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K. J. HARWOOD ET AL

2,902,037

SANITARY NAPKIN

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Fig. 1

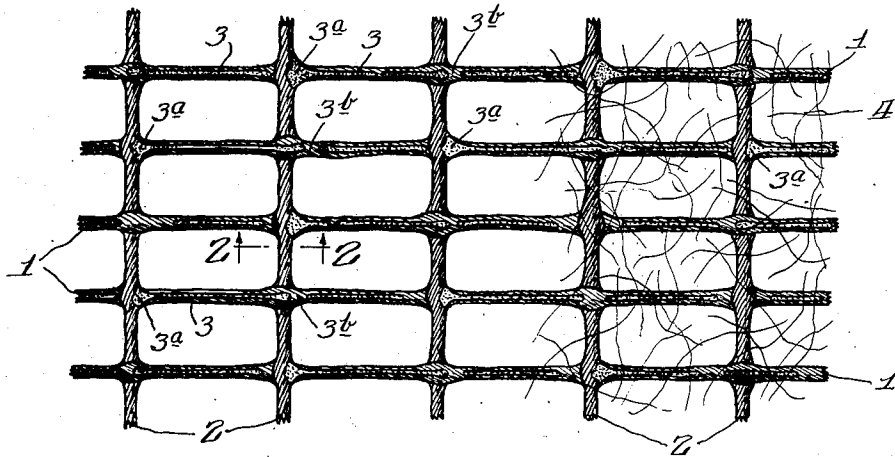


Fig. 4

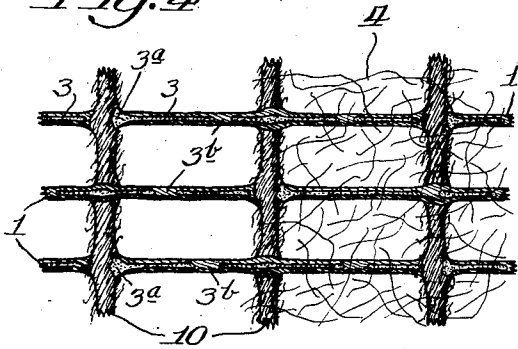


Fig. 2

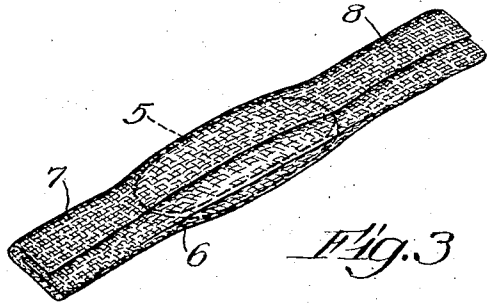
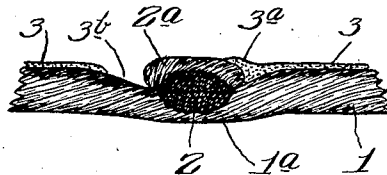


Fig. 3

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## SANITARY NAPKIN

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4 Claims. (Cl. 128—290)

This invention relates to an improvement in cellulosic products, and it has reference especially to an improved sanitary or catamenial napkin which embodies an absorbent pad element and a wrapper around such pad element, and to an improved form of material adapted for use in such wrapper, and for other purposes.

The material most commonly used for wrapper purposes in sanitary napkin construction is woven cotton gauze, this material being used because of its substantial tensile strength which enables the material to effectively hold and confine the absorbent pad and to provide attachment tabs which extend beyond the ends of the absorbent pad for supporting the napkin from a belt or garment through the agency of suitable fastening means. Conventional gauze wrappers thus afford a high degree of security but against the skin of the wearer of a sanitary napkin, the threads of such gauze wrapper have a rather hard and harsh feel. Various treatments, for example, facings of soft, fiber material, have been employed on gauze wrappers to avoid the said chafing tendency, for example, as shown in Patent 2,564,689.

Another difficulty in respect of the use of gauze, especially gauze of very open mesh, for sanitary napkin wrapper purposes, is incident to the necessity of employing well bleached gauze in order to obtain the desired clean, white and sanitary appearance. As a practical matter, gauze is woven from unbleached cotton threads and the woven fabric subjected to bleaching operations which may be accompanied by substantial handling of the fabric, resulting in severe and extensive fraying even in meshes as close as 18 x 14, and the fraying becomes more severe as the mesh is made more open. For sanitary wrapper purposes, it is important that the wrapper fabric be of uniform thread distribution, that is to say, free from distorted thread lay or fraying, in order that the product present a very neat appearance, and for other reasons.

According to the present invention a woven gauze-like wrapper is provided which comprises low twist threads, and preferably, low twist, continuous, multi-filament threads, the fabric being much smoother, softer, and more pliant than conventional gauze.

The main objects of the invention will, therefore, be understood as being those of providing woven gauze-like material which is substantially smoother, softer, and more pliant or supple than conventional spun thread gauze; to provide a sanitary napkin of the character indicated having the security characteristics of a napkin having a conventional gauze wrapper and having improved non-chafing and other comfort characteristics; to provide sanitary napkin wrapper material which will be lighter in weight than conventional gauze wrapping material; to provide a soft and pliant fabric of the character indicated which will be stable in respect of the spacing of the threads notwithstanding very open mesh construction and its increased softness and flexibility; and in general, it is the object of this invention to provide an improved absorbent bandage such as a catamenial napkin and an improved fabric of the character indicated.

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Other objects and advantages of the invention will be understood by reference to the following specification and accompanying drawing wherein a preferred embodiment of the invention is illustrated.

In the drawing:

Figure 1 is a face view of a piece of fabric made according to this invention;

Figure 2 is a cross-section on the line 2—2 of Figure 1, but on an enlarged scale;

Figure 3 is a perspective illustrating a sanitary napkin according to the present invention; and

Figure 4 is a face view of a piece of fabric embodying the invention in another form.

The fabric shown in Figure 1 comprises interwoven machine and cross direction threads, i.e., warp and filler threads 1 and 2 respectively. These threads 1 and 2, instead of being of conventional high twist spun fiber threads are low twist threads, and preferably of low twist continuous multi-filament construction. Low twist cotton fiber or similar fiber threads may be employed but because of the low twist and the short lengths of the fibers, the threads are rather weak if the threads are fine enough to be well suited to the manufacture of sanitary napkin wrapper material; if made strong enough to suit said purposes, they tend to be bulky.

The greatest benefits are obtained when the threads employed in making the fabric are of low twist continuous multi-filament construction embodying, for example, rayon filaments having a denier within the range of 1 to 15, and from 2 to 150 filaments forming a thread having a denier within the range of 30 to 150, the threads having a twist of not more than about twelve turns per inch, and preferably six or less turns per inch.

One desirable embodiment of the fabric contains machine direction threads of 75 denier formed of 30 filaments and a twist of about 4 turns per inch, and filler threads of 75 denier containing 30 continuous filaments and having a twist of about 4 turns per inch.

The fabric made with low twist threads as above explained may be stabilized to resist shifting of its threads relative to each other. One way to stabilize the fabric is to adhesively bond the intersections of the threads or at least some of them. In one arrangement adhesive is applied in such a manner that adhesive will occur along the lengths of the longitudinal or machine direction threads 1 as shown at 3, and in accumulations or blobs 3a at intersections where the cross or filler threads cross over the other threads on one face of the fabric. This arrangement, in effect, provides adhesive bonding at alternate thread intersections, which are, of course, substantially uniformly distributed over the area of the fabric.

A method and apparatus not a part of the present invention has heretofore been developed for applying adhesive in the manner just described. However, all of the intersections may be bonded by employing other methods. For example, threads coated with thermoplastic adhesive may quite easily be interwoven with other threads bearing such adhesive or free of adhesive and the interwoven threads subjected to heat (such as radiant heat or hot air without physically engaging the threads), and the adhesive thereby reactivated sufficiently to cause the threads to become adhesively interconnected at their intersections. In such an arrangement, all of the intersections would be adhesively bonded. Types of adhesive adapted to be reactivated by solvents may, of course, be used and in some instances it may even be practicable to interweave the threads while either or both the warp and filling threads carry active adhesive to cause adhesive bonding to occur immediately after the threads assume their final positions relative to each other. Adhesive reactivating, drying, and setting operations may be effected very soon after the interweaving is effected and

before the threads have much of an opportunity to shift from their proper relative positions.

This adhesive interbonding of the woven threads provides for a stable fabric and is especially advantageous when producing open mesh fabrics such as gauze. Conventional spun-thread gauze having a count of 18 x 14, for example, is generally more stable than more open meshes such as 4 x 4 for example. The adhesive bonding of the fabric is, of course, more important with the more open mesh weaves, but is also of considerable value in connection with such relatively close meshes such as 18 x 14. For many purposes, it is highly advantageous to have a gauze fabric which is very stable and will present and maintain a very uniform appearance in respect of thread spacing.

The employment of threads of low twist is of substantial benefit in that the softness of the low twist threads attains not only benefits inherent to the softness of the threads but also permits modification of the woven fabric to attain several other important benefits. Also, the employment of continuous, multi-filament, low twist threads is advantageous in that such threads usually exhibit considerably higher tensile strength than conventional spun fiber threads of like weight or denier. For example, in conventional gauze production, 40's warp and 50's filling threads are commonly used to produce woven gauze of 18 x 14 construction, the weight of such gauze averaging about 12.6 grams per square yard. Conventional spun threads of lower weights can be used only with considerable 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 fabric made of such continuous, multi-filament, low twist, low denier threads would be in the neighborhood of 8½ 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. The tensile strength of a 40's warp thread is approximately equalled by the tensile strength of a 75 denier rayon filament, low twist thread embodying 30 continuous filaments each filament being of 2.5 denier. The weight of said 40's warp thread is about 1.75 times the weight of said low twist, multi-filament thread, quantity for quantity.

In addition to the weight advantage obtained without sacrificing strength, advantages of softness, pliability or flexibility and smoothness are easily attainable by employing continuous multi-filament, low twist threads.

Low twist threads are, of course, soft and compressible transversely of their lengths whereas conventional spun threads are usually quite hard and much less compressible transversely. When fabric is made of low twist threads, there is a normal tendency for the knuckles of the fabric, that is to say, the thread cross-over areas of the fabric, to flatten against one another so that the prominence of the knuckles on the faces of the fabric is considerably less than when conventional high twist spun threads are used. Such flattening may occur merely as an incident to the interweaving operation and the tensioning of the threads in contact with one another and as a result of the travel of the fabric over guide rods and rolls and the reeling of the fabric into rolls.

The said flattening can be made particularly significant by calendering the woven web between calender rolls under considerable pressure, for example, in the neighborhood of 85 pounds per lineal inch of roll contact between rolls having diameters of about 8 inches. By such calendering, the knuckles in the fabric may be reduced in thickness (face-to-face of the fabric) to such an extent that said thickness is no greater than or only slightly greater than the thickness of the thread portions intermediate the knuckles, said intermediate thread portions being also flattened incident to such calendering. For example, as

shown in Figs. 1 and 2 of the drawing, by calendering, the cross-section of a thread 2 is made thinner and wider as indicated in full lines at 2a, the normal cross-section being shown at 2 in Fig. 2, said thread portion 2a being pressed or recessed into the underlying portion 1a of the thread 1, said portion 1a being also flattened and made thinner and wider in cross-section to substantially the same degree as said portion 2a. As shown in Fig. 2, the flattening is effected to such an extent that the thickness of the fabric at its knuckles is reduced to only slightly more than the thickness of the thread portion intermediate said knuckles.

The low twist of the threads permits the individual filaments to readily shift laterally under pressure so that when crossing thread portions are calendered, the threads in said portions tend to fan out into said wider but thinner dimensions. This fanning out of the filaments in the areas of the knuckles and the flattening of said knuckles may readily be effected to such a degree that the projection or prominence of the knuckles on the faces of the fabric is so greatly reduced that projections of the knuckles on the faces of the fabric are hardly if at all detectable by feel. Of course, this flattening effect is dependent to a large extent upon the degree of pressure employed in calendering the web and it may accordingly be effected to a selected degree within a wide range. It is especially significant that by employing low twist threads, especially continuous, multi-filament, low twist threads, the projection of the knuckles on the faces of the fabric may be practically eliminated, as represented in Fig. 2, and this without causing cutting of the threads at their intersections incident to the pressing of the threads into one another. The ease with which the filaments may shift their positions into thin but wide cross-sections probably accounts in a large measure for the facility with which the low twist threads may be pressed into one another without much danger of causing cutting or breaking of the threads at their intersections.

The flattening of the threads at their cross-sections also has the effect of improving the adhesive bonding of the threads to one another at their intersections for the reason that such flattening not only increases areas of interengagement between the threads wherein adhesive may occur for bonding, but also because the flattening and widening of the threads in their intersecting areas has the effect of increasing the lengths of the side edges of the intersecting thread portions so that greater lengths are available for adhesive engagement in said areas. This increased length is, of course, due to the more or less arcuate form of the side edges of the crossing thread portions as compared with the normal straight side edges of crossing thread portions in uncalendered material.

As indicated in Figure 1, the adhesive may advantageously be applied along the lengths of the threads in a discontinuous manner, breaks in the continuity of the adhesive being indicated at 3b so that at least small lengths of adhesive free thread will occur at intervals along the lengths of said adhesive bearing threads. By causing the adhesive to be discontinuously applied, the normal softness and flexibility of the threads before adhesive application is preserved to a substantial degree. The adhesive may be of a permanently flexible kind and of a type which will remain surfaced on the threads to thereby further avoid adhesive hardening of the threads.

For some purposes, fabric prepared as above described and shown in Figure 1, may have applied to its adhesive bearing face, an applique or facing 4 of fibers. The fibers may be deposited in free form by suitable airlaying or other apparatus or the applique may be produced by carding, drawing, waterlaying or other apparatus which will form the fibers into a non-woven web which may then be guided into assembled relation with the adhesive bearing face of the woven fabric. The assemblage of fiber and woven fabric may then be calendered to increase the embedment of the fibers in the adhesive so as to more

securely bond the fiber applique to the thread web and to also effect the flattening of the threads and knuckles as above explained.

A gauze web woven of low twist multi-filament rayon threads and provided with a non-woven fiber facing 4 of very low weight, for example, 1½ grams to 6 grams per square yard of web, constitutes a very satisfactory wrapper material for use in the production of sanitary or catamenial napkins such as shown in Figure 3. The fiber facing is preferably on the outside of the wrapper but may be on the inside thereof since the fiber will be caused to project through the openings or interstices of the gauze so as to appear to a significant extent on the outside of the wrapper. Such a napkin comprises an absorbent pad 5 and a wrapper 6 of the described material, the wrapper being folded lengthwise around the pad and of such length as to provide tab portions 7 and 8 which may be employed in the usual manner for supporting the napkin from a belt or other supporting garment.

A sanitary napkin made in this manner presents a very smooth surface which substantially avoids chafing. Furthermore, when the fiber applique is of very light weight such as mentioned, it does not significantly impair permeability of the wrapper so that menstrual exudate may readily pass through the wrapper to be absorbed by the absorbent pad body. The outside surface of the napkin is thereby kept dry and more comfortable to the wearer.

One example of a satisfactory sanitary napkin embodies a calendered woven wrapper made of continuous, multi-filament rayon threads adhesively bonded together as shown in Fig. 1. The warp threads are of 75 denier and are made of 30 filaments each having a denier of 2.5, the twist of such warp threads being 4 turns per inch; the filling threads are of 75 denier and are made of 30 filaments, each having a denier of 2.5, the twist being 4 turns per inch. Such woven wrapper material weighs approximately 8.75 grams per square yard, and about two grams of adhesive is applied to the gauze. An airlaid cotton fiber facing weighing from 1½ to 6 grams per square yard attached to the woven web by the adhesive thereon, significantly augments the smoothness of the calendered woven web.

The described invention may also be embodied in various combinations of low twist threads of multiple continuous filament construction, with low twist threads of cotton or other fibers or relatively short filaments spun together (with a low twist) to form continuous threads. Such low twist discontinuous fiber or filament threads usually have a fuzzy surface which results from the projection of fiber or filament ends from the thread. When these two types of threads are employed in a web formed by weaving or otherwise, the fuzzy surfaced threads impart a smooth, soft feel to the faces of the fabric. As shown in Figure 4 the longitudinal threads 1 of one fabric construction may be of multiple continuous (or long length) filament construction as in Figure 1, and the cross threads 10 may be of the said low twist cotton fiber construction. In another arrangement, not illustrated, either the set of longitudinal threads or the set of filler threads, or both, may comprise both types of threads arranged, for example, in alternate relationship, so as to distribute the smooth or soft feeling surfaces of the low twist threads over the area of the fabric, or such threads may be arranged in other desired relationships by means of which the smooth or soft surfaces provided by the fuzzy-surfaced threads may be located in selected areas of the fabric. Also, for some purposes, a fabric may be made in which either the warp or the filler threads are of high twist construction and the other threads are of low twist construction; the softness and smoothness of the low twist threads serve in such an arrangement to impart to the fabric a measure of the attributes above indicated as flowing from the use of low twist threads.

This invention is particularly useful in connection with open mesh woven fabric; by "open mesh" we mean, for

example, cotton fabrics having a thread construction of 20 x 16 with 30's warp threads and 40's filling threads, or other thread constructions and thread counts (on the cotton system) which result in comparable or greater openness, and also fabrics such as rayon, nylon, and others having such openness or porosity.

Various changes in the described structures may be made while employing the principles and obtaining the benefits 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 interwoven 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 interwoven 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 interwoven 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 interwoven 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.

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