United States Patent

[11] 3,529,600

[72] Inventor Norman L. Seltzer
Lexington, Massachusetts

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[73] Assignee The Kendall Company
Boston, Massachusetts
a corporation of Massachusetts

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[54] **HYDROPHOBIC-HYDROPHILIC DIAPER AND TEXTILE FABRIC FOR FORMING THE SAME**
12 Claims, 7 Drawing Figs.

[52] U.S. Cl. 128/284, 139/383

[51] Int. Cl. A61f 13/16
[50] Field of Search 128/284

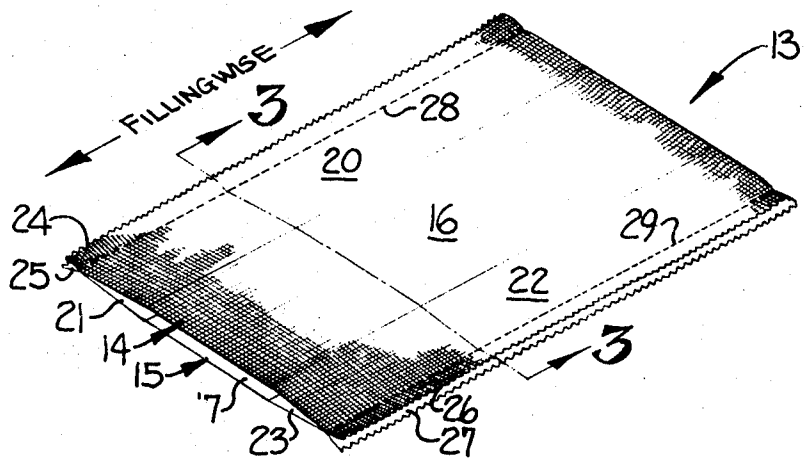
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Primary Examiner—Charles F. Rosenbaum
Attorney—Parrott, Bell, Seltzer, Park and Gilson

ABSTRACT: A textile fabric having corespun yarns formed of hydrophilic core fibers and hydrophobic sheath fibers, for use as a diaper to wick moisture away from the wearer's skin.



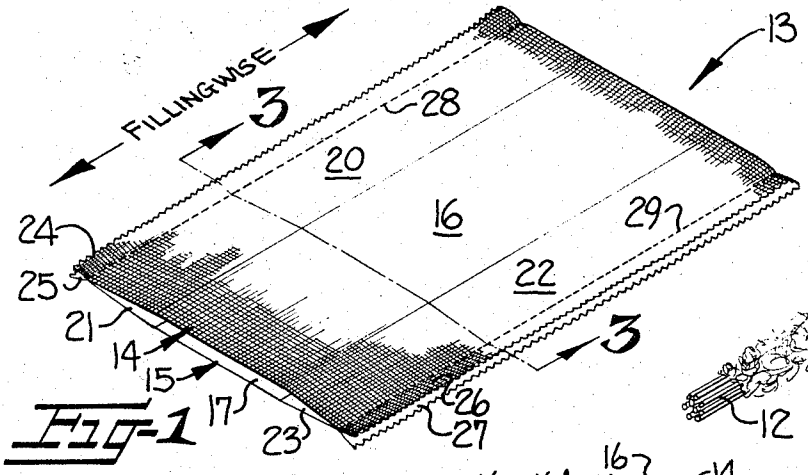


Fig-1

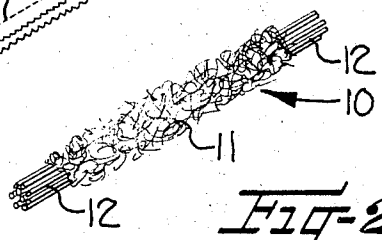


Fig-2

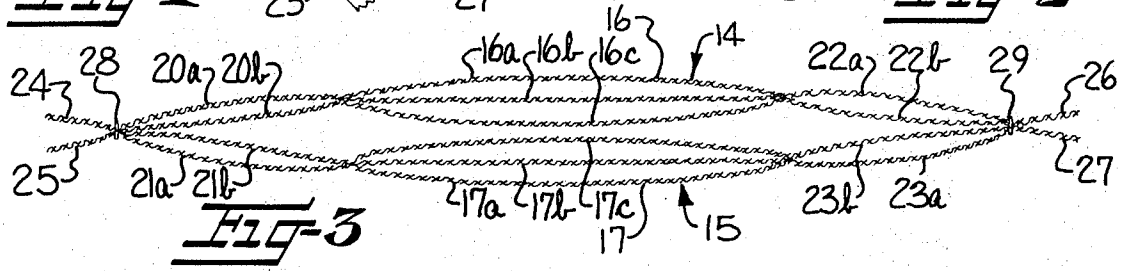


Fig-3

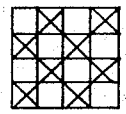


Fig-4

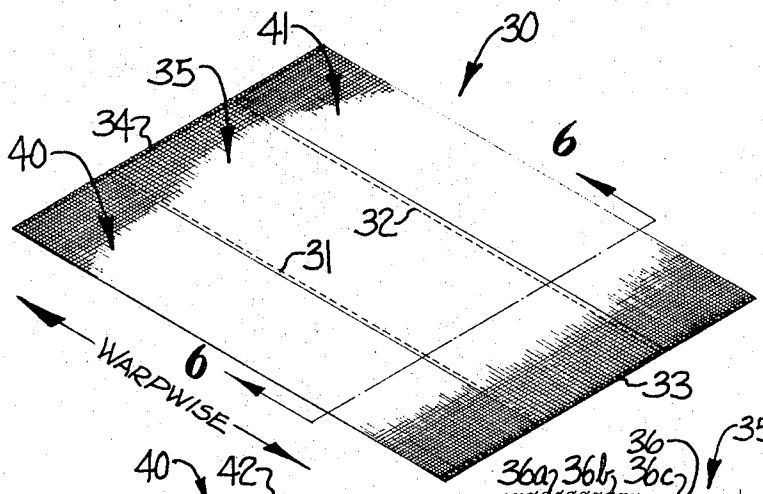


Fig-5

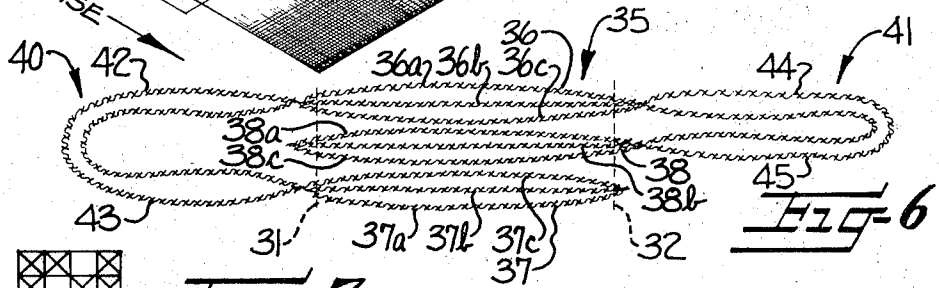


Fig-6

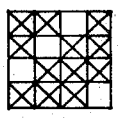


Fig-7

INVENTOR
NORMAN L. SELTZER
BY Parrott, Bell, Seltzer, Park & Heard
ATTORNEYS

HYDROPHOBIC-HYDROPHILIC DIAPER AND TEXTILE FABRIC FOR FORMING THE SAME

The present invention relates to diapers and textile fabric for forming the same, and more particularly to such diapers and textile fabric wherein substantial moisture absorptive capacity and retention is required but wherein the retention of moisture on the face of the diaper in contact with the wearer's skin is highly undesirable.

The adverse effects, such as diaper rash and other maladies, encountered when the moisture from body fluids is maintained in contact with the skin of the wearer of a diaper are well known. Many proposals for correcting or at least reducing this problem have been proposed and most recently it has been proposed to utilize the wicking characteristics of hydrophobic material for this purpose.

One such proposal was that a moisture pervious pad or insert of hydrophobic material be disposed on the internal surface of the diaper adjacent the wearer's skin. This moisture pervious insert, due to the characteristics of the hydrophobic material, would wick the moisture or body fluids away from the wearer's skin where the same would be absorbed by the diaper, in spaced relation to the wearer's skin, to thereby provide a substantially dry surface in contact with the wearer's skin. Such inserts are usually independent of the diapers and considerable difficulty has been encountered in properly positioning the inserts and maintaining the same in proper position during use.

Another of such prior proposals was that the hydrophobic material be incorporated within one surface of the diaper fabric and to fold the fabric in such a manner that this surface would contact the wearer's skin. This has heretofore been accomplished by utilizing hydrophobic yarns, in place of some of the hydrophilic yarns which would otherwise be used, in the diaper fabric and by positioning these hydrophobic yarns predominantly on the outer surface of the diaper corresponding to the surface adapted to contact the wearer's skin. For example, in a woven diaper fabric construction, this has been accomplished by utilizing hydrophobic warp yarns with hydrophilic filling yarns and in weaving the yarns together in a float-weave design to position the hydrophobic yarns predominantly on the outer surface of the diaper and the hydrophilic yarns predominantly on the interior surface thereof.

Since such hydrophobic yarns do not have any moisture absorptive retention, these prior hydrophobic-hydrophilic diapers have considerably reduced moisture absorptive retention as compared with conventional all-hydrophilic diapers. Since diapers are conventionally sold within a predetermined range of overall weight and because of cost aspects, this reduced absorptive retention may not readily be compensated for by the addition of hydrophilic yarns to the diaper. Accordingly, this reduced absorptive retention constitutes a serious deficiency in these prior hydrophobic-hydrophilic diapers over conventional hydrophilic diapers.

Also, to achieve a predominance of the hydrophobic yarns on the outer face of the diaper such prior hydrophobic-hydrophilic diapers have been restricted as to the fabric structure and weave design which may be utilized therein and the many benefits, such as reduced shrinkage, greater overall stability, etc., which may be achieved by the use of other weave designs, such as a plain weave, could not be achieved in such prior hydrophobic-hydrophilic diapers.

With the foregoing in mind, it is an object of the present invention to provide an improved diaper of the hydrophobic-hydrophilic type wherein substantially increased moisture absorptive retention is provided over prior diapers of this type without an increase in the overall weight of the diaper.

This object is achieved by forming at least one face of the diaper to contain corespun yarns having hydrophilic cores and hydrophobic fibrous sheaths surrounding and substantially covering the cores. The hydrophobic sheaths of the corespun yarns provide a face on the diaper which is at least partially hydrophobic and which upon being placed in contact with the wearer's skin, when the diaper is worn, will wick or draw moisture away from the wearer's skin into the interior of the yarns where the same is absorbed by the hydrophilic cores in spaced relation to the wearer's skin. These hydrophilic cores therefore provide substantially increased moisture absorptive retention over the prior diapers which utilized conventional hydrophobic yarns for this wicking action.

It is another object of this invention to provide a diaper of the character described having the aforementioned increased retention and wherein the predominantly hydrophobic face may be achieved without restrictions as to the type of weave employed so that any desired weave may be used including a plain weave which provides relatively high overall stability and resistance to shrinkage.

A more specific object of the present invention is to provide a diaper of the character described wherein a substantially all-hydrophobic face may be provided on the diaper while still providing substantial moisture absorptive capacity therein.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings in which:

FIG. 1 is an isometric view of a diaper incorporating the features of the present invention;

FIG. 2 is a fragmentary isometric view of a portion of a corespun yarn included in the diaper of FIG. 1;

FIG. 3 is an enlarged sectional view taken substantially along line 3—3 in FIG. 1;

FIG. 4 is a schematic weave diagram illustrating four repeats of a plain weave design which may be used in each of the layers of the fabric in the diaper in FIG. 1;

FIG. 5 is an isometric view of another embodiment of diaper incorporating the features of the present invention;

FIG. 6 is an enlarged, transverse sectional view taken substantially along line 6—6 in FIG. 5; and

FIG. 7 is a schematic weave diagram illustrating one repeat of a float type weave design which may be used in each of the layers of fabric in the diaper of FIG. 5.

Referring now to the drawings, there are illustrated therein two types of diapers constructed to include the features of the present invention, and, in accordance therewith, these diapers have at least one outer face thereof formed at least partially of corespun yarns, such as corespun yarn 10 (FIG. 2) having a hydrophobic fibrous sheath 11 surrounding and substantially covering a core 12 formed at least predominantly and preferably substantially, if not entirely, of hydrophilic material. Preferably, sheaths 11 of the corespun yarns are formed of thermoplastic material and more particularly are polyester and polypropylene fibers. Also, cores 12 are preferably formed of cellulosic material and more particularly are rayon or cotton fibers. Additionally, cores 12 of the corespun yarns 10 are preferably collectively about 30—40 percent by weight of the corespun yarns in the outer face of the diaper to provide the desired moisture retention while still providing substantial coverage of the cores by the sheaths 11. Preferably, each core 12 is about 30—40 percent by weight of the corespun yarns.

Accordingly, when the diapers are being worn with these faces in contact with the wearer's skin, moisture will be wicked away from the wearer's skin by the hydrophobic sheaths 11 of the corespun yarns 10 and will not be maintained in contact therewith as is the case with conventional hydrophilic diapers. Additionally, the hydrophilic cores 12 will absorb this moisture interiorly of the corespun yarns and in spaced relation to the wearer's skin. Thus, hydrophilic cores 12 provide increased retention in these diapers over prior diapers of this general type and also result in quicker absorption of the moisture due to the same being closer to and in more intimate contact with the hydrophobic sheaths 11 than the combination of hydrophobic yarns and hydrophilic yarns of prior diapers of this general type.

Preferably, both faces of these diapers are formed at least predominantly of corespun yarns 10 so that either face may be placed in contact with the wearer's skin and the great particularity and care in folding and placement on a wearer hereto-

fore encountered with prior diapers of this type are obviated. Also, these diapers are preferably formed of woven textile fabric, but it should be understood that textile fabrics formed in any other manner, such as by knitting, cross-laying, etc., to include these corespun yarns may also be utilized. Further, these diapers may be of any standard construction, either regular or prefold, but they are illustrated in the drawings and will be described herein as being of two of the more popular diaper prefold styles.

Referring now to FIGS. 1—4, there is shown a diaper **13** formed of textile fabric woven of a width corresponding to twice the desired length of the diaper and this fabric is folded along a medial fold line to superimpose halves thereof to form diaper **13** into a shape and size adapted to fit a wearer. Diaper **13** includes upper and lower diaper sections **14, 15** which have one end thereof defined by selvages of the fabric and the other end thereof defined by the fabric at the fold line. Upper and lower diaper sections **14, 15** include upper and lower elongate central panels **16, 17** respectively, each preferably formed of a plurality of layers of fabric. As illustrated in FIG. **3**, these central panels are each formed of three layers **16***a*, **16***b*, **16***c* and **17***a*, **17***b*, **17***c*, respectively.

Upper and lower diaper sections **14, 15** also include side panels **20, 21**, and **22, 23** which are formed integral with opposite sides of the central panels **16** and **17** and preferably are each formed of two layers of fabric **20***a*, **20***b*; **21***a*, **21***b*; **22***a*, **22***b*; and **23***a*, **23***b*, respectively. Preferably, the central and side panels extend longitudinally in a fillingwise direction, but may extend warpwise without departing from the present invention.

Suitable ravel resistant edge portions are provided at opposite side edges of diaper **13** and, in the illustrated embodiment, these side edge portions are defined by pinking bars **24, 25** and **26, 27**, respectively joined to the side portions of the upper and lower sections **14, 15**. If desired, these edge portions may have the desired ravel resistant characteristics imparted thereto by heat fusion of the hydrophobic sheaths **11** of the corespun yarns **10** to the adjacent yarns in accordance with copending application, Ser. No. 578,259 filed September 9, 1966, and entitled Fabric Having Ravel Resistant Edge Portion.

Preferably, diaper **13** may be sewn, sealed or otherwise secured in its folded condition so as to be of a shape and size ready for use on a wearer. As illustrated, spaced lines of stitching **28, 29** penetrate through the folded fabric to hold the sections **14, 15** in superimposed relation.

Referring now to FIGS. **5—7**, there is shown therein another type of prefold diaper **30** formed of textile fabric which preferably is woven of a width exceeding the desired width of the finished diaper and is folded about fold lines spaced apart a distance corresponding to the desired width of diaper. The diaper fabric is preferably secured in this folded condition as by spaced lines of stitching **31, 32** and opposite ends are preferably finished, as by overedge stitching **33, 34** to provide ravel resistant characteristics.

Diaper **30** includes an elongate central panel **35** which is formed by three superimposed upper, lower and intermediate central panel sections **36, 37, 38** each of which preferably includes a plurality of layers of fabric. As illustrated, these sections are defined by layers **36***a*, **36***b*, **36***c*; **37***a*, **37***b*, **37***c*; and **38***a*, **38***b*, **38***c*, respectively.

Side panels **40** and **41** are disposed on opposite sides of central panel **35** and are woven integral therewith. Side panels **40, 41** include upper and lower sections **42, 43**, and **44, 45**, respectively, and these sections are also preferably defined by a plurality of fabric layers. As illustrated, these side panel sections are respectively defined by layers **42***a*, **42***b*; **43***a*, **43***b*; **44***a*, **44***b*; and **45***a*, **45***b*.

While the above-described construction of diaper **30** is preferred and, in accordance therewith, the central and side panels extend longitudinally in a warpwise direction of the fabric, it should be understood that the construction of this diaper may be changed without departing from the present invention and that the present invention is applicable to other diaper forms or constructions from those specifically shown and described herein, including non-prefold diapers which are not secured in folded condition but are folded prior to each use.

As stated above, at least one and preferably both outer faces of diapers **13** and **30** are formed at least partially of corespun yarns **10**. Preferably, these faces are formed at least predominantly of the corespun yarns. This predominance of the corespun yarns on the outer faces of these diapers may be achieved in any desired manner, two of which will be described hereinafter as exemplary ways of forming these diapers to achieve the advantages of the present invention.

It is frequently desirable to have at least the central portion of diapers woven in a plain weave for many reasons including the increased overall stability and resistance to shrinkage provided by this weave. Because of these desirable advantages, most gauze diapers fabric is woven in a plain weave design. However, prior hydrophobic-hydrophilic diapers have relied upon float-type weaves to achieve predominance of hydrophobic material on the outer faces of diapers. The present invention has removed any such restrictions as to the type of weave design which may be utilized to achieve the predominance of hydrophobic material on the outer faces of the diaper which is preferable in accordance with the present invention.

Accordingly, a plain weave design, four repeats of which is illustrated in FIG. **4**, may be utilized in the fabric of either diaper **13** or diaper **30** and, in such event, the predominance of hydrophobic material on the outer faces thereof may be achieved by having the yarns forming the outer layers of the textile fabric formed predominantly of the corespun yarns **10**. For example, one set of the yarns forming these outer layers may be formed of corespun yarns **10** and be greater in number and/or size than the other set formed of hydrophilic yarns, and will provide the predominance of hydrophobic material even though the sets of yarns are interwoven in a plain weave design. Also, both sets of yarns forming the outer layers may be formed at least partially of corespun yarns **10** and collectively provide the predominance of hydrophobic material on the outer faces. In many instances, it is highly desirable to have the outer faces of the diaper, at least in the central portion, formed entirely of hydrophobic material and in these instances, both sets of warp and filling yarns forming the outer layers of at least the central panel would be formed substantially entirely of corespun yarns **10**.

In accordance with the present invention, the predominance of hydrophobic material may be achieved on the outer faces of these diapers by a float-type weave, and in accordance therewith, one of the sets of yarns forming these outer layers may be corespun yarns **10** and the other set of yarns will be hydrophilic yarns. The corespun yarns and the hydrophilic yarns are then interwoven in a float weave design, such as a 3/1 warp float twill illustrated in FIG. **7**, to position, in this instance, the corespun yarns predominantly on the outer surfaces of the outer layers of the diapers and the hydrophilic yarns predominantly on the inner surfaces of such outer layers. Of course, other float-type weaves may be utilized and, as used herein, a float-type weave is any weave in which the warp or filling yarns pass over more than one of the other yarns between interlacings.

Regardless of the construction of the outer layers to provide the presence and predominance of the corespun yarns **10** on the outer surfaces thereof, it is preferable that the interior layers of the diapers in both the central and side panels be formed substantially of hydrophilic yarns to enhance the moisture absorptive retention interiorly of the diaper. For example, in diaper **13**, interior layers **16***b*, **16***c*, **17***b*, **17***c* of central panels **16, 17** and interior layers **20***b*, **21***b*, **22***b*, **23***b* of the side panels are preferably formed substantially entirely of hydrophilic yarns. The same is true for diaper **30** with respect to the interior layers **36***b*, **36***c*, **37***b*, **37***c* and all layers of section **38** of central panel **35**, except that layer **38***a* of section **38**

may include some of the corespun yarns **10** due to the particular manner of forming the diaper **30**. Also, the interior layers of side panels **40**, **41**, namely layers **42***b*, **43***b*, **44***b*, and **45***b*, are also preferably formed substantially entirely of hydrophilic yarns.

It will therefore be apparent that the present invention provides hydrophobic-hydrophilic diapers having at least one partially hydrophobic outer face and having considerably increased moisture absorptive retention over previous hydrophobic-hydrophilic diapers without any restriction as to the type of weave which may be utilized therein.

In the drawings and specification there have been set forth preferred embodiments of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. A diaper of multi-layer fabric construction characterized by substantial moisture absorptive capacity and retention and an ability to wick moisture away from either face thereof, said diaper being adapted to be placed on a wearer with either face in contact with the wearer's skin, said faces of said diaper being formed at least predominantly of woven corespun yarns each having a hydrophilic core and a hydrophobic fibrous sheath surrounding and substantially covering the core, said hydrophobic sheaths of said corespun yarns serving to wick moisture away from the wearer's skin and said hydrophilic cores serving to absorb this moisture internally of the corespun yarns and in spaced relation to the wearer's skin to present a substantially dry face in contact with the wearer's skin.

2. A diaper according to claim **1** wherein each fabric layer comprises warp and filling yarns interwoven in a plain weave to provide relatively high overall stability and resistance to shrinkage.

3. A diaper according to claim **1**, wherein each fabric layer comprises interwoven sets of warp and filling yarns, and wherein one of said sets of yarns in at least the face fabric layers comprises said corespun yarns and said other set of yarns therein comprises hydrophilic yarns, said sets of yarns being interwoven in a float-type weave with the corespun yarns predominantly on the outer surfaces of the diaper.

4. A diaper according to claim **1**, wherein said hydrophilic cores of said corespun yarns are cellulosic strands and said hydrophobic fibrous sheaths are of thermoplastic material.

5. A diaper according to claim **4** wherein said cellulosic strands are rayon and the said thermoplastic fibrous sheaths are polypropylene.

6. A diaper according to claim **4** wherein said cellulosic strands are cotton and said thermoplastic fibrous sheaths are polyester.

7. A diaper according to claim **1** wherein said hydrophilic cores are collectively about 30 percent to 40 percent by weight of the corespun yarns.

8. A diaper according to claim **7** wherein each hydrophilic core is about 30 percent to 40 percent by weight of the corespun yarn.

9. A diaper characterized by substantial moisture absorptive capacity and retention and an ability to wick moisture away from at least one face thereof, said diaper being adapted to be placed on a wearer with said face in contact with the wearer's skin, said diaper comprising a textile fabric folded into a generally rectangular shape and a size adapted to fit a wearer, spaced lines of stitching penetrating the folded fabric and securing the same in its folded condition, said face of said diaper being formed at least predominantly of woven corespun yarns each having a hydrophilic core and a hydrophobic fibrous sheath surrounding and substantially covering the core, said hydrophobic sheaths of said corespun yarns serving to wick moisture away from the wearer's skin and said hydrophilic cores serving to absorb this moisture internally of the corespun yarns and in spaced relation to the wearer's skin to present a substantially dry face in contact with the wearer's skin, and wherein said diaper has a central panel and side panels disposed on opposite sides of said central panel and integral therewith, at least said central panel comprising two outer fabric layers and at least one interior fabric layer, the outer surfaces of said outer layers defining central face portions of the diaper and being formed at least predominantly of said corespun yarns for wicking moisture away from the wearer's skin and said interior layer being formed substantially of hydrophilic yarns for providing moisture absorptive capacity interiorly of the diaper.

10. A diaper according to claim **9** wherein each side panel also comprises two outer fabric layers, and at least one interior fabric layer, the outer surfaces of said outer layers of said side panels defining side face portions of the diaper and being formed at least predominantly of said corespun yarns, said interior layer being formed substantially of hydrophilic yarns for absorbency interiorly of the side panels, and wherein said central panel has a greater number of fabric layers than each side panel.

11. A diaper according to claim **9** wherein said central panel fabric layers are formed of interwoven sets of warp and filling yarns with at least said outer layers thereof being of plain weave construction, and said corespun yarns substantially forming both sets of such yarns in said outer layers.

12. A diaper according to claim **9** wherein said central panel fabric layers are formed of interwoven sets of warp and filling yarns, said corespun yarns substantially forming one of said sets of yarns in said outer layers and the other set therein being formed of hydrophilic yarns and said outer layers being of float weave construction with said corespun yarns positioned predominantly on the outer surfaces thereof.