

[54] **SCRIM REINFORCED DISPOSABLE
DIAPER**[75] Inventors: **Frederick K. Mesek**, Downers
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Brunswick, N.J.[22] Filed: **Aug. 6, 1973**[21] Appl. No.: **386,113**

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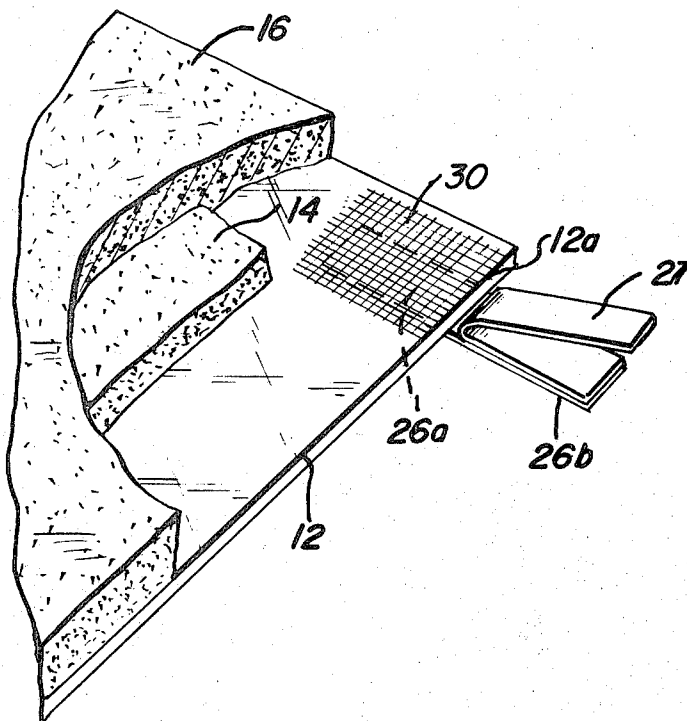
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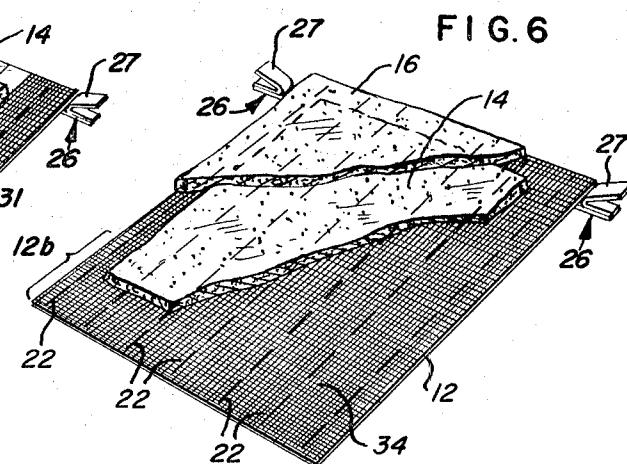
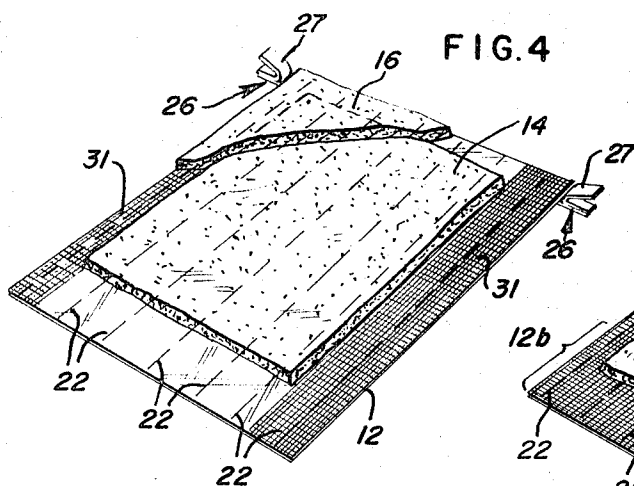
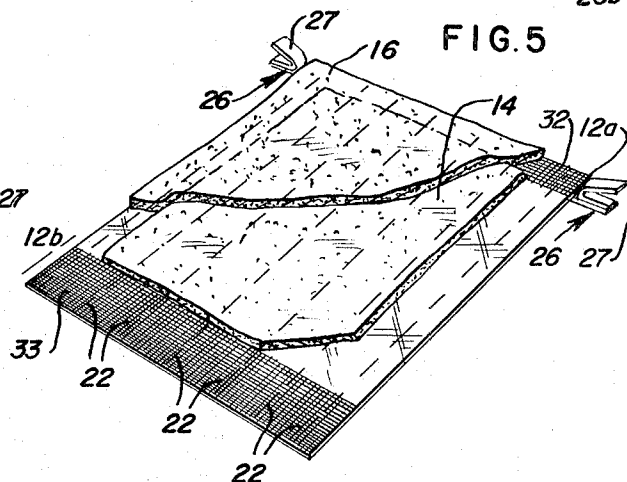
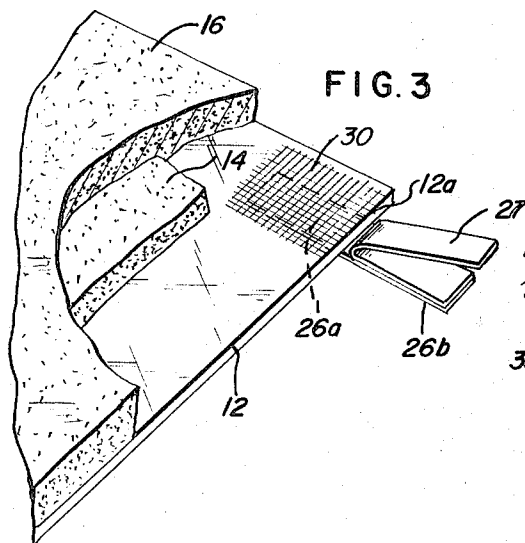
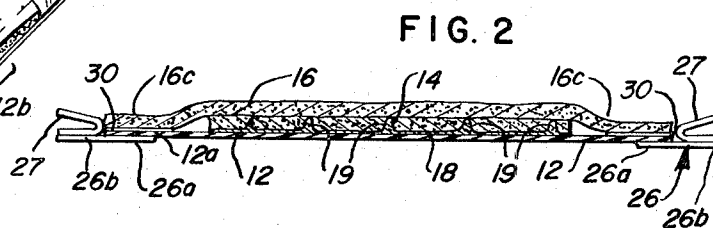
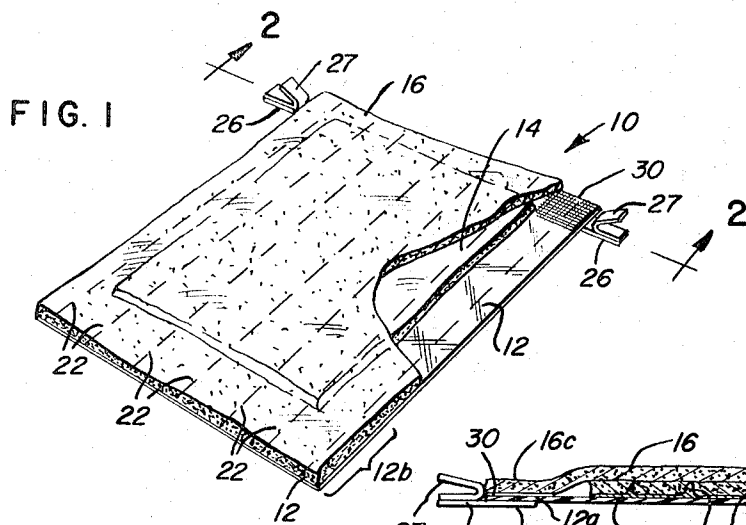
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[57] **ABSTRACT**

A multi-layer diaper includes a porous facing layer to be positioned adjacent an infant's skin, an absorbent batt and a water-impervious backing sheet. The backing sheet is provided with adhesive tabs on its outer surface at its side portions near one end of the diaper, and is reinforced with flexible structural material, such as scrim, to prevent stretching and rupture thereof due to tension in the tabs generated during diapering, during the wearing of the diaper and during the removal of the diaper from the infant. The selected areas of reinforcement include the areas in the vicinity of tab permanent attachment to surface of the backing sheet, the front waist portion area, the marginal side portions, or the entire inner surface of the backing sheet.

6 Claims, 6 Drawing Figures



SCRIM REINFORCED DISPOSABLE DIAPER

BACKGROUND OF THE INVENTION

Disposable diapers due to their convenience have become an accepted substitute for cloth diapers, and several different constructions have achieved significant market penetration. However, even the more successful diapers are inadequate in certain functional aspects.

The typical disposable diaper is made of three major components, namely, a facing layer which is positioned adjacent the infant's skin, an absorbent pad or batt immediately beneath the facing layer which distributes and stores the liquid deposited on the diaper, and finally, a water-impervious sheet which contains the liquid within the diaper structure. Most cloth diapers and disposable diapers are usually positioned on the infant by pinning the side portions of the diapers together. However, when pins have been used with disposable diapers, the water-impervious sheet which is normally in the form of a plastic sheet material is punctured by the pin. These punctures are sometimes extended under tension from the pins so that ruptures are created in the impervious sheet which may allow liquid to escape therefrom. It will be appreciated that the plastic sheets which form the backing sheet are quite easily stretchable and will tear or rupture under the influence of tension.

In addition, when pins are used to secure the diaper on an infant, there is the danger of sticking the infant when diapering and the hazard of the pins opening and sticking the infant during use which results in discomfort and possible infection. To overcome the rupturing problem and for added convenience and safety in use, many disposable diapers have been equipped with adhesive tabs, such as tabs of adhesive tape.

The adhesive tabs are normally attached on both side edges of the diaper on one end corresponding to the back of the diaper when it is positioned on the infant. One end of each tab is permanently attached to the back of the diaper, and the opposite end of the tab, which will be attached to the waist or front portion of the diaper, is prevented from sticking to the diaper during shipment and handling by placing a non-stick strip over the exposed end of the tab, such strips include teflon-coated paper, etc. While adhesive tabs obviate the puncture problem attributable to safety pins, the tabs will, under some circumstances, stretch the backing sheet and tear it while the baby is being diapered, while the diaper is being worn, or when the diaper is adjusted by the parent.

Normally the backing sheet is adhered to the facing layer along the marginal side portions of the diaper, or to the batt and marginal side portions of the facing layer by adhesive glue lines or islands. Such adherence keeps the diaper components in relative position to each other and provides some reinforcement of the backing sheet. The degree of reinforcement provided depends upon the location and closeness of the areas of adhesion, the strength of the fibrous layer adhered to, and the ease of separation of the fibrous layer adhered to from the non-adhered fibers surrounding it. Quite often, such reinforcement is inadequate to cope with strong pulling and when tension in the tabs reaches sufficient magnitude, the backing sheet will stretch and rupture.

It has been suggested that the side margins be reinforced by folding over the sides to create a double thickness along the margins but this method inhibits the conformability of the diaper and requires a wider diaper to compensate for the fold over.

Saber, U.S. Pat. No. 3,604,422 utilizes an extruded backing sheet with a thickened marginal bead portion to provide a reinforced margin for anchoring pins. However, this construction is inadequate for reinforcing the waist portion of the backing sheet and is not economical to produce.

SUMMARY OF THE INVENTION

The present invention represents an improvement upon disposable diapers having a plastic backing sheet which prevents rupturing of the sheet due to tension in the securing means. The present invention is adaptable for use with both safety pin secured diapers and adhesive tabs secured diapers. The backing sheet is reinforced by bonding a material having a greater modulus of elasticity than the backing sheet to the backing sheet in at least the areas thereof where the tabs or pins will be attached.

By reinforcing at least the area of the backing sheet in the vicinity of the anchoring location of the tabs with additional material, such as a high strength scrim in the form of cotton gauze or polyethylene fibers or a strong film, such as a polyethylene terephthalate film, the tensile strength of the backing sheet is greatly increased thereby minimizing stretching and rupturing of the backing sheet. The term "anchoring locations" refers to the areas of the backing sheet on which the tabs are positioned and adhered to by the manufacturer prior to shipment of the diapers to the consumer. The term "securing areas" as used herein, refers to the areas of the backing sheet to which the tabs will be secured by the user when the diaper is positioned on an infant. The securing areas are located in the front waist portion of the diaper. When the diaper is not equipped with tabs and safety pins are used as securing means, "anchoring locations" and "securing areas" refer to the areas of the backing sheet through which the safety pins are passed to secure the diaper about an infant.

In one embodiment of the invention, reinforcement is provided by bonding reinforcement material on the surface of the backing sheet in the vicinity of tab anchorage either on the inner or outer surface of the backing sheet. The backing sheet in the anchoring locations is subjected to increase tension from the tabs during the removal of the non-stick cover strip which is generally ripped off by the mother. And the anchoring locations are also subjected to increased tension when the diaper is being positioned on the infant as the mother pulls on the tab to conform the diaper to the infant's shape. By reinforcing the anchoring locations, the stress is absorbed through a greater surface area and stretching and rupture is eliminated under normal use.

While this embodiment provides adequate reinforcement of the anchoring locations, the bonding of the scrim material to the vicinity of the anchoring locations presents registry problems during the high speed production of the backing sheets. The backing sheets are normally in the form of a continuous roll of plastic sheet which is cut to size in the assembly line and adhered to the other components of the diaper. As a result, it is possible that the anchoring location reinforce-

ment will become out of register with its desired location. Accordingly, a second embodiment of this invention utilizes reinforcement material which extends continuously along the marginal side portions of the backing sheet thereby eliminating problems with respect to registry in the length dimension.

A third embodiment of the diaper of this invention includes a backing sheet which is reinforced in the anchoring locations, as in the first embodiment, and also includes reinforcement material across the waist portion of the diaper. The waist portion reinforcement is provided by bonding scrim material, or other reinforcing material, from one side edge of the backing sheet to the other side edge and from the end of the sheet to a selected distance inwardly corresponding to the portion of the diaper that is positioned adjacent the infant's abdomen. This embodiment provides reinforcement not only for the anchoring locations but also for the securing areas of the diaper to which the free ends of the tape tabs may be secured when the diaper is worn. Such areas may be stressed quite highly when the diaper is being worn by the infant and when the tabs are being detached to remove the diaper from the infant. Tearing of the backing sheet while the diaper is being removed or readjusted will prevent its continued use if it is found to be unsoiled.

Registry problems in manufacture may also be presented with the third embodiment. Accordingly, a fourth embodiment of the diaper of this invention utilizes a backing sheet which is reinforced by reinforcing material which extends completely over the inner surface of the backing sheet, thereby reinforcing the entire backing sheet.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view, with certain portions broken away for clarity of illustration, of an open unfolded diaper illustrating a first embodiment of this invention;

FIG. 2 is a sectional view of the diaper of FIG. 1 taken along plane 2-2;

FIG. 3 is an enlarged fragmentary perspective view, with certain portions broken away, of a corner of the diaper of FIG. 1;

FIG. 4 is a perspective view with certain portions broken away, illustrating a second embodiment of this invention;

FIG. 5 is a perspective view, with certain portions broken away, illustrating a third embodiment of this invention; and

FIG. 6 is a perspective view with certain portions broken away, illustrating a fourth embodiment of this invention.

DETAILED DESCRIPTION

While this invention is susceptible of an embodiment in many different forms, there is shown in the drawings and will be hereinafter described in detail, preferred embodiments of the invention and modifications thereof, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention, and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

Referring to the drawings and particularly to FIG. 1, the diaper assembly 10, when fully opened and laid out

flat, comprises a lowermost water impervious sheet 12 which is rectangular in shape, a highly water-absorbent pad or batt 14, which is also rectangular in shape, but smaller than the impervious sheet and centrally disposed thereon, and an overlying facing layer 16 of fibrous material, which is also rectangular in shape, equal in dimension and coterminous with the impervious sheet and in contact therewith in the marginal portions of the diaper extending peripherally beyond the absorbent batt. Batt 14 has an integral continuous paper-like densified highly compacted lowermost fibrous layer 18 that may include spaced, parallel, longitudinally disposed, thickened densified portions 19. The paper-like densified, highly compacted, fibrous layer 18 is continuous in the lowermost portion of the batt 14 and covers substantially its entire area. The lower major face of the batt 14, including the densified layer 18, is adhered to the impervious sheet 12 by bead lines 22 of adhesive substantially throughout the interface therebetween. The marginal portions 16c of the facing layer extending beyond batt 14 are also adhered to impervious sheet 12 by adhesive bead lines 22.

In the preferred embodiment of the invention, moisture impervious sheet 12 is formed of polyethylene having a thickness of approximately 0.001 inch. The sheet may be smooth or it may be embossed to improve its drape and feel.

Batt 14 may be formed of loosely compacted short cellulosic fibers, such as wood pulp fibers, or cotton linters, or mixtures thereof, which are primarily held together by inter-fiber 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 $\frac{1}{4}$ inch in length, in contrast to "long fibers," or "textile length fibers" which are longer than about $\frac{1}{4}$ 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 or The Technical Association of Pulp and Paper Industry (TAPPI-T233 SU64).

The 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 thickened, densified portions 19 are formed by further compression of batt 14 while it is still moist, as described in Repke U.S. Pat. application Ser. No. 266,013, filed June 26, 1972, as with embossing rollers which produce recesses on the surfaces of the batt 14 in line with the thickened portions 19.

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.

In the diaper of FIGS. 1 and 2, facing layer 16 is made up of a mixture of fibers consisting predominantly of short cellulosic fibers such as wood pulp fi-

bers 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 the facing layer, the short fibers are preferably 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 $1\frac{1}{2}$ inch length. The short and long fibers are preferably randomly and substantially uniformly dispersed and bonded with a bonding agent such as a self-cross-linking acrylic emulsion. The facing web may also be treated with a wetting agent to partially counteract the water-repellency of the bonding agent and bring the facing layer to the desired degree of wettability. Facing layers of this character are described in greater detail in commonly-owned Liloia et al. U.S. Pat. No. 3,663,348.

Facing layers suitable for use in the preferred diaper of 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 0.10 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.

Preferably the diaper 10 is provided with two adhesive tabs 26, each having a fixed end 26a secured to the impervious sheet 12 at the anchoring locations 12a (FIG. 2) adjacent one end thereof, and a free end 26b whose adhesive surface is covered by a facing strip 27, such as teflon coated paper. The facing strips 27 are removed to expose the adhesive surfaces when the diaper is applied to the infant and the free end 26b of the adhesive tabs 26 are secured to the securing areas 12b of the backing sheet in the front or waist portion of the diaper.

Backing sheet 12, according to the present invention, is reinforced by structural material having a greater modulus of elasticity than the backing sheet in at least the anchoring locations 12a of the tabs 26. The reinforcement is achieved by bonding the reinforcing material either to the surface of the backing sheet 12 which is in juxtaposition with the other components of the diaper, i.e., the inner surface of the backing sheet, or to the outer surface of the backing sheet. The reinforcing material may take various structures including scrim material, such as cotton gauze or polyethylene filaments, or film materials such as biaxially oriented polyethylene terephthalate.

The reinforcing material 30, as illustrated, is bonded to the interior surface of the backing sheet in the vicinity 12a of the tabs 26. The reinforcing material in this embodiment is rectangular in shape and larger in dimension than the anchored end 26a of the tab 26, FIG. 3.

The anchoring locations 12a are subjected to increased stress when the facing strips are removed from the tab prior to securing the diaper on the infant. Each facing strip is usually removed in a ripping or tearing manner so that high stress must be absorbed by the

backing sheet 12 to prevent stretching and rupture. By providing reinforcing scrim 30, the stress is transferred to the scrim material and is thereby distributed over a larger area of the backing sheet resulting in making more of the backing sheet available to absorb the stress.

As has been indicated, the single patch reinforcements 30 functions well for reinforcement but may result in registry problems during the high speed manufacture of the diaper. The backing sheet 12 is normally supplied in a continuous roll which is fed into the processing stream and adhered to the other components of the diaper and then cut to size. To minimize the registry problem, a second diaper is illustrated in FIG. 4 in which the reinforcing material 31 consists of two strips of material which are adhered along the marginal side portions of the backing sheet 12. Strips 31 extend continuously along the side portions of the diaper and may be conveniently formed on the supply roll from which the backing sheet is cut either on the inner or outer surface thereof.

While the anchoring locations 12a receive a large amount of stress during the diapering of the infant, the waist portion 12b of the diaper which extends from side to side and from the end of the diaper opposite the anchoring locations to about one-fourth of the length of the diaper is also subjected to stress from the secured ends of the tabs while the diaper is being worn by the infant and when the tabs are being removed. The tabs 26 presently come in two varieties, one in which the tab is formed from a paper tape which may be easily torn, and a second in which the tab is formed from a plastic material which may not be easily torn. When the latter type tabs are used, the diaper is removed or readjusted by pulling the tab from the securing areas 12b in the waist portion of the backing sheet. Understandably, this results in increased stress in the backing sheet in this area. To overcome this detaching stress, as well as the stresses generated by either type of tabs while the diaper is being worn by the infant, reinforcement material 33 is also provided in the waist portion 12b of the backing sheet, as shown in FIG. 5.

The reinforcement in the anchoring locations of the embodiment illustrated in FIGS. 3 and 5 may be of two patches of material 30, as illustrated in FIG. 3, or may be a continuous strip 32 extending across the rear end of the backing sheet and overlapping at least a portion of the anchoring locations 12a, preferably from one lateral edge to the other lateral edge of the backing sheet, as illustrated in FIG. 5. The continuous strip 32 provides greater reinforcement for the anchoring locations than the patches 30, and also allows more flexibility during the manufacture of the diaper by allowing reinforcements 32 and 33 to be formed by a single band of reinforcing material. It will be appreciated that such a band would extend across the backing sheet in accordance with the length of material needed to reinforce the anchoring locations 12a and securing areas 12b and would correspond in width to the combined width of areas 12a and 12b. When the diaper of FIG. 5 is produced in a production line, a single band of reinforcement will be cut after the diaper elements are assembled to become reinforcement 32 of one diaper, and reinforcement 33 of the next preceding or next succeeding diaper, depending on the direction of the production line. When such a band is used, the diaper components must be placed in register with the backing

sheet so that, upon cutting of the assembled elements, the reinforcements will be properly located. In high speed production lines such registry may be difficult to maintain.

FIG. 6 illustrates a fourth diaper which obviates the registry problem of FIG. 5 as well as providing reinforcement continuously over the entire inner surface of the backing sheet. The backing sheet of FIG. 6 has reinforcing material 34 bonded to the inner surface of the backing sheet 12 and coterminous therewith. The backing sheet 12 of this embodiment is adaptable for positioning of the tabs at any location and thereby provides the greatest flexibility in use of the diaper, but of course, results in increased cost in the manufacture of the diaper.

The scrim reinforcement utilized in the diaper of the present invention may be in the form of cotton gauze which can be bonded to the plastic backing sheet by known methods or alternatively and preferably, may comprise polyethylene filament gauze. The latter provides for easier bonding of the scrim to the backing sheet since it may be boned by the application of heat and pressure, thus reducing the overall cost in manufacturing. The reinforcement may also be formed by other structural materials which are flexible, such as biaxially oriented polyethylene terephthalate films or other plastic films having a greater modulus of elasticity than the backing sheet.

Reinforcement by scrim is preferable when the diaper is to be used with safety pins since the puncture area caused by the pin will be limited to approximately the size of the spacing between filaments in the scrim. In this manner, as tension in the pin is increased, the plastic will stretch until a filament is reached at which time the stress will be distributed throughout the scrim material.

The adhesion of scrim or other reinforcing material to one surface of the backing sheet or to portions thereof, may of course, roughen the surface. However, the reinforcement contemplated by this invention is preferably adhered to a surface of the backing sheet which is covered at all times by the facing layer, or by the facing layer and the pad and is thus out of contact with the infant wearing the diaper or with the parent applying it or removing it.

It will be understood by those skilled in the art that variations and modifications of the specific embodiments described above may be employed without de-

parting from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A multi-layer diaper comprising: a porous facing layer; a highly porous absorbent batt in face-to-face juxtaposition with said facing layer; a water-impervious backing sheet adhered to said batt; means comprising adhesive tabs attached to said backing sheet for attaching locations at the sides of said backing sheet to other locations on said backing sheet to secure said diaper about the thighs and waist of an infant, said adhesive tabs being located at anchoring locations at the sides and near one end of the backing sheet and adaptable to be attached at securing areas near the other end of the backing sheet; said water-impervious backing sheet being reinforced against stretching and rupture by having adhered to a minor portion of the surface thereof a flexible structural material having a higher modulus of elasticity than said backing sheet, said minor surface portion being located in at least the vicinity of said anchoring locations.

2. The diaper of claim 1 wherein said backing sheet is reinforced by a cotton gauze scrim.

3. The diaper of claim 1 wherein said backing is reinforced by a scrim formed of polyethylene filaments.

4. The diaper of claim 1 wherein said structural material extends along and is restricted to the marginal side portions of said backing sheet surface.

5. The diaper of claim 1 wherein said structural material is restricted to an area extending transversely across said backing sheet between and overlapping at least a portion of said anchoring locations.

6. A multi-layer diaper comprising: a porous facing layer, a highly porous, loosely compacted, cellulosic fibrous batt having greater wettability to water than said facing layer; a paper-like, densified compacted cellulosic fibrous layer of relatively high wettability and relatively high fluid retentivity integral with said loosely compacted batt on the face thereof opposite the face in juxtaposition to said facing layer; a water-impervious backing sheet adhered to said densified layer; adhesive tabs attached to anchoring locations at one end of the outer face, opposite said adhered face, of said backing sheet, said tabs being adaptable to secure the diaper on an infant; said impervious backing sheet having scrim reinforcement adhered to a minor portion of its surface in at least the vicinity of said anchoring locations.

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