

Sept. 1, 1959

J. C. BLETZINGER ET AL

2,902,038

SANITARY NAPKIN

Filed Feb. 14, 1956

2 Sheets-Sheet 1

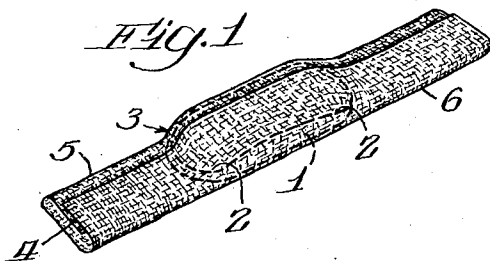
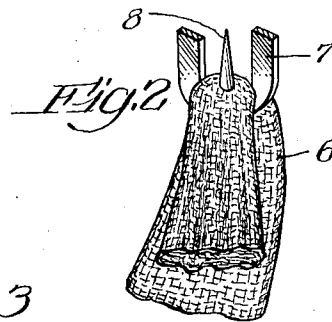
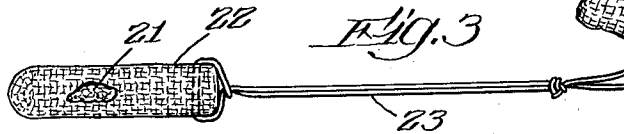
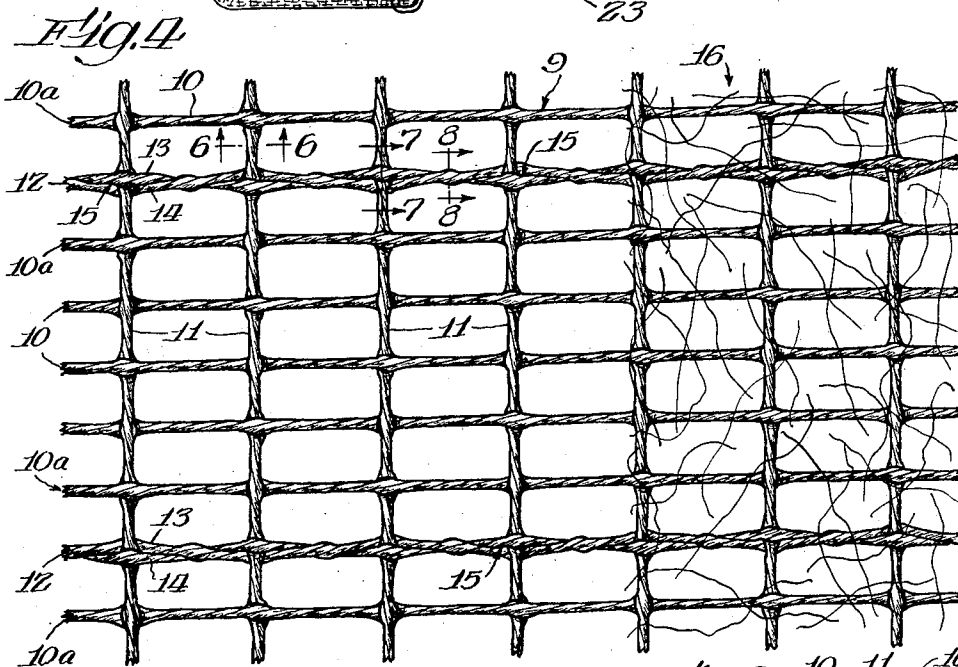
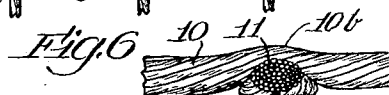
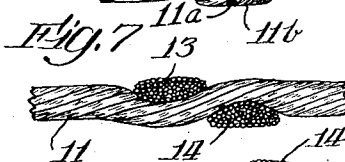
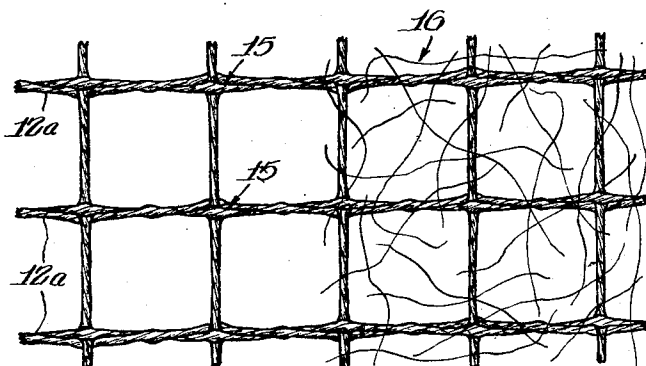


Fig. 5

By Soana, Glaister + Anderson attys.

Inventors:
John C. Bletzinger
Winterton U. Day

Sept. 1, 1959

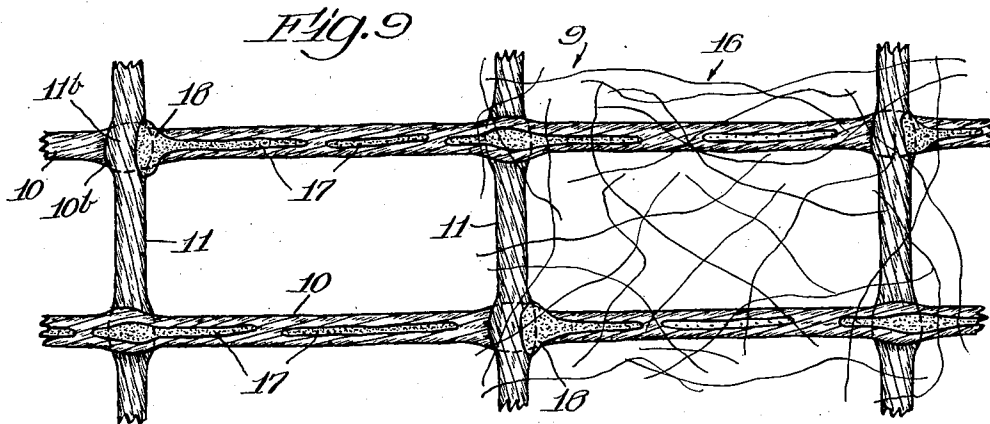
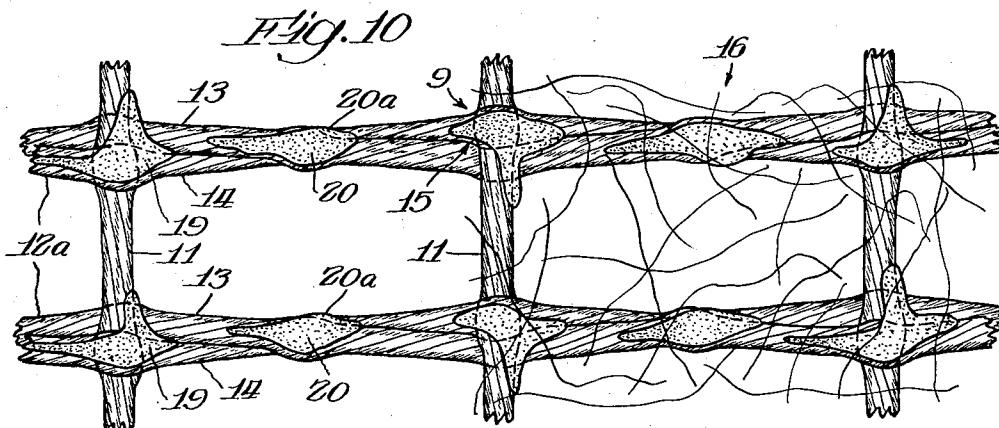
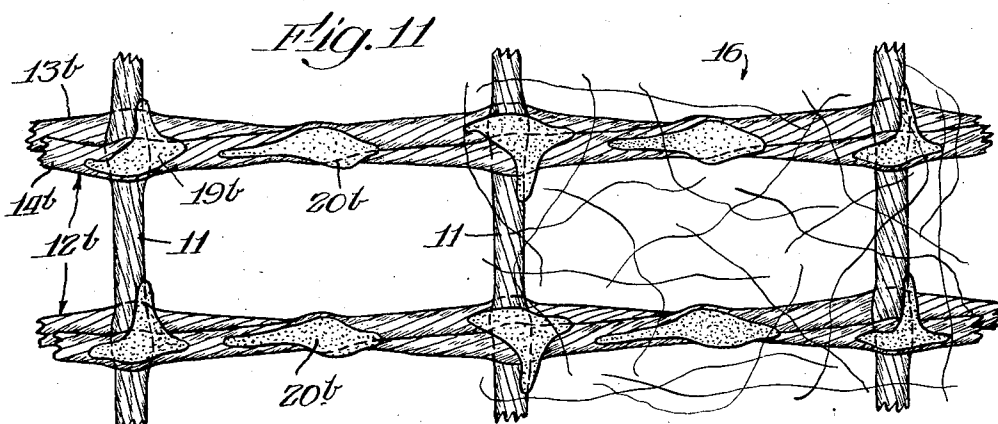
J. C. BLETZINGER ET AL

2,902,038

SANITARY NAPKIN

Filed Feb. 14, 1956

2 Sheets-Sheet 2



Inventors:
John C. Bletzinger
Winterton H. Day
By *Loans, Maister + Anderson Attys.*

1

2,902,038

SANITARY NAPKIN

John C. Bletzinger and Winterton U. Day, Neenah, Wis.,
assignors to Kimberly-Clark Corporation, a corpora-
tion of Delaware

Application February 14, 1956, Serial No. 565,462

4 Claims. (Cl. 128—290)

This invention relates to improvements in absorbent dressings, and especially perineal dressings and catamenial devices, the latter comprising sanitary napkins and catamenial tampons. This application is a continuation in part of our copending application Serial No. 528,228, filed October 5, 1956, now abandoned.

Such dressings and devices comprise absorbent bodies enclosed in wrappers of highly pervious material. The wrapper serves the highly important purpose of confining the absorbent pad and the components thereof which are usually of fibrous character, often including a substantial volume of fibers which tend to separate from the absorbent body unless effectively confined. The use of a substantial proportion of short fibers in the pad is desirable for technical and also economic reasons, and the use thereof imposes the requirement that the wrapper be capable of retaining the short fibers or that some means other than the wrapper be provided for fiber retention purposes.

The wrapper of a sanitary napkin is usually extended beyond the ends of the absorbent pad body to provide supporting tabs or loops through the agency of which the bandage may be supported by attachment to the buckles of a sanitary belt or by pins to portions of a supporting belt or clothing. When supporting tabs are provided in this manner, it is important that the wrapper material be strong enough that pins, buckle prongs or the like used for securing the bandage to the supporting article will not cause such fraying, distortion, or other injury to the wrapper fabric as to impair the security with which the napkin may be supported through the agency of the wrapper-formed tabs. At the same time, it is highly desirable that the wrapper fabric be of light weight and highly pervious to the exudate which is to be absorbed. Constructional details to meet the indicated requirements of strength are more or less opposite or antagonistic to constructional details which attain openness or high permeability and light weight.

Surface smoothness is another desirable characteristic of both catamenial napkins and tampons, to avoid body irritation and chafing.

Woven cotton gauze having a thread count construction of about 18 x 14 has heretofore been commonly used as wrapper material for sanitary napkin wrappers. More open meshes have been tried but they have been somewhat unsatisfactory because of their tendency to fray and become distorted both as an incident to the hereinabove mentioned considerations, and also as an incident to handling of the material in various steps by which it is prepared for use in the manufacture of sanitary napkins (or other perineal dressing and absorbent bandages) and by which it is applied to the absorbent pad to form the napkin or bandage.

As a practical matter, ordinary woven gauze webs of about 18 x 14 construction have been preferred for sanitary napkin wrapper purposes in order that the fabric have sufficient stability, that is to say, permanency of spac-

2

ing of the threads to provide (a) adequate strength, especially to resist fraying and damage by pins, buckles and the like used for attaching the napkin to a supporting belt or other support, (b) a good appearance which is of considerable importance in connection with articles such as sanitary napkins, and (c) the ability to prevent short fibers from separating from the pad. So far as strength and pad support is concerned, webs of much more open constructions could be used but such webs fray much too readily during bleaching and other treatments by which the fabric is prepared for the indicated end use, and as an incident to normal manipulation of the fabric during its conversion into an absorbent bandage, and as an incident to the necessary handling of the bandage in normal application and use.

In general, it is the object of the present invention to provide an absorbent dressing, such as a sanitary napkin, in which the requirements of permeability in the wrapper and of surface smoothness, and strength, are effectively incorporated while at the same time avoiding the use of excessive quantities of material, objectionable bulk, and excessive constructional cost; and to provide a sanitary napkin in which the wrapper material, even though made of highly open mesh woven fabric is nevertheless very regular or uniform in respect of its thread spacing and in which the thread spacing is effectively preserved so that when the napkin reaches the ultimate user, it will present a neat and otherwise satisfactory appearance. It is also an object of this invention to provide an improved fabric of the character indicated.

Other objects and advantages of the invention will be understood by reference to the following specification and accompanying drawings (2 sheets).

In the drawings:

Fig. 1 is a perspective illustration of a sanitary napkin; Fig. 2 is a perspective illustrating a typical manner in which a sanitary napkin is supported when in use;

Fig. 3 is a side elevation of a catamenial tampon; Fig. 4 is a schematic face view, on an enlarged scale, of a portion of a web of fabric having certain characteristics suitable for some forms of the present invention;

Fig. 5 is a schematic face view, on an enlarged scale, of a portion of another web of fabric having characteristics suitable for some forms of the present invention;

Figs. 6, 7 and 8 are cross sections on the lines 6—6, 7—7, and 8—8 respectively of Figure 4 on a further enlarged scale; and

Figs. 9, 10 and 11 are schematic face views of fabric made according to this invention, Figs. 9 and 10 respectively corresponding to different portions of Figure 4 but on a further enlarged scale and illustrating a modification, and Fig. 11 representing a modification of the structure shown in Fig. 10.

The sanitary napkins represented in Figure 1 comprises an absorbent pad body 1 which may be of any preferred construction. It should, of course, be selected to provide the desired fluid absorbing and holding capacity. In this instance, the pad 1 is represented as having thinned or compressed and rounded ends as indicated at 2. Said pad may consist of cellulose wadding of short absorbent wood pulp or other fiber. Some suitable fibers may range in length from about one-sixteenth of an inch or less to about three-sixteenths of an inch or more. Said absorbent pad body is enclosed in a wrapper 3 which is made of very open mesh, highly permeable, woven gauze which permits menstrual exudate to readily penetrate the wrapper and reach the absorbing body 1. The wrapper 3 is a rectangular section of fabric which is folded lengthwise around the pad body 1, opposite side margins of the fabric overlapping as indicated at 4. The wrapper is of such length as to extend beyond the opposite ends of the

absorbent pad so as to provide front and rear attachment tabs 5 and 6. In this instance, the front attachment tab 5 is shown as being slightly shorter than the rear tab 6 but this is not important so far as the present invention is concerned.

The fabric of which the wrapper 3 is made should be strong enough to provide effective support for the absorbent pad, that is to say, to prevent the pad from breaking through the wrapper, and also to provide in the attachment tabs 5 and 6, adequate strength to permit effective support of the napkin by attachment of said tabs to a supporting belt or garment by means of a pin or the like passed through the tabs and such belt or garment. For example, as shown in Figure 2, one common form of support for the napkin is to pass a tab end through the buckle 7 of a sanitary belt, the buckle including a pin 8 on which the tab is impaled as it passes through the buckle. It can be readily appreciated that the threads forming the wrapper fabric are subjected to severe strains by the impaling pin 8 and that unless the threads of the wrapper fabric are held in fixed relation to each other, the wrapper material will tend to break down and fray where it engages the impaling pin 8. Such fraying impairs the firmness and security of supporting attachment of the napkin to the belt (or other article) and is highly objectionable.

One way in which an especially satisfactory wrapper may be made is to employ the known technique of leno weave in connection with at least some if not all of the warp threads of the woven fabric. For example, Figure 4 represents on an enlarged scale, woven gauze 9 having a mesh construction of about 10 x 5 in which certain of the warp threads are of leno weave form. The fabric 9 is mainly of conventional in and out or alternately over and under woven construction, i.e., conventionally interwoven warp and filler threads represented at 10 and 11 respectively. Leno weave warp threads 12 are incorporated in predetermined spaced relation. Said leno weave warp threads 12 each embody a pair of threads 13 and 14 located in close proximity to each other and generally in contact with each other along their lengths. Said threads 13 and 14 cross back and forth relative to each other and are offset in opposite directions normal to the plane of the fabric to provide loops or eyes as indicated at 15 through which pass the filler threads 11. The filler threads 11 are gripped or pinched between the threads 13 and 14 of the leno weave warp threads 12 with sufficient force to strongly resist relative shifting of the filler threads and warp threads; that is to say, the grip of the leno warp threads on the filler threads strongly resist shifting of the leno warp threads laterally along the lengths of the filler threads, and of the filler threads laterally along the lengths of the warp threads.

As an incident to the more or less interlocked relationship which exists between the leno weave warp threads 12 and the cross or filler threads 11, the conventionally interwoven warp and filler threads 10 and 11 are also more or less held against shifting relative to each other, the magnitude of this effect being determined, at least in part, by the frequency of occurrence of the leno weave warp threads.

The secure locking of the filler threads 11 against shifting lengthwise of the warp threads is of very great importance in that the fixation of the filler thread positions imparts to the fabric, significant resistance to displacement of the filler threads along the lengths of the warp threads; hence, the strains or forces imposed by a fastening pin 8 or the like, can be easily withstood without serious shifting of said filler threads, and the security of attachment of the napkin to the supporting member and the firmness of support are not readily materially impaired. This is not to stay that the cross threads 11 are rigidly held against shifting or that said cross threads may not be displaced to a limited but unobjectionable

extent by the said forces. Rigid inter-locking of the threads may be effected by adhesive interattachment of the crossing thread portions, but the described leno weave arrangement provides an important, highly useful thread position stabilizing effect without adhesive stabilization and without significant sacrifice of important flexibility, softness and other desirable qualities or attributes of the wrapper fabric.

The employment of at least some leno weave warp threads in sanitary napkin wrapper material permits the fabric to be made of more open construction than has heretofore been practicable; the reduced amount of thread per unit of area reduces the cost of the material entering into the fabric, and the reduced number of filler threads per inch, permits production of the fabric at a higher rate of speed which is determined largely by the number of said filler threads per unit of length of the fabric.

The reduced amount of thread per unit of area provides a softer and more flexible fabric which is more easily foldable lengthwise around the absorbent pad body, and the stabilization of thread positions as above explained, attains not only desirable strength attributes but also the desirable good appearance resulting from uniformity of thread arrangement in the fabric. Said stabilization permits various treatments of the fabric, such as bleaching and various manufacturing and converting processes to be carried out with much less loss due to damaged wrapper fabric than has heretofore been experienced with equally open mesh fabric of conventional weave. In a combination or mixed leno and conventional weave fabric, the warp threads in one of the weaves, for example in the leno weave threads, may be made of lighter weight than those in the other weave. Also, leno weave warp threads, or conventional weave warp threads, or combinations thereof may be arranged in higher thread count relationships in selected areas than in other areas, for example, in the areas of a sanitary napkin wrapper which overlie the side edges of the absorbent pad. Other advantageous attributes may also be cited but the foregoing are perhaps the most important.

Very satisfactory results are obtained with combination leno and plain weave fabric such as shown in Figure 4. Experience indicates that a suitable sanitary napkin wrapper may be made from combination weave fabric having from 5 to 18 warp or machine direction threads per inch of width with one pair of warp threads as a leno weave, and from 4 to 14 cross or filler threads per inch of length.

All of the warp threads may be of leno weave construction if desired as represented at 12a in Figures 5 and 10, in which case the mesh construction of the fabric may be as large as 4 x 4 and as small as 18 x 14, or, in terms of thread construction, as open as 8 x 4, and as tight or closed as 36 x 14.

("8 x 4" thread construction means that there are 8 warp or lengthwise threads per inch of width of the fabric and 4 filler or cross direction threads per inch of length of the fabric, the first figure indicating the number of warp threads per inch and the second figure indicating the number of cross threads per inch. In "leno" weave fabrics of the type illustrated, the warp threads are arranged in pairs and the pairs are spaced farther from each other than are the single warp threads in conventionally woven fabric of like warp thread construction.)

The ranges of construction just given in respect of mixed or combination weaves and in respect of all-leno weaves, are not to be considered as excluding other thread constructions and other paired leno weave thread frequencies; they merely indicate to a limited extent, fabric variations which have been found suitable.

Variations of the above described true leno weave, for example, mock leno weave shown in Figure 11, may also be used. Mock leno weave warp threads, rep-

5

resented at 12b in Figure 11, embody pairs of threads 13b and 14b which not only cross each other intermediate adjacent filler threads 11 as illustrated (and as in the true leno weave of Figure 10), but also alternately cross over and under the successive filler threads as shown in Figure 11. The thread pairs 12b in mock leno weave thus are arranged to provide eyes or loops between them through which the filler threads 11 pass and in which said filler threads are gripped.

Mock leno weave and other leno weave variations provide thread stabilization and other advantages of the character above and hereinafter set forth in respect of true or normal leno weave construction; however, there may be some differences in the effectiveness with which some of the variations accomplish the indicated benefits of true leno weave construction. The effectiveness of various leno types of weave to maintain the threads in relatively fixed position (incident to the grip of the pairs of warp threads on the filler threads) makes fabric embodying such weaves very desirable for the uses herein set forth. References to leno weave hereinafter and in the appended claims, unless otherwise indicated, should be understood to refer generally to leno type weaves rather than the specific, true leno weave shown in Fig. 10. Leno type weaves embody filler threads which are gripped between one or more pairs of associated warp threads, each of which pairs have associated threads crossed in any manner to cause the same to form eyes through which the filler threads pass and whereby the pairs of leno warp threads are enabled to cooperatively grip the filler threads.

A sanitary napkin wrapper is usually in the neighborhood of about eight inches in width, this width being folded transversely around the length of the absorbent pad. It appears that for such a width of fabric, important benefits will be obtained by using as few as one or two leno weave warp thread pairs in combination with conventionally interwoven warp and filler threads in a fabric of 10 x 5 mesh construction.

Fabric embodying the above described constructions made of conventional spun cotton fiber threads, is suitable for the wrapper component of a sanitary napkin. However, additional advantages are obtained by making the fabric from low twist cotton or other fiber threads or low twist, multiple, continuous filament threads, mixtures of these, or mixtures of either or both of the latter with said conventional spun cotton fiber threads. Low twist threads are usually somewhat softer than conventional spun threads of comparable weight and the softness obtained by the use of low twist threads is quite desirable in a sanitary napkin wrapper. The softness of low twist threads not only provides high flexibility and ease of folding of the wrapper material around a pad, but also imparts to the surface of the bandage a desirable soft or smooth feel by which irritation or chafing of the contacted body areas is avoided.

The above mentioned softness, smoothness, and non-irritating characteristics of fabric made of low twist threads, may be greatly amplified by applying to the woven material an applique or facing 16 of suitable fibers such as, for example, cotton fibers. The fibers employed in the facing are preferably of such length that they will generally span the interstices of the fabric so as to engage several thread portions of the fabric to become effectively attached thereto. This attachment may be the result of mere frictional engagement of the fibers with the threads, but said attachment is usually strengthened by interlacing of at least some of the fibers with the threads of the fabric, such interlacing normally occurring as an incident to the deposition of the fibers on the fabric, either by air laying in the form of free fibers or in web form as they issue from a card, garnett, or other apparatus by which the fibers are more or less matted together into a continuous web. Such self-attachment may be and pref-

6

erably is improved by calendering the web with the fiber facing thereon.

A fiber applique such as above referred to may also be adhesively secured to the gauze web by incorporating a small percentage of thermoplastic fibers or adhesive-bearing fibers in either the fiber layer or in some or all of the threads in the gauze fabric, or in both, and applying heat or pressure, calendering, or otherwise treating the composite web to reactivate the thermoplastic fibers or other adhesive component to cause the parts to be more strongly interbonded. For another example, adhesive may be applied directly to the threads of the woven web, and the fiber facing applied to the adhesive bearing web. The adhesively bonded composite web may also be calendered to cause deeper embedment of the fibers into the adhesive for more secure attachment. For another example, adhesive may be sprayed on the composite web, some of the adhesive being certain to engage fibers where they cross threads to effect the desired bonding. The adhesively sprayed web may also be calendered if desired to improve the contact between the adhesive and the fibers and threads. When adhesive is used in any manner for improving the attachment of the fiber facing to the woven web, thermoplastic adhesive material may be applied to the woven web and permitted to set or partially set before the fiber facing is applied and the composite web thereafter calendered or otherwise treated to reactivate the adhesive and to enable the fibers of the facing to become embedded in the adhesive to improve the adhesive attachment of the fibers to the threads.

The fiber applique may embody any desired kind of fibers and in a sanitary napkin wrapper, said fiber applique should be of rather light weight or low density so as to avoid impairment of the porosity of the wrapper fabric. A fiber applique having a basis weight within the range of about 1½ to 6 grams per square yard is suitable, a weight of around 4 grams being very satisfactory for a carrier web of 10 x 5 mesh. One example of suitable fiber would be the grade of cotton commercially known as B comber cotton which contains fibers varying in length from about ⅓ of an inch and less to around 1 inch or more with around 50 percent of fiber being in the neighborhood of about ⅞ of an inch in length.

Whether the gauze is all leno weave, or mixed or combination leno and conventional over and under weave, the threads employed in weaving the gauze, if of conventional spun fiber construction, preferably (but not necessarily) have a cotton count in the range of between 20 and 100 in webs having a thread count construction within the range of about 5 x 4 to 18 x 12. If low twist, continuous multiple-filament threads are employed, it is preferable (but not essential) that they have a denier within the range of 15 to 150 and be formed of from 2 to 150 filaments having a denier within the range of about 1 to 15. The twist of the threads should preferably be not more than about 12 turns per inch and preferably 6 or less turns per inch. One desirable embodiment of the woven fabric contains continuous multiple-filament threads of 75 denier formed of 30 filaments with a twist of about 4 turns per inch. These specifications apply to both the warp and filler threads.

("Cotton count" is herein used in accordance with the standard English cotton count system which is used in both England and the United States. It expresses the relation between length and weight of a cotton thread or yarn and is determined by dividing the number of yards of the yarn by its weight in grains, dividing 7,000 by the number of yards of yarn in a standard hank of the kind of yarn under consideration, and multiplying the dividends thus obtained. 7,000 is the number of grains in a pound, and a "standard" hank contains, for example, 840 yards of cotton, spun silk, or spun rayon, or 560 yards of worsted yarn.)

("Denier" is the standard textile denier which is the weight in grams of 9,000 meters of yarn or thread.)

The employment of threads of low twist is also of substantial benefit in that such threads usually exhibit considerably higher tensile strength than conventional spun fiber threads of like weight. For example, in a conventional gauze construction having 40's warp and 50's filling threads woven into gauze of 18 by 14 construction, the weight of such gauze averages about 12.6 grams per square yard. Conventional spun threads of lower weight can be used only with great difficulty because of the occurrence of thread breakage which seriously hampers the weaving operation. By using continuous multi-filament, low twist threads of rayon, for example, the relatively increased strength of such threads permits the weaving of 18 x 14 mesh gauze with threads of about 75 denier. The weight of woven gauze made of such low twist low denier multi-filament rayon threads would be in the neighborhood of 8.5 to 9 grams per square yard, i.e., from 3.6 to 4.1 grams less than the weight of a corresponding conventional spun thread gauze web of like construction. The tensile strength of a 40's thread is approximately equalled by the tensile strength of a 75 denier rayon thread embodying 30 continuous filaments, each filament being of a 2.5 denier. The weight of a 40's warp thread is about 1.75 times the weight of an equal yardage of the last mentioned low twist multi-filament rayon thread. An additional advantage of using multi-filament rayon threads when weaving absorbent bandage wrapper material, is that bleaching and associated treatments and handling is usually unnecessary while still producing a fabric of a suitable degree of whiteness.

Another benefit attained by employing low twist threads, whether of cotton fiber or multi-filament construction is that the low twist facilitates flattening of the threads when the woven fabric is calendered, whether or not a fiber facing is applied. The flattening of the threads tends to reduce the thickness of the fabric and to produce a more flexible fabric having flat and smooth thread surfaces as distinguished from the normal roundness of the uncalendered threads. As shown in Figure 6, on an enlarged scale, a thread 11 intermediate its intersections with the warp threads is often more or less oval shape in cross-section as shown at 11a although it may sometimes retain its normal cross sectional shape, depending largely on the calendering pressure to which the fabric is subjected. The cross section of the warp threads 10 intermediate filler threads 11, would be similar to that indicated at 11a. This results in an overall flattened or smoothened surface which is desirable. For purposes of adhesive attachment of a fiber applique to the woven thread web, this widening of the faces of the threads which form the faces of the fabric is advantageous in that it provides increased thread surface area to which adhesive may be applied for receiving the fibers of the facing.

At intersections of the woven thread, calendering pressure is effective to flatten the knuckles or crossing thread portions of the fabric substantially as indicated at 10b and 11b, the flattened crossing portions being partially pressed into each other as shown. This flattening of the thread intersections or knuckles by calendering and the pressing of the intersecting thread portions into each other as represented in Figure 6 results in substantial elimination of the normally projecting knuckles of the woven fabric and thereby further aids in obtaining smoothness on the faces of the fabric. This flattening is especially effective when the gauze is made of low twist threads, the low twist permitting the fibers or filaments to freely shift laterally relative to each other. Hence, the flattening of intersecting thread portions or crossings, is effected largely by laterally spreading the low twist fibers or filaments in the intersecting areas rather than by condensing the thickness of the threads. The thread intersections of the leno weave warp threads 12 with the filler threads 11 are, of

course, also flattened approximately as illustrated in Figure 7, and the crossings of the pairs of threads 13 and 14 intermediate filler threads are also flattened approximately as indicated in Fig. 8. The increased interengaging surface areas of the intersecting leno weave warp threads and filler threads increases the frictional contact between the threads to thereby further aid the leno weave warp threads in gripping the filler threads to stabilize the positions of the threads.

In some instances, stabilization of the described woven fabric may further be amplified by applying adhesive to the woven fabric preferably in such a manner that adhesive will be applied more or less discontinuously along the lengths of the warp threads as illustrated at 17 in Figure 9 and also accumulated in blobs at the places where the filler threads cross over said warp threads on one face of the fabric as indicated at 18. Adhesive may be applied in this manner by a roller method which has heretofore been developed but which is not a part of the present invention and, therefore, is not herein described. The adhesive applied in this manner to conventionally woven gauze, serves to adhesively bond alternate thread intersections (both lengthwise and crosswise of the fabric) leaving the intervening thread intersections unbonded and leaving the threads which extend in one direction, usually the cross or filler threads, substantially free of adhesive intermediate the bonded intersections.

Leno weave warp threads may similarly be adhesively bonded to the cross threads and to each other as shown in Figure 10. As there shown, adhesive will occur at 19 to bond the pair of threads 13 and 14 to each other and to the filler thread 11. Adhesive will also occur at 20 along the length of one of the warp threads 13 or 14 or along both—depending upon the relationship of these threads to each other intermediate their intersections with the filler threads. The adhesive at 20 will often spread across both threads as shown at 20a to adhesively bond the leno weave thread pair to each other intermediate the filler threads. This adhesive application is such that most of the normal softness of the woven fabric is preserved and not impaired by the limited adhesive bonding indicated. The adhesive so applied may also be utilized to bond the fiber applique to the woven fabric, such bonding occurring upon mere deposition of the fiber layer on the fabric but being improved by calendering whereby the fiber layer is more deeply embedded in the adhesive. Mock leno weave fabric, such as represented in Fig. 11, may also have adhesive applied thereto by the said roller method whereby adhesive bonds will be formed as indicated at 19b between the intersecting warp and filler threads and as indicated at 20b between the intersecting portions of the intersecting threads 13b and 14b intermediate the filler threads.

It is not necessary that the adhesive be roller applied to attain the discontinuous application above described and shown in Figures 9 to 11 inclusive of the drawings. Adhesive may be applied in any other manner so as to provide adhesive continuously or discontinuously along the lengths of either or both the warp and filler threads, or along some of either or both of said warp and filler threads. To preserve softness and flexibility in the fabric, it is generally preferred that the adhesive be discontinuous along the lengths of such threads as are provided with adhesive. Adhesive may be applied either continuously or discontinuously along the lengths of only certain of either or both the warp or filler threads, there being left intervening warp or filler threads free of adhesive, or certain groups of either or both the warp or filler threads may be provided with adhesive in any desired manner to provide adhesive bonding in selected areas of the fabric, leaving other areas free of adhesive.

For certain purposes, the adhesive may be applied to the threads before the same or woven into the fabric, the adhesive being preferably (but not necessarily) in a dry or inactive condition during the weaving operation;

for this purpose the adhesive should be of the thermoplastic or other character which enables it to be reactivated by means of solvent, heat, or pressure, or any combination thereof, or otherwise, after the threads are interwoven to form the fabric. Fabric woven with threads bearing adhesive of the last mentioned character may be subjected to such chemical or mechanical treatment as may be desired to reactivate the adhesive and thereby cause the same to bond together crossing thread portions. Also, if a fiber or other facing is applied to the fabric, such facing may also be bonded to the woven carrier fabric by such reactivated adhesive.

Adhesive may be applied to the woven fabric by immersion, spraying, printing, or any other available method or means by which it may be applied in the desired manner, i.e., as a longitudinally, continuous or discontinuous coating around the entire circumference of the selected threads or as a longitudinally continuous or discontinuous coating on only a portion of the circumference of the selected threads, and the adhesive may be applied to the desired threads either before or after the same are woven into fabric.

Adhesive may be applied in selected areas or zones of the woven fabric to provide increased stability in the selected areas or zones; for example, in the combination weave fabric shown in Fig. 4, adhesive may be provided on or binder fibers may be provided in the plain weave warp threads 10a immediately adjacent the leno weave threads to cooperate with the latter in stabilizing the fabric. Similarly, adhesive bonding may be confined to the leno weave warp threads 12 of the combination weave structure represented in Figure 4. Many variations in respect of the application of adhesive may be employed.

A sanitary napkin embodying the principles of construction above described and illustrated in Fig. 1, has an absorbent pad of suitable character, for example, superposed plies of crepe tissue paper, or a layer of wood pulp fiber material which is commercially called "fluff" and which resembles cotton fiber except that the wood pulp fiber is generally of a short length (i.e., usually a mixture of various lengths not greater than $\frac{3}{16}$ of an inch), or combinations of crepe tissue paper and wood pulp fiber in any desired arrangement. The wrapper of such napkin is of all leno weave construction (such as represented in Fig. 5) having per inch of width and length respectively, 14 warp threads of 40's cotton staple and 7 filling threads of 50's cotton staple, the warp threads being, of course, paired to form the leno weave so that the mesh of the fabric is 7 x 7.

The said 7 x 7 mesh leno woven web, although of very open mesh, is quite stable due to the gripping effect of the leno woven warp threads on the filler threads, but this stability is increased by applying adhesive at thread crossings on one face of the fabric where threads cross over other threads as represented in Figure 10 of the drawings.

The adhesive, when applied by the roller method above referred to, occurs discontinuously along the warp threads on only one face of the fabric, and the filler threads remain substantially free of adhesive intermediate thread intersections as indicated in Figure 10. This discontinuous and restricted or limited application of adhesive on some threads and absence of adhesive on others (except at thread crossings) leaves a large portion of the threads in their normal soft, flexible condition whereby the fabric retains a large measure of the normal softness and flexibility of the threads of which it is made.

Furthermore, the adhesive is preferably of a permanently flexible type so that its softening or hardening effect on the threads is kept down to a minimum.

One such adhesive used is a plastisol, formulated of 120 parts polyvinyl chloride paste resin (commercially available under the name "Geon 121") and 92 parts dioctyl phthalate plasticizer (commercially available under the names "Flexosol DOP" or "GP-261").

A non-woven facing of cotton fiber is applied to the

adhesive-bearing face of the fabric and is bonded thereto by said adhesive. The weight of the fabric is approximately 15.1 grams per square yard, made up of 8.5 grams of thread fabric, 2.6 grams of adhesive and 4 grams of the cotton fiber facing. The cotton fiber facing is formed of the above described grade of cotton known as "B comber" cotton.

The attributes of high porosity, strength, stability, softness and flexibility, and light weight attainable with fabrics embodying at least some leno weave warp threads are also advantageous in connection with the production of catamenial tampons such as represented in Figure 3. Such a tampon comprises an absorbent body 21 of any suitable material. A wad of cotton compressed both lengthwise and crosswise to a stable, predetermined length and diameter, is representative of one suitable form of body. The extent of compression is such that so long as the tampon remains dry under average atmospheric conditions, the tampon will remain substantially stable in compressed condition but when wetted under normal conditions of use, will quickly reexpand and provide a rapid and a large absorbing capacity.

A tampon body of the character indicated is desirably enclosed in a wrapper 22 which may be of woven material within the range of constructions described above. Such a wrapper is applied in any suitable manner to the uncompressed tampon body after which compression is effected whereby the wrapper is gathered around the surface of the tampon body and to a considerable extent pressed into the body. The embedment of the wrapper in the tampon body incident to the described compressing operation causes the wrapper material to be partially concealed in the surface of the tampon body and such embedment together with the above described softness of the wrapper fabric insures the attainment of a very soft smooth feeling surface on the tampon. Fiber faced fabric as described above may be employed for enclosing an absorbent tampon body especially when the body contains short fiber which might pass through the unfaced fabric, but the fiber facing may be omitted without materially reducing the smoothness of the surface of a tampon, especially when the absorbent body thereof is of cotton fiber as above mentioned.

The gathering of the wrapper material around the surface of the tampon body incident to either or both longitudinal or transverse compression thereof has a tendency to convert the fabric wrapper into an enclosing sheath of much lower permeability than the wrapper material in its normal extended condition. The employment of the more open meshes of fabric made possible by the use of fabrics made partially or entirely of leno weave warp threads avoids an objectionable degree of closing of the wrapper fabric so that the surface of wrapper of the tampon remains sufficiently pervious in the compacted condition of the wrapper to afford menstrual fluids free access to the absorbing body through the wrapper.

The softness or flexibility of the fabric, especially when made of low twist threads, is an important advantage in a tampon construction such as described because such flexibility and softness permits the wrapper to be easily distended by the expansive force of the absorbent body when it is wetted. It should be understood that when the wrapper tampon body is compressed, the gathers or folds of the wrapper do not themselves have an important effect in holding the tampon in its compressed or compacted condition; it is the interlocking effect of the fibers in the absorbent body which causes the compressed body to remain compressed until wetted and the intertwining of some of the body fibers with the wrapper material which holds the latter in its gathered and embedded condition on the surface of the tampon. When the fiber body is wetted, the fibers soften and lose their ability to hold one another and the wrapper in the position produced by compression and the increased flexibility and

softness of the wrapper imparts to the tampon freedom to expand with great rapidity upon being wetted.

As shown in Figure 3, the tampon is equipped with a draw string or cord 23. The employment of a wrapper fabric having adequate strength helps to insure complete withdrawal of the tampon through the agency of the string by preventing pulling apart of the fabric incident to the forces applied by the string 23 and the forces resisting withdrawal of the tampon.

In the following claims, "open mesh" refers to fabric having an openness or porosity which is similar to or greater than that of conventionally woven gauze having a mesh of 18 x 14 with 30's count warp and 40's count filling threads (on the English cotton system).

Various modifications of the described structure may be made while retaining the principles of the invention.

We claim:

1. A sanitary napkin having an absorbent pad and a wrapper enclosing said pad, said wrapper comprising a set of spaced threads which extend in one direction, and a second set of spaced threads which extend transversely of the threads of said first mentioned set, said sets of threads being leno woven at their crossings, the threads of at least one of said sets having a twist less than six turns per inch and being of multiple filament construction of a denier within the range of 30 to 150, whereby the filaments thereof are caused to fan out under pressure to form thin flat thread crossing portions.

2. A sanitary napkin comprising an absorbent pad and a wrapper enclosing said pad, said wrapper comprising at least two sets of spaced threads with the threads of one set extending transversely of those of the other set and at least some of the threads of the one set being leno woven with at least some of the threads of the other set, at least one of said sets of threads comprising low twist multiple filament threads having a twist less than six turns per inch and being of a denier within the range of 30 to 150, whereby said low twist threads respond to forces on the wrapper to assume a flattened cross sectional form which falls generally into the plane of the

adjoining surface of said absorbent pad to thereby provide a smooth soft and flexible surface with the pad.

3. A sanitary napkin having a wrapper and an absorbent pad, said wrapper comprising a set of spaced threads which extend in one direction, and a second set of spaced threads which extend transversely of the threads of said first mentioned set with at least some of the threads of each set being leno woven with respect to some of the threads of the other set, the threads of at least one of said sets being of low twist, multiple filament construction, having a twist less than six turns per inch and having a denier within the range of about 30 to 150, the filaments having a denier within the range of 1 to 15.

4. A sanitary napkin having an absorbent pad and a wrapper enclosing said pad, said wrapper comprising a thread web having a set of spaced threads which extend in one direction, and a second set of spaced threads which extend transversely of the threads of said first mentioned set and leno woven therewith, the threads of both of said sets being of low twist multiple fine filament construction, the twist of said threads being less than six turns per inch to permit the filaments thereof to fan out at the crossings having flat areas engaged with one another, and a non-woven applique of fibers on the face of and adhesively secured to said threads.

References Cited in the file of this patent

UNITED STATES PATENTS

887,886	Wilot	Dec. 17, 1906
2,039,312	Goldman	May 5, 1936
2,360,245	McFarlane	Oct. 10, 1944
2,564,689	Harwood et al.	Aug. 21, 1951
2,580,202	Talalay et al.	Dec. 25, 1951
2,679,677	Crandall	June 1, 1954
2,777,779	Harwood et al.	Jan. 15, 1957

FOREIGN PATENTS

151,363	Australia	May 11, 1953
---------	-----------	--------------

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

September 1, 1959

Patent No. 2,902,038

John C. Bletzinger et al

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 20, for "October 5, 1956" read --- August 15, 1955 ---;
column 2, line 54, for "sanittary" read -- sanitary --; line 60, after
"wadding" insert -- or ---; column 10, line 53, after "surface" strike out
"of" and insert instead -- or --.

Signed and sealed this 29th day of March 1960.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents