereto. The nature of the batt and of its densified layer and the method of producing the same are described in U.S. Pat. No. 3,017,304, dated Jan. 16, 1962.

The composite density of batt 14, including its densified layer 18, should be above about 0.07 gm./cc., and preferably between about 0.10 and 0.15 gm./cc. The foregoing density values are applicable to the diaper as produced. In storage and handling, the loft or thickness of the batt is increased to some extent, resulting in lowered densities.

Facing layer 16 is made up of a mixture of fibers consisting predominantly of short cellulosic fibers such as wood pulp fibers or cotton linters, in amounts of about 75 percent to about 98 percent, the balance being textile length fibers such as rayon. Short cellulosic fibers such as wood pulp fibers or cotton linters are substantially less expensive than textile length cellulosic fibers such as cotton and rayon, and this low cost is a factor in reducing the cost of the facing layer component of the diaper of this invention.

In facing layer 16, the short fibers are in uniform admixture with 2 percent to 25 percent by weight of textile length fibers, such as 1.5 denier rayon fibers uniformly cut to $1\frac{1}{2}$ inches length. The short and long fibers are randomly and substantially uniformly dispersed and bonded with a bonding agent such as a self-cross-linking acrylic emulsion. One bonding agent that has been applied with considerable success is a latex of a polyethyl-acrylate copolymer containing small amounts of acrylonitrile and a cross-linking monomer sold under the trademark HYCAR 2600 $\times$ 120. The bonding agent should be of the low viscosity type with a viscosity less than 5 centipoises. The facing web is also treated with a wetting agent, preferably an anionic surfactant, to partially counteract the water repellency of the bonding agent and bring the facing layer to the desired degree of wettability. A typical surfactant which has been found to be suitable is the ionic sulfonated alkyl ester sold under the trademark TRITON GR-5. Facing layers of this character are described in greater detail in commonly-owned copending U.S. Pat. No. 3,663,348, dated May 16, 1972.

Facing layers suitable for use in this invention have fabric weights in the range of 1 to 5 oz./yd.² and densities less than 0.15 gm./cc., generally in the range between 0.05 and 0.1 gm./cc. The dry strength of the facing layer, for a fabric having a weight of about 1.5 oz./yd.², is at least 0.15 lbs./in. of width in the machine direction and at least 0.08 lbs./in. of width in the cross direction. The fabrics have unusually good elongation, loft, softness and drape characteristics in comparison to prior products incorporating any substantial amount of short fibers.

For a more detailed description of batt 14 and facing 16 as well as the methods of producing them, reference may be made to the above mentioned U.S. Pat. No.

3,612,055, the disclosure of which is hereby incorporated herein in its entirety by this reference.

Outermost layer 13 is preferably identical to facing layer 16 insofar as fiber mixtures and proportions are concerned, although layer 13 differs from layer 16 in certain other important respects. For example, it is desirable that layer 13 be water repellent to prevent liquid from wicking around sheet 12 when the batt 14 becomes saturated, and to prevent liquid from striking through the diaper as a result of a pin hole or other aperture. To this end, the wetting agent is omitted from the bonding solution for layer 13, and as a result the bonding agent renders outer fibrous layer 13 hydrophobic. Thus, the outer layer tends to reject fluid and remain dry. The improved feel, handle and water repellency characteristics of layer 13 are, to a large extent, independent of the thickness of the layer, and thus layer 13 may be substantially thinner than layer 16, if desired.

The weight of layer 13 is also preferably less than the weight of facing 16, for sake of economy, the optimum range being about $\frac{1}{2}$ oz./yd.² to about 2 oz./yd.² Furthermore, in its broadest aspects, the present invention is not limited to any specific type of fibrous material for layer 13, and this layer can be formed of a woven or non-woven fabric, and in the event of a non-woven fabric, the same may be wet or dry formed. In fact, certain of the advantages of the present invention, i.e., the improved feel and appearance of the diaper, can be obtained by forming outermost layer 13 of flocked fibers or tissue. This alternative can be resorted to when the strength of a self-supporting web is not required, for example, when a polyethylene sheet 0.001 inches thick is used as moisture-impervious sheet 12.

As is explained in detail in our above mentioned U.S. Pat. No. 3,612,055, an important aspect of the improved diaper is the provision for selective wettability among the above described fibrous components, such that the moisture is selectively drawn from the facing layer into the body of the batt and then from the body of the batt into the densified layer thereof. Specifically, when liquid, such as urine, flows into a small area on the outer surface of facing layer 16, it flows preferentially into underlying batt 14 rather than to other areas of the facing layer, thus tending to restrict wetting in the facing layer to a small area and to move the liquid away from the infant's skin. The liquid flowing into a small area of loosely compacted batt 14 flows preferentially into underlying densified layer 18, rather than to other areas of the batt, thus tending to restrict wetting in the batt to an area of moderate size and to move the liquid farther from the infant's skin. The liquid flowing into densified layer 18 tends to spread laterally because of its wicking action, and liquid which might pass through the densified layer during discharge (when flow is rapid) is held back by the impervious backing sheet for sufficient time to permit absorption to take place. Liquid in excess of the absorptive capacity of densified layer 18 is forced back by impervious layer 12 into the dry portion of loosely compacted batt 14, thus utilizing the additional absorptive capacity therein. Any liquid tending to wick around the edges of impervious sheet 12 when the diaper is saturated, or tending to escape through an aperture in sheet 12, is repelled by the hydrophobicity of outermost layer 13. Thus, layer 13 cooperates with impervious sheet 12 to hold the urine within the diaper and keep it from wetting the

bed clothes or outer clothing. In addition, since layer 13 is adhered to the impervious sheet over a widely distributed area, layer 13 strengthens the diaper by reinforcing impervious sheet 12.

While layer 13 has heretofore been described as being adhesively secured to impervious sheet 12, it should be understood that the invention is not limited to any particular mode of securement, since the layer could also be secured to sheet 12 in other manners, such as by heat sealing. If a heat sealing process is used, outer layer 13 may be bonded to sheet 12 in selected areas, as around the outer margin of the diaper, or along lines similar to lines of adhesive 22.

The embodiment of FIGS. 1 and 2, described above, is one of the simplest and most economical forms of the present invention. For superior performance, however, the embodiment of FIG. 3 is preferred. The construction of FIG. 3 is similar to that of FIG. 2, except that facing layer 16 is cut wider than the impervious sheet and is folded under on itself in the marginal portions to provide a thicker and heavier border. The underfolded portion of the facing layer is shown as 16c and the right as 16d.

Since facing layer 16 has substantial body and strength, folding it over at the marginal portions of the diaper enhances the strength of the diaper and provides additional tear resistance where pins are used. In addition, the configuration of FIG. 3 improves the balance and feed of the diaper and provides better sealing where the edge portions come into contact with the thighs of the infant when the diaper is secured in place.

Another advantage of the FIG. 3 embodiment is derived from the fact that the folding over of the facing layer compresses it at the inner surface of the fold and stretches it at the outer surface of the bend to produce a lower density at the outermost edge of the folded facing layer. When the diaper is thoroughly saturated with urine to the edges of the facing layer, the urine will tend to be held in the densified inner portion of the fold in preference to the less dense outermost edge and will thereby tend to be held within the diaper.

While the diaper described above has been characterized as including a specific type of facing layer and a specific type of batt, it should be understood that in its broadest aspects the present invention is not limited thereto, and specifically different types of facings and/or batts are within the purview of the present invention. For example, the facing could be formed by a tissue sheet-creped or uncreped, a suitable foam material or a woven sheet. Also, the batt could be formed or creped wadding or tissue.

In the embodiment of FIG. 4, there are two batts disposed between facing layer 16 and impervious sheet 12, batt 14' and a second, larger batt 20. The overall effect is to provide a stepped cross section as shown in FIG. 4. While neither of batts 14' or 20 has been illustrated as having a densified layer, as shown at 18 in FIGS. 1-3, it should be understood that a densified layer could be provided on either or both of these batts, and our invention is to be construed as including a densified layer, where desired.

When an infant's weight rests on the stepped construction of FIG. 4, there is a tendency for the uncompressed absorbent material of batts 14' and 20 to become partially compressed by the weight. Since there is a greater thickness of material in the center of the stepped construction of FIG. 4 than at the margins,

there will be greater pressure (and hence more compression) at the center. This results in a smaller effective capillary radius in the center section and greater wickability of the more highly compressed center portion as compared to the less compressed marginal portions.

In the case of a night diaper designed to hold several voidings, the construction of FIG. 4 helps to keep the urine in place in the central portion of the diaper and away from the edges from which it might leak out.

The diaper of this invention is normally packaged and sold in a folded condition. FIG. 6 illustrates the diaper of FIG. 1 in a folded state and also illustrates, in phantom, the diaper in a partially opened state, ready for application onto the lower torso and thighs of an infant.

As shown in FIG. 6, side margins 12b and 16b of impervious sheet 12 and facing fabric 16, respectively, together with a portion of batt 14, are folded inwardly in a first fold to provide as the uppermost layer of the fold, a portion of the moisture-impervious sheet. This sub-assembly is then folded outwardly about its midportion in a second fold to cover the first folded portion and to expose edge portion 16e of the facing fabric as the upper layer of the double fold. In the preferred embodiment, each double fold at the edge of the diaper comprises approximately one-third of the resulting transverse dimension of the folded diaper, leaving approximately one-third of the width of the folded diaper as a central unfolded and uncovered portion.

The diaper is held in its folded condition, for example, by two small central spots of adhesive 24 applied between the main body of the diaper and overlying sides 16b of the facing layer, one spot on each folded side of the diaper.

When the diaper is to be put on the infant, the folds are opened on one side of each of the adhesive spots, as shown in phantom in FIG. 6, and the open portion of the diaper is put under the infant's buttocks while the folded portion between adhesive spots 24 is raised into the crotch region. The final form of the diaper is shown on a reduced scale in FIG. 5, and as illustrated therein, end portions 10b and 10c of the diaper are folded upwardly to define a waistband, and the corner portions 10e - 10h of the diaper are folded outwardly toward the position illustrated in phantom in FIG. 6 at 10d, so that corner 10e approximately mates with corner 10b on one side of the infant's waist, while corner 10g mates with the corner 10h on the opposite side of the infant.

In one form of the invention, as illustrated in FIGS. 5 and 6, the diaper is provided with adhesive tabs 26, each having a fixed end secured to outermost layer 13 and a free end 30 wherein the adhesive surface is covered with a facing sheet 32. Facing sheets 32 are removed to expose the adhesive surfaces when the diaper is applied to the infant, as in the configuration shown in FIG. 5, and free ends 30 of the adhesive tabs are secured to the opposite corners of the diaper.

FIG. 8 discloses an exemplary type of production line, in schematic form, that may be utilized to produce the previously described diaper structures. As shown therein, roll 36 of suitable backing sheet material is provided to feed continuous sheet 12 between adhesive supplies 38 and 39, which apply adhesive to opposite sides of the sheet 12. The adhesive may be sprayed or rolled in lines along the length of sheet 12, or if desired,

a weir arrangement or print rollers can be employed to distribute the adhesive in any desired pattern.

Roll 40 of batt material is provided downstream of adhesive supply 38, and feeds batt sections 14 onto adhesively treated sheet 12. A cutter (not shown) may be provided adjacent roll 40 to sever the batt material into appropriate lengths, or alternatively, roll 40 may be driven intermittently, and because of the minimal longitudinal strength of the batt material, the batts will be automatically severed into the desired length.

Roll 42 of facing fabric material is provided above sheet 12 downstream of roll 40, and roll 42 is driven continuously to lay the facing layer 16 over the sheet 12 and batts 14. In a similar manner, a supply of material for outer layer 13 is provided on roll 43 beneath sheet 12 and downstream of adhesive supply 39, and roll 43 is driven continuously to apply outer layer 13 against the undersurface of sheet 12.

A pair of vertically aligned pressure rollers 44, 46 squeeze batts 14, outer layer 13 and the facing 16 against the adhesively coated sheet 12, to insure that all of the elements of the diaper will be positively held in place. A cutting roller 48 downstream of pressure rollers 44, 46 severs the chain into individual diapers, either before or after the diapers have been folded into the configuration shown in FIG. 6.

Referring now to FIG. 9, a further form of production line for producing the previously described diaper embodiments is illustrated therein. The facing and outer layers of the diaper are formed from a composite fibrous sheet 90, which is preferably made in the manner described in U.S. Pat. No. 3,483,051. Briefly, individual fibrous webs of mixed short and long fibers, as described above, are air-laid on separate machines, with a majority of the fibers of each web being arranged in shingle-like fashion. The webs are plied together with the fibers of each web being disposed at oppositely inclined acute angles with respect to the interface between the webs. The resulting composite is then through bonded with a stabilizing agent, and led to a supply roll, such as shown at 92. The composite sheet 90 is fed from roll 92 between rolls 94 and 96 with the common vertex between the aforesaid acute angles facing to the right as viewed in FIG. 9, and as fabric 90 leaves rolls 94 and 96, it is separated generally along the interface between the two starting webs into two separate fabrics 98 and 108. Fabric 90 can be separated into two substantially equal layers 98 and 108; however, if desired, the manufacturing steps can be controlled to provide layers which have different weights-per-unit area, different densities, and different thicknesses. This may be accomplished, for example, by control of the air laying of the individual webs that comprise the composite sheet 90. For example, by feeding the fibers of the individual webs to their respective air laying devices at different rates, the individual webs will be of unequal thickness, and the separation at the interface 107 (FIG. 10) will not occur in the center of the web 90. As is illustrated in FIGS. 10 and 11, when fabric 90 is separated in the above described manner, separated faces 99 and 109 of fabrics 98 and 108, respectively, are roughened as a result of fibers projecting outwardly therefrom.

Outer layer 98 passes upwardly from roller 94 over horizontally spaced rollers 100 and 102, and thence downwardly between horizontally aligned cooled squeeze rollers 104 and 106. Facing layer 108 is guided

directly between squeeze rollers 104 and 106, and suitable lengths of batting are severed from an intermittently driven supply roll 110 by cutter roll 112 to provide individual batt sections 118 on facing layer 108 prior to passage between the nip of rollers 104 and 106.

Impervious sheet 114 is extruded in situ from a suitable supply 116 and passes downwardly between outer layer 98 and pads 118 on facing layer 108. Faces 99 and 109 of fabrics 98 and 108, respectively, come into contact with film 114 while it is freshly extruded and still tacky, and the roughness of these faces causes these fibers to adhere tenaciously to film 114. The resulting composite assembly is cooled by a cooling medium such as water which enters rolls 104 and 106 from supplies 122.

A further diaper embodiment is illustrated in FIG. 12, and as shown therein, the moisture-impervious film 124 has the same dimensions as the batt 126, with the facing 128 and the outer layer 130 being larger than the film 124 and batt 126, so that only layers 128 and 130 are present in the edge portion of the diaper. This structure is somewhat easier to pin, somewhat more pliable, but also has somewhat reduced strength in the pinning and waistband areas.

It will be understood by those skilled in the art that variations and modifications of the specific embodiments described above may be employed without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A multi-layer diaper comprising: a rectangular facing layer adapted to be positioned adjacent the skin of an infant during use, said facing layer being a lofty and

soft nonwoven fabric having a density of less than 1.15 gm./cc. and comprised of mixed long and short fibers; a highly porous, loosely compacted, cellulosic fibrous batt in face-to-face juxtaposition to said facing layer and having a greater wettability to water than said facing layer, the face of said batt opposite said facing layer having a paper-like, densified compacted cellulosic fibrous layer of relatively high wettability and relatively high fluid retentivity formed integrally with said batt, said batt being rectangular, narrower than said facing layer and centrally disposed with respect thereto; a water impervious sheet on the side of said batt opposite said facing layer, said sheet being rectangular, coterminous with said facing layer, and adhered to said batt and to the marginal portions of said facing layer outwardly of said batt; and a rectangular outer layer on the side of said sheet opposite said batt, said outer layer being coterminous with said sheet and secured thereto, said outer layer being a lofty and soft nonwoven fabric having a density of less than 0.15 gm./cc. and comprised of mixed long and short fibers.

2. The diaper of claim 1 wherein said outer layer is hydrophobic.

3. The diaper of claim 2 wherein said outer layer is through bonded with an acrylic latex binder.

4. The diaper of claim 2 wherein said outer layer has a weight between about ½ oz./yd.² and about 2 oz./yd.²

5. The diaper of claim 2 wherein said outer layer is adhesively secured to said sheet.

6. The diaper of claim 2 wherein said sheet is formed of a thermoplastic material and said outer layer is heat sealed to said sheet.

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