March 5, 1968 R. W. JOHNSON 3,371,668

SANITARY NAPKIN

Filed April 14, 1965 2 Sheets-Sheet 1

Fig.1.

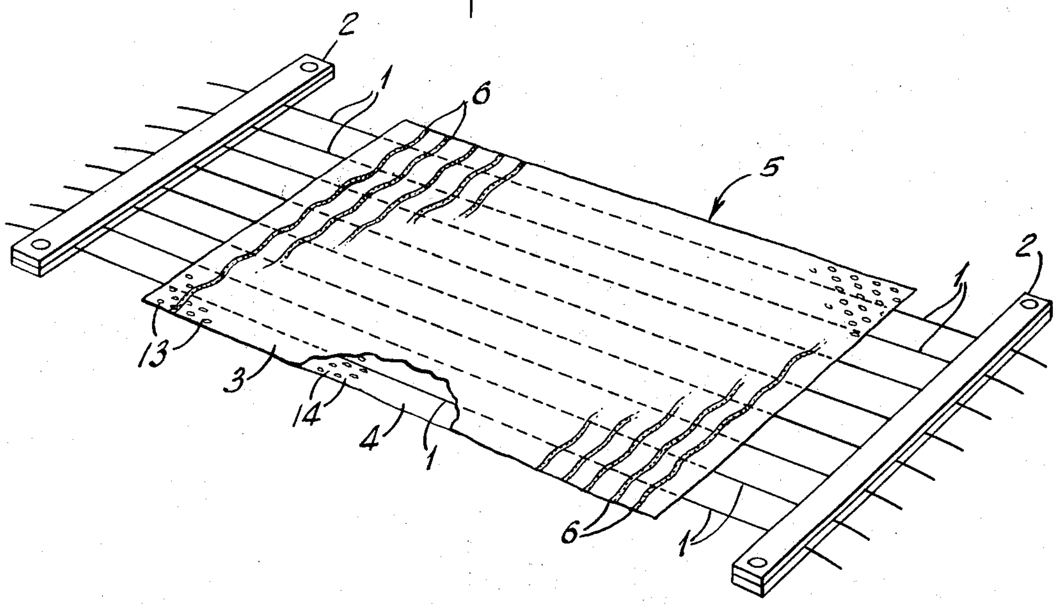
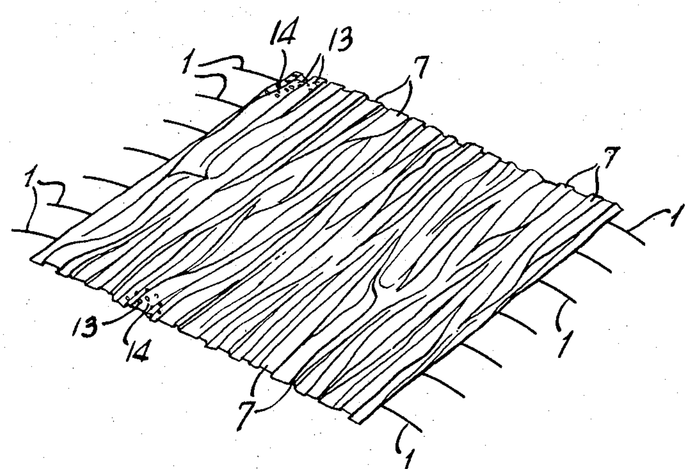


Fig.2.



INVENTOR.
ROBERT W. JOHNSON
BY John W. Tregoning
ATTORNEY

March 5, 1968 R. W. JOHNSON 3,371,668
SANITARY NAPKIN
Filed April 14, 1965 2 Sheets-Sheet 2

Fig. 3.

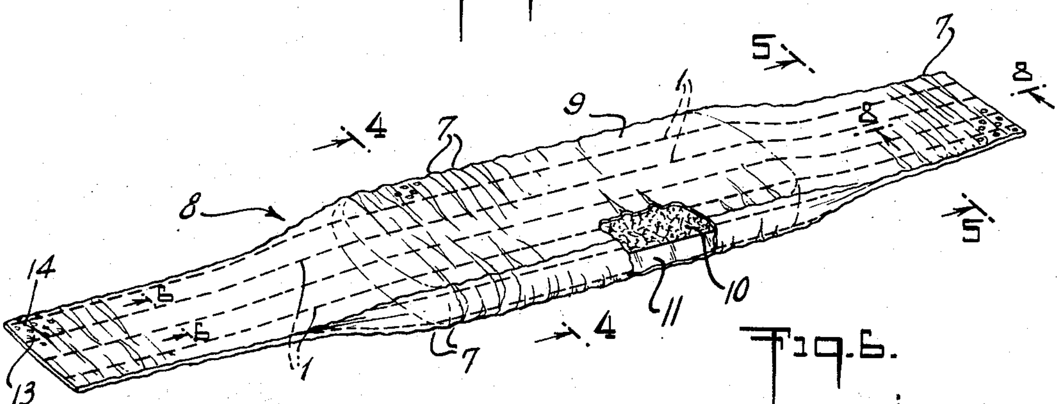


Fig. 4.

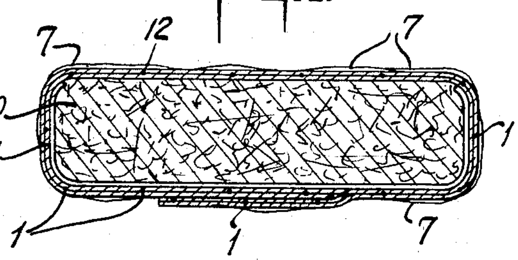


Fig. 6.

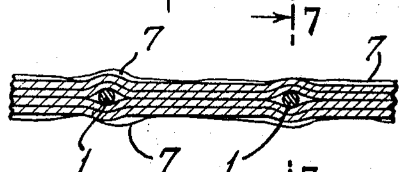
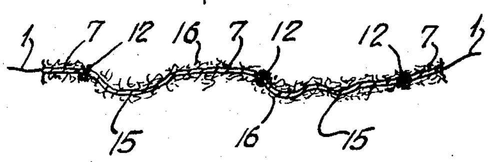


Fig. 7.



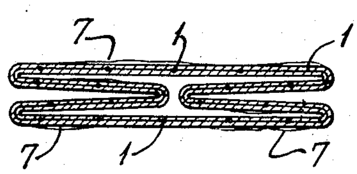
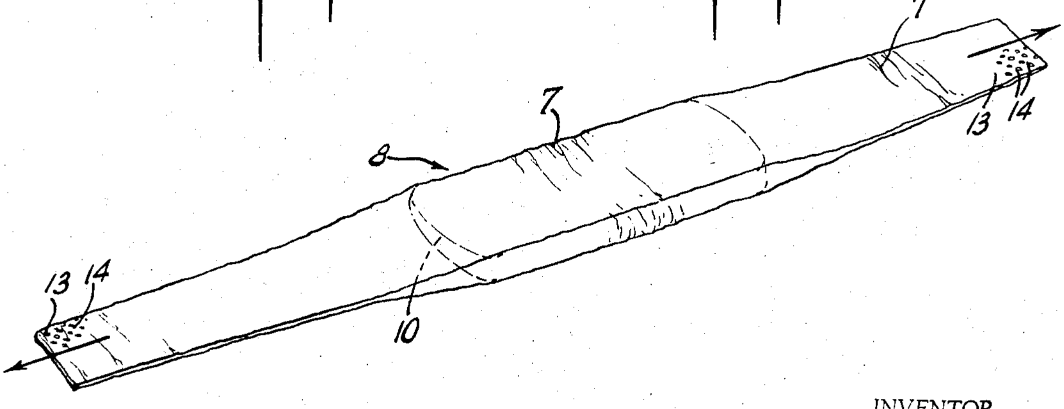


Fig. 5.

Fig. 8.



INVENTOR.
ROBERT W. JOHNSON
BY John H. Tregoning
ATTORNEY

United States Patent Office 3,371,668
Patented Mar. 5, 1968

1

3,371,668
SANITARY NAPKIN
Robert Wood Johnson, Princeton, N.J., assignor to Johnson & Johnson, a corporation of New Jersey
Filed Apr. 14, 1965, Ser. No. 448,060
5 Claims. (Cl. 128—290)

ABSTRACT OF THE DISCLOSURE

A nonwoven cover for a sanitary napkin where said cover is characterized by elasticity induced by tension-bonded strands of elastomeric material providing resultant improved comfort features.

A recognized problem associated with the use of fibrous articles of manufacture in direct contact with the skin for absorbing or padding purposes is that of insuring the maintenance of the initial positioning of the article to avoid displacement.

This has been overcome by the instant invention which provides in a sanitary napkin having an absorbent core encased by a fluid permeable cover, the cover for encasing said absorbent core comprising at least one web of individualized fibers and a plurality of strands of an elastic material secured to said fabric in spaced parallel relationship to each other to provide a multitude of elongated buckled areas extending transversely to said elastic strands throughout said fabric, said fabric being characterized by elastic extensibility and said napkin being characterized by body conforming properties and improved resistance to displacement.

By the term "elastic material" as used herein is meant an elastomer, i.e. a substance that can be stretched at room temperature to at least twice its original length and, after having been stretched and the stretch removed, returns to approximately its original length in a short time; however, this is not meant to exclude elastic yarns made by covering a core of rubber or elastic material with a sheet or covering of textile fabric.

The term "elastic extensibility" as used herein is meant to define the general elasticity of the fabric of this invention which is characterized by the ability to return to its original size and shape after removal of the stress causing deformation such as stretching, compression or torsion.

The term "strands" as used herein is meant to define the physical characteristics of the elastic material secured to the nonwoven fabric and providing the novel cover of this invention. It is meant to include cords, strings, thin bands, etc., of elastic material.

Co-pending application Ser. No. 344,123, filed Feb. 11, 1964, discloses the fabric of this invention. Basically, it is defined as a web or a plurality of webs of nonwoven fabric constructed of individualized fibers and intersecting, overlapping disposition within each web. The elastic materials in strand form are secured to the face of a laminate of the nonwoven web or to the face of one web. Alternatively, these strands may be sandwiched in spaced substantially parallel relationship between the webs and the composite secured in position by appropriate bonding to provide a laminate having the elastic strands encased within. In any event, the elastic strands are held under sufficient tension to provide at least 15% elongation and preferably at least about 25% elongation in a nonwoven fabric, and are held via such tension throughout the process of positioning the strands on or within the nonwoven fabric and bonding. The positions is maintained until the bonding material used has dried sufficiently to preclude slippage of the elastic at the bond sites.

The fibrous web may contain natural or synthetic, vegetable or animal fibers such as cotton, silk, wool, vicuna, mohair, alpaca, flax, ramie, jute, etc.; synthetic or man-made fibers such as the cellulosic fibers, notably cupraammonium, viscose or regenerated cellulose fibers; cross linked cellulose fibers such as "Corval" and "Topel"; cellulose ester fibers such as cellulose acetate and cellulose triacetate; the saponified cellulose ester fibers; the polyamide fibers; protein fibers; halogenated hydrocarbon fibers; hydrocarbon polyolefin fibers such as polypropylene and polyethylene; polyester fibers; vinyl fibers; acrylic fibers; modacrylic fibers; mineral fibers such as glass and metal; and others.

2

The composite fabric of this invention which includes the elastic strands spaced in substantially parallel relationship is a buckled fabric due to the extending, position-bonding and the relaxing of the elastic strands. Since the extended elastic is bonded in position, relaxation after bonding has been completed and causes the fabric to buckle at or along these sites. The buckles so formed extend transversely to said elastic strand and are spaced one from another by troughs but are substantially parallel to one another. They do not extend in their lengthwise direction for any great distance but originate and terminate within the boundaries of the fabric itself, i.e. except for those that originate near a boundary. They are irregular rather than uniform and they vary in magnitude. It should be understood that the magnitude of the buckles is essentially dependent upon the amount of the deformation caused by the relaxing of the elastic material which, of course, is itself dependent upon the degree of extension applied to it. Thus, the extent of buckling can be controlled and the degree of bulk which the buckling imparts to the fabric can also be controlled and predicted as desired to conform to its desirability in the end product. The absorbency of the fabric is also enhanced by the degree of buckling. Other factors which contribute to the kind and degree of buckling are the weight of the fabric, the number of plies making up the composite fabric and, of course, the particular bonding agent used.

The particular placement of the elastic means within or on the fabric will also control the amount of intensity of the buckling. For example, thin bands or strings of an elastic material under tension and positioned very close together in parallel relationship in or on the fabric and secured in position will cause a greater number of buckles per square inch than will the same elastic material under the same tension spaced four or five times the distance from its nearest neighbor than it was in the first instance. Also, in the latter case, the magnitude of the buckle will be greater. A like result will appear with a significant variance in the dimensions of the elastic material, i.e. a variance in the amount of tension or extension placed on a strand or band of elastic material as opposed to that placed on its neighbor, and with the use of differing elastic materials.

It is important, of course, that the chemical binder used be one that will not only bind the fibers within the webs but one which will bind the elastic means to a fabric and hold it securely but not rigidly.

The binder used in adhering the individualized fibers in position for simultaneously adhering the plurality of webs together and for bonding the elastic strands in position may be selected from a large group of such binders known to industry. It is necessary, however, that a binder be used which can satisfactorily adhere to and bond the different types of fibers together or at least mechanically interlock the fibers together and that it also binds securely the elastic strands to the fabric at the bond sites. Representative of the binders available for such a purpose are regenerated cellulose; vinyl resins such as plasticized or unplasticized polyvinyl acetate, polyvinyl chloride, polyvinyl alcohol, etc., either as homopolymers or copolymers;

acrylic resins such as ethyl acrylate, methyl methacrylate, methyl acrylate, butyl methacrylate, etc.; butadiene resins such as butadiene-acrylonitrile, butadiene-styrene, etc.; other synthetic rubbers; natural rubber, urea resins such as urea-formaldehyde, cyclic urea-formaldehyde, etc.; aldehyde resins such as melamine-formaldehyde, phenol-formaldehyde, resorcinol-formaldehyde, etc.; epoxy resins; cellulose derivatives such as carboxymethyl cellulose; hydroxyethyl cellulose, etc.; starches; gums; casein; etc.

These binders may be added, as desired, in the form of emulsions, solutions, dispersions, plastisols, powders, etc. Autogenic bonding, preferably by heat and/or pressure and/or solvents, may also be used when thermoplastic fibers are present.

The percent add-on of such binder materials may be varied within relatively wide limits depending to a large extent upon the specific binder employed and upon the type, weight and thickness of the nonwoven fabric. For some binders, as low as about 1% by weight up to about 12% by weight, based on the weight of the dry webs being bonded, has been found satisfactory. For other binders, as high as from about 15% to about 50% by weight has been found preferable. Within the more commercial aspects of the present invention, however, from about 2% to about 35% by weight, based on the weight of the dry webs being bonded, has been found desirable.

The binder must be applied in a repeating pattern of spaced binder areas to provide repeating free areas where the buckles in the buckled fabric of this invention are developed. The bonding operation employed for stabilizing and strengthening nonwoven fabrics in this invention is one of intermittent bonding using a spaced repeating pattern of bonding sites defining discrete binder areas or lines extending across the width of the nonwoven fabric. The individual fibers passing through these binder areas or lines are adhered into a stable, self-sustaining relationship. The binder areas may also take on any desired shape or form including circles, annuli, ovals, ellipses, triangles, rectangles, squares, diamonds, parallelograms, or other polygons, or combinations of such forms, either regularly or irregularly shaped. The binder lines may extend across the nonwoven fabric at any desired angle to the long axis; the binder lines may be parallel, or they may cross each other to form diamond or irregular polygonic figures; the binder lines may be continuous or discontinuous; or they may be straight, curved, sinuous, or irregularly wavy. Examples of some of these patterns and shapes may be found in the above-mentioned U.S. Patents 2,705,687 and 2,705,688 or in U.S. Patent 2,880,111.

One common factor, however, is to be particularly noted in all of these patterns, namely, that the total surface coverage of the binder areas or lines on the nonwoven fabric should not substantially exceed about 35% of the total surface of the nonwoven fabric. Preferably, such coverage should be less than about 25% and sometimes down to about 8% of the total surface of the nonwoven fabric. Binder areas occupying greater than about 35% stiffens the fabric and interferes with the elastic properties desired.

Nonwoven fabrics are normally noted as having no extensibility in the machine direction but this direction does represent the direction of greatest tensile strength in the fabric. Placing the elastic materials under tension in parallel relationship running in the machine direction, securing it in position to the nonwoven fabric while it is still under tension, and removing the tension when the chemical bonding material has been dried will cause the buckling which will permit hitherto unobtainable elasticity in the machine direction of the nonwoven fabric. The degree of elasticity can be controlled by the amount of tension applied to the elastic material and the degree of buckling can also be predicted and controlled as mentioned earlier.

The elastic means will, in the usual case, always be positioned under tension in the nonwoven fabric in parallel relationship to the other strands, strips, bands, etc., of elastic material so positioned. The buckles created using this placement as a foundation will extend transversely to the longitudinal direction of the strands. This could be varied by using elastic materials having different degrees of elasticity but applying equal tension to all or by varying the parallel relationship of the elastic strips, strands or bands to produce unusual effects or designs in the fabric.

The present invention will be more fully understood by reference to the following detailed description in the accompanying drawings in which:

FIGURE 1 is a schematic presentation depicting an in-production composite structure of one embodiment of the fabric used in this invention,

FIG. 2 depicts the fabric of FIG. 1 in a relaxed condition,

FIG. 3 presents one embodiment of the improved sanitary napkin represented by this invention,

FIG. 4 is a cross section taken through **4—4** of FIG. 3,

FIG. 5 is an enlarged cross section taken through **5—5** of FIG. 3,

FIG. 6 is an enlarged cross section taken through **6—6** of FIG. 3,

FIG. 7 is an enlarged cross section taken through **7—7** of FIG. 6, and

FIG. 8 depicts the napkin of FIG. 3 in an extended state.

In FIG. 1 a series of substantially parallel strands **1** of elastic material are held under tension by means **2**, e.g. a pair of clamps, and are shown sandwiched between two webs **3** and **4** of individualized fibers. The composite or laminate **5** is bonded by a horizontal wavy-line pattern **6** which bonds the individualized fibers in their respective nonwoven webs **3** and **4** providing integrity and also secures each of the strands **1** of elastic material to both of the webs **3** and **4**. The bonding material is permitted to dry thoroughly to effect a complete bond and to insure that the substantially continuous bond sites running the length of each strand **1** do not permit slippage or disengagement of the strand **1** with each of the webs **3** and **4** along their length. Thus, when the tension created by means **2** is released, each of the strands **1** relaxes and creates the multitude of buckles **7** which extend transversely to the longitudinal direction of the strands **1** as shown in FIG. 2.

Each of the webs **3** and **4** is seen to be constructed such that a repeating pattern of voids **13** span the length and width of each web. In actuality the webs are produced in accordance with the teachings of either U.S. 3,081,514 or U.S. 3,081,515, and are more aptly described as webs of rearranged individualized fibers where a repeating pattern of spaced fiber bundles **14** span the length and width of each of the fabrics or webs **3** and **4**. In construction the elastic strands **1** in the laminate **5** have been tensioned sufficiently during manufacture to permit 100% extrusion of the finished fabric, i.e. after bonding of the sandwiched strands, which are extended to a little better than twice their original length; release of tension provides a buckled fabric which, in this instance, can be extended to twice its length. Of course, the fibers used in the webs need not be the same and can be chosen from any presently known to the art, or from any later developed which are found suitable.

Note should be taken that the buckles **7** in FIG. 2 extend in a parallel manner with respect to each other and that they extend at substantially right angles to the lengthwise direction of the strands **1**. The buckles **7** do not extend uninterruptedly distances sufficient to span the width of the fabric and their magnitude is that which effects the bulk, and thus the softness and absorbency of the fabric **5**.

In FIG. 3 there is shown a sanitary napkin **8** which is defined by an absorbent core **10** wrapped in a liquid permeable cover **9** of a fabric similar to that shown in

FIG. 2. Because of its elastic extensibility, the cover **9** conforms readily to the absorbent core **10**. Positioned between one face of the core **10** and the contiguous surface of the cover **9** is a thin, flexible plastic layer, e.g. polyethylene, which extends upward along each of the longitudinal sides of the core **10** and acts to prevent seepage of liquids through the napkin **8**.

The absorbent core **10** may comprise any material, structure or composition capable of distributing and channeling the flow of liquids inside the core and thus capable of substantially containing liquids. The absorbent core **10** may, for example, comprise a single layer of wadding of cotton fibers, fluffed wood pulp (purified cellulose), creped cellulose tissues, or any of the known materials used for this purpose as well as any material which may be developed for this purpose.

The buckles **7**, characteristic of the fabric cover of this invention, are plainly visible and extend transversely to the elastic strands **1**. The elastic extensibility of the fabric and the buckles produced thereby, function to provide much improved bulk and resulting softness in the napkin but also add the body-conforming feature to the napkin plus the tenacious ability to maintain its body-contacting position. The plurality of buckles not only provide enormously improved absorbent sites but their disposition prevents surface seepage of liquids and their bulk provides expanding sites that insure continuing body contact.

Elastic strands **1** are shown sandwiched between the two plies **3** and **4** of individualized fibers. The cover **9** is seen to overlap and is bonded in position along the non-body-contacting face of the napkin, and the buckles **7** are shown in longitudinal cross section.

An enlarged cross section taken along **4—4** of FIG. 3 is shown via FIG. 4. The absorbent core **10** of the napkin **8** is composed of fluffed wood pulp and a thin, flexible sheet of polyethylene film **11** which spans one-third of the core **10** and extends about one-half way up the sides of the core. The film or shield **11** is impermeable to body liquids.

In FIG. 5 which is a stylized view taken along **5—5** of FIG. 3, the composite fabric is shown constructed of two-ply nonwoven fabric having elastic strands **1** sandwiched therebetween. The cross section is taken along the tab of napkin **8** in FIG. 3 and shows that the sides have been inverted to compensate for the much smaller cross section at this point, due to the absence of the absorbent core, and in order to present a neat package devoid of cutting edges. Since the buckles **7** extend transversely to the elastic strands **1**, the longitudinal cross sections of several of these buckles **7** are present.

FIG. 6 is an enlarged stylized cross section taken along line **6—6** of FIG. 3. The elastic strands **1** are clearly visible sandwiched between four layers of nonwoven fabric. Once again the buckles are shown in longitudinal cross section. Since this is also an idealized cross sectional view, the individual webs are shown and, in fact, the line of demarcation between plies is also readily apparent. In point of fact, the fibers of each web so intermingle that lines of separation are indistinct and this is also true of that distinction between plies. The elastic strands **1** are shown as are the longitudinal cross sections of several of the buckles **7**. A realistic view taken along **7—7** of FIG. 6 is given in FIG. 7. The cross section is taken along a line spaced somewhat from the elastic strand **1** although it is shown, in the background, as projecting from the lengthwise limits of the cross section given. The buckles **7** are bounded on either side by bond sites **12** representing the spaced pattern of repeating binder areas depicted as **6** in FIG. 1. These buckles are shown as compound, i.e. having two apexes, and as singular, but in either case they are separated by troughs **15** or inverted buckles and the combination and positioning of these two, i.e. the buckles **7** and the troughs or inverted buckles **15**, provide cushion sites adding bulk and softness but also a certain elastic-like property in the direction of thickness in the fabric. Each buckle **7** or trough **15** has a multitude of individualized fiber ends **16** projecting therefrom which contribute to the improved hand of the fabric in that they provide a rather dense outer layer of small fiber ends which surrounds the fabric as a whole contributing the softness exhibited by the mass presence. These fiber ends also contribute capillary functions to enhance liquid penetration and preclude surface wicking. In summary, it should be apparent that the fabric cover **9** on napkin **8** of FIG. 3 provides a member of the whole which possesses an adhesive-like quality, due to the longitudinal elastic properties it presents, which contributes to body conformability by insuring close body contact regardless of body movement.

The napkin **8** depicted in FIG. 8 represents the napkin **8** of FIG. 3 with opposing forces (represented by the arrows) applied to each tab. In this manner it can be seen that the buckles are plainly still in existence even though the lengthwise direction of the napkin **8** has been significantly increased. The absorbent core is given by **10**.

The sanitary napkin of this invention has softness due to the bulk provided by the buckling of the fabric. It thus offers increased comfort to the wearer.

Having now described the invention in specific detail, it will be readily apparent to those skilled in the art that innumerable variations, applications, modifications and extensions through the basic principles involved may be made without departing from the spirit or scope of the invention.

I claim:

1. In a sanitary napkin having an absorbent core encased by a fluid permeable cover, the improvement which provides a fluid permeable cover characterized by a plurality of substantially parallel buckled fabric areas positioned substantially transverse to the lengthwise direction of said napkin, said buckled areas being induced by spaced, substantially parallel strands of elastomeric material tension-bonded to said fabric, said cover exhibiting from about 15% to about 25% elasticity in the lengthwise direction of said napkin and said napkin being resultantly characterized by longitudinal elasticity and increased bulk.

2. The fluid permeable cover of claim **1** wherein said spans of elastomeric material are core spun filaments.

3. The fluid permeable cover of claim **1** wherein said strands of elastomeric material are filaments.

4. The fluid permeable cover of claim **1** wherein said strands extend in the machine direction of said fabric and said buckles extend transversely to said strands.

5. In a sanitary napkin having an absorbent core encased by a fluid permeable cover, the improvement which provides a fluid permeable cover characterized by at least one web of individualized fibers having a plurality of substantially parallel buckled fabric areas positioned substantially transverse to the lengthwise direction of the napkin, said buckled areas being induced by spaced substantially parallel filaments of elastomeric material, tension-bonded to said fabric, said core exhibiting from about 15% to about 25% elasticity in the lengthwise direction of said napkin and said napkin being resultantly characterized by longitudinal elasticity, increased bulk providing improved absorbency and improved adaptability to body contour.

References Cited

UNITED STATES PATENTS

2,697,678	12/1954	Ness et al.	128—290
2,840,078	6/1958	Smith	128—286
3,047,444	7/1962	Harwood	128—290

RICHARD A. GAUDET, *Primary Examiner.*

CHARLES F. ROSENBAUM, *Examiner.*