April 5, 1955 R. W. JOHNSON ET AL 2,705,497

ABSORBENT DRESSING AND METHOD OF MAKING SAME

Filed April 7, 1952 2 Sheets-Sheet 1

Fig. 1.

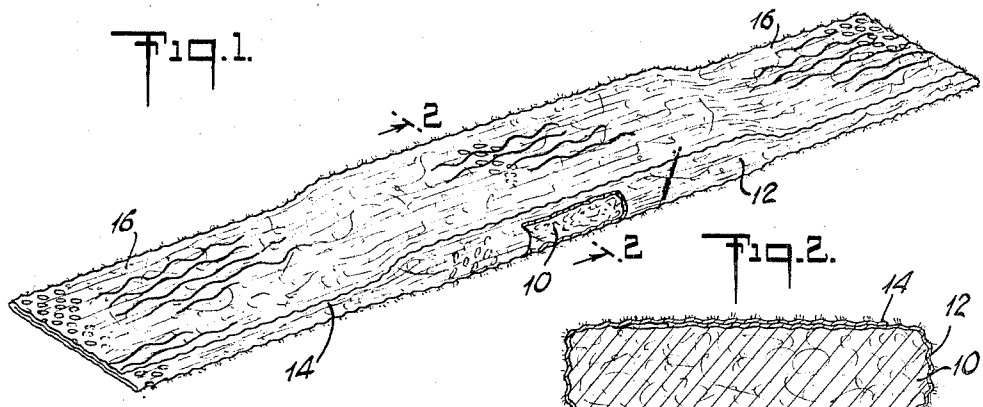


Fig. 2.

Fig. 3.

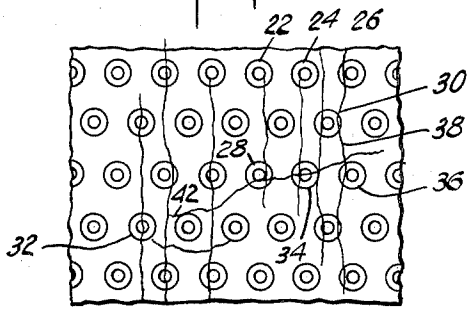


Fig. 4.

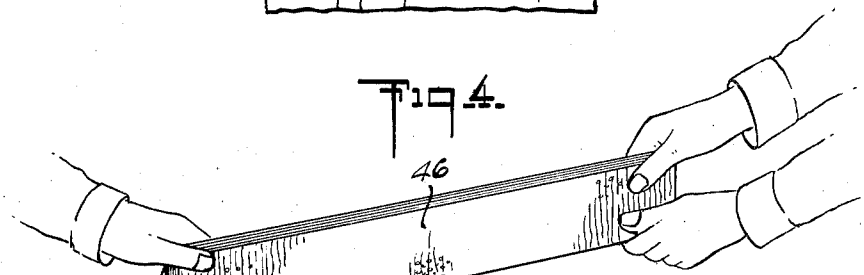
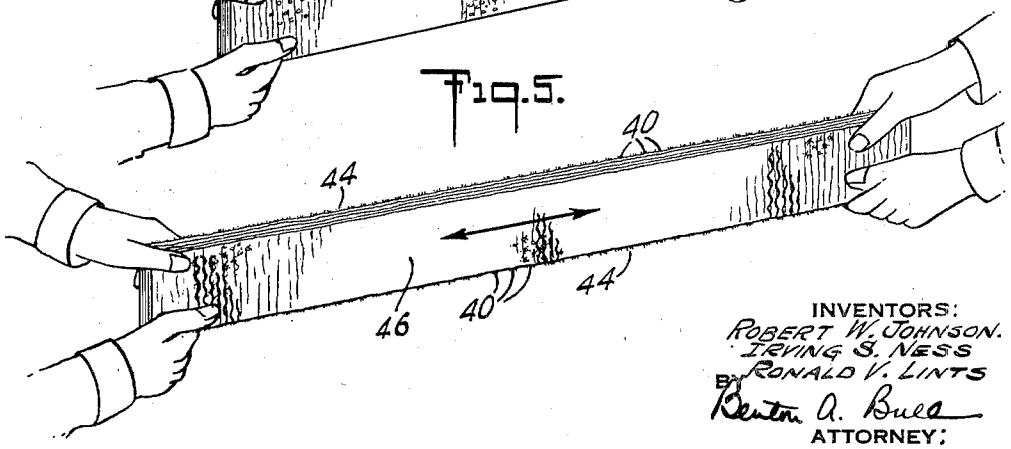


Fig. 5.



INVENTORS:
ROBERT W. JOHNSON.
IRVING S. NESS
RONALD V. LINTS
BY Benton A. Buell
ATTORNEY.

April 5, 1955 R. W. JOHNSON ET AL 2,705,497

ABSORBENT DRESSING AND METHOD OF MAKING SAME

Filed April 7, 1952 2 Sheets-Sheet 2

Fig. 6.

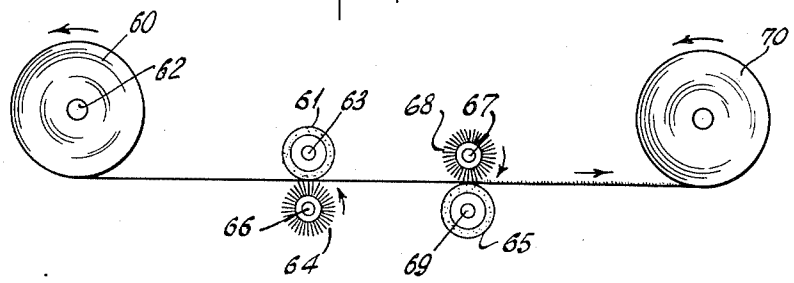


Fig. 8.

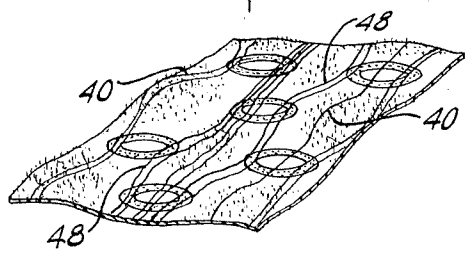


Fig. 7.

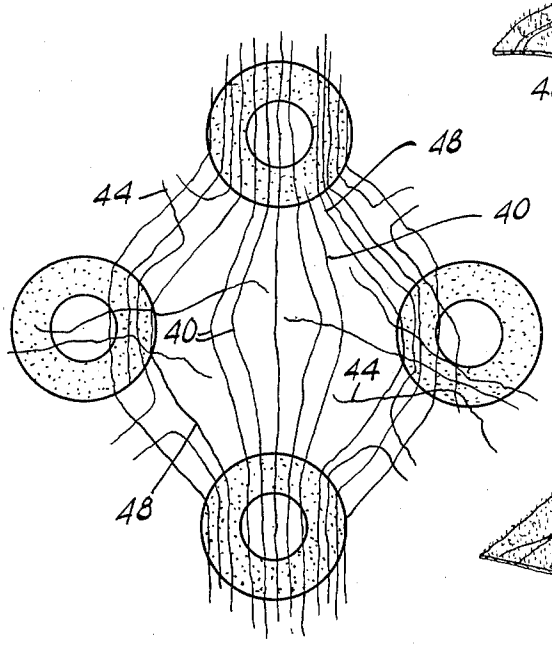
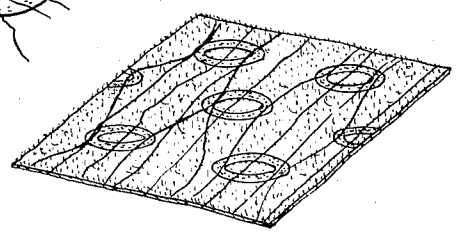


Fig. 9.



INVENTORS:
ROBERT W. JOHNSON
IRVING S. NESS
BY RONALD V. LINTS
Benton A. Buell
ATTORNEY.

United States Patent Office 2,705,497 Patented Apr. 5, 1955

2,705,497

ABSORBENT DRESSING AND METHOD OF MAKING SAME

Robert W. Johnson and Irving S. Ness, Princeton, and Ronald V. Lints, Rahway, N. J., assignors to Chicopee Manufacturing Corporation, a corporation of Massachusetts

Application April 7, 1952, Serial No. 280,965

11 Claims. (Cl. 128—290)

This invention relates to absorbent dressings of all types, including those employed for medical, surgical, obstetrical, hygienic, "first aid" or other purposes and is directed to improving the softness, strength, comfort and absorptive effectiveness thereof. While not limited thereto, the invention in its preferred embodiment relates to and will be described in connection with a catamenial device of the "sanitary napkin" type.

Sanitary napkins customarily have an absorbent pad or core surrounded by a pervious cover or sheath which serves the twofold purpose of holding the core together and providing supporting or pinning tabs by which the napkin is secured to a belt. The materials formerly available for covers have not been completely satisfactory for an effective and comfortable cover. The most generally used cover material has been a woven gauze. This is uncomfortable because, among other reasons, gauze is rough, especially where folded over the edges of the core. It becomes even rougher when the napkin becomes moistened and so chafes the wearer.

Attempts have been made to provide covers of nonwoven short-fiber materials generally classified as paper, but these attempts have failed because the paper is not sufficiently pervious, and is either too weak or too rough and hence uncomfortable. Attempts have also been made to provide covers of sheet material made from nonwoven textile fibers such as are shown in the Goldman Patent 2,039,312, but these have had the disadvantage that the sheet did not have sufficient crosswise strength to make a thoroughly reliable cover which would not rupture in use. One example of such attempt is shown in British Patent 549,254. In napkins made as there disclosed, if the cover has been sufficiently thin for practical use and comfort, it has not been strong enough, particularly in the crosswise direction.

The present invention eliminates many of these and other disadvantages of previous napkins by improving the porosity, cross strength and softness of the cover of the napkin and provides a cover which cooperates with the core to become softer when the napkin is folded. Thus under the conditions of use which normally increase the harshness and roughness of gauze covers, our improved napkin is designed to increase in softness to the touch and general comfort to the wearer.

The following description and accompanying drawings show, for example only, one form of absorbent dressing embodying our invention, and two methods of carrying the invention into practice.

In the drawings:

Fig. 1 is a perspective view of one form of our improved napkin;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a plan view, approximately full scale, of a fragment of the fabric from which the cover shown in Fig. 1 is formed;

Figs. 4 and 5 are perspective views showing one method of converting the fabric of Fig. 3 to form the cover of Fig. 1;

Fig. 6 is a schematic view showing another method of converting the fabric of Fig. 3 to the cover of Fig. 1;

Fig. 7 is a plan on an enlarged scale of a fragment of the cover of Fig. 1, produced as shown in Figs. 4 and 5;

Fig. 8 is a perspective view, partly in section of the fabric of Fig. 7; and

Fig. 9 is a perspective view, partly in section, of the fabric produced by the method shown in Fig. 6.

Referring to the drawings, any suitable absorbent core **10** is surrounded by a cover **12** folded about the core and usually overlapped as indicated at **14**. The core may be made of any known and suitable materials such as cotton fibers, paper, fluffed paper pulp and the like. Such cores are flexible and capable of being folded or bent and they are resilient to a degree that tends to make them resume their original configuration when the folding force is removed. This resilience is practically unavoidable, but not undesirable. This, and the thickness of the core create problems of stretching or strength of the cover which affect safety and comfort in the cover. The cover extends beyond the ends of the core to form pinning tabs **16**. So much has broadly been done before our invention.

The sheet material used for our cover is formed preferably of a nonwoven web of textile fibers, by which is meant fibers long enough to be spun into yarn and woven into cloth. Such fibers may, for example, have a predominant length of about half an inch or longer, that is, the majority of the fibers in the web will be about half an inch or longer although the web will include a minor proportion of shorter fibers and a minor proportion of longer. Preferably the fibers are predominantly aligned in one direction, for example by carding. A conventional lightweight card web, having a weight of about 100 to 300 grains per square yard, and so carded as to have, for example, 75% of the fibers substantially aligned in the direction of the length of the web, is suitable for our purpose. In such a web, perhaps 25% of the fibers will be "non-oriented" (i. e., more or less randomly arranged), although the major proportion (e. g., about 75%) of the fibers will be substantially aligned with the length of the napkin. Cotton fibers are suitable, as are rayon and mixtures of various fibers. Preferably the fibers are absorbent, that is, they readily take up and hold water when placed in contact with it.

The web of carded fibers is bound into a sheet which is substantially inextensible in the direction of the length of the napkin, but is extensible in the direction of its width. A preferred method of accomplishing this is to imprint on the web an articulated multiannulate binder pattern covering only a minor portion of the lateral surface of the web, not more than about 35% thereof. As illustrated in Fig. 3, the binder pattern comprises a multiplicity of discrete, physically separated, inherently elastic, annular binder areas **20**, **22**, **24**, **26**, **28**, **30**, **32**, **34** and **36** infused locally into the body of the web. These areas are arranged preferably in parallel courses extending across the web, and also in staggered relationship, in overlapping columns parallel to each other and to the direction of fiber orientation. Such columns on the applicator roll or plate should preferably overlap to the extent of 0.02 to 0.05 of an inch. The annular areas are so dimensioned and positioned that, within the overlap zone every imaginary line parallel to the direction of fiber orientation passes through at least three discrete binder areas within a distance along the axis of the imaginary line equal to the average length of the fibers comprising the web. Additionally, as mentioned before, the binder pattern should cover only a minor portion (e. g., about 5 to 35%, preferably about 10%) of the total lateral surface of the web, otherwise the resulting product will tend to be stiff and paperlike, and will also be incapable of substantial lateral extension.

Such a binder pattern coacts with the oriented fibers on the well-known "lazy tongs" principle. Thus the web is substantially extensible in a direction perpendicular to the oriented fibers, and behaves in effect as a "collapsible gate" with a web of oriented fibers extending diagonally across its collapsible parallelograms, i. e. with the oriented fibers parallel to one of the axes of such parallelograms.

When a web, bonded as described above, is stretched crosswise, either wet or dry, it undergoes lateral extension with three highly significant results. In the first place, a major reorientation of the originally parallelized fibers takes place with the formation of an open, lacelike, netlike or reticular structure due to the development of a series of parallel sinuous or serpentine bands of fibers arranged side by side in a common plane, and in apposi-

tion to each other, each band being the substantial reflection of the two adjacent bands on either side. In the second place, the "collapse" of the binder pattern in one direction which characteristically accompanies its extension in the cross direction, tends to buckle or "pucker" some of the oriented fibers (e. g., **40**, Fig. 7) out of the plane of the binder pattern, with the development of a uniform quilt-like pattern of tiny "pillows" (**40**, Fig. 8) on the surface of the fabric. In the third place, a substantial proportion of the non-oriented fibers (in Fig. 3) in the web, when subjected to tensional stress as the web is extended crosswise, are either ruptured or pulled out of the binder areas. The thus released ends of the non-oriented fibers tend to bend out of the plane of the fabric proper forming a uniform "nap" or "down" (e. g., **44**, Fig. 7 and **40**, Fig. 8) on the surface of the fabric. These three factors substantially improve the softness of the fabric when it is stretched crosswise beyond its elastic limit.

One method of bringing about these desirable consequences is diagrammatically shown in Figs. 4 and 5. A length of annulate bonded fabric, preferably in a dry condition, is accordion-folded lengthwise (i. e., in the direction of fiber orientation) to form an accordion-folded bolt **46** of cloth that can conveniently be held in the hands. One end of the bolt is firmly grasped by one individual while the other end is held by another. The two individuals then pull in opposite directions until the bolt is stretched beyond its elastic limit, and preferably until its stretched length is about 150% or more of its original length, as shown in Fig. 4, but not beyond the yield point of the fabric, i. e. the point at which the fabric rips or tears apart.

This stretching of the fabric is accompanied by a very characteristic "snapping" or "cracking" noise as the non-oriented fibers are ruptured or pulled out of the binder areas. At the same time an interesting fundamental change in fiber orientation takes place. A substantial proportion of the originally parallelized fibers are pulled into sinous bands of fibers **48** and **50**, each band being the reflection of its neighboring sinuous band on either side, as shown in Figs. 7 and 8, the bands being held together at their points of apposition by the annular binder areas. The resulting fabric has a quilt-like appearance, a uniformly open, lacelike, reticular structure and is covered over its lateral surface by a uniform nap or down. The reticular structure is characterized by uniformly varying fiber density across the lateral surface of the web. If stretching has been effected while the fabric is wet, the over-all fiber density is substantially decreased due to lengthening of the "lazy tongs" linkages.

Another method of producing a satisfactory napped cover is by brushing the fabric. One method of accomplishing this is shown in Fig. 6. The annulate bonded fabric is fed from a suitable supply roll **60** pivotally mounted on a shaft **62**. The roll **60** is desirably provided with suitable brake (not shown) to restrain but not prevent rotation in the counterclockwise direction. The fabric passes between felt covered idler rolls **61** and **65** rotating on shafts **63** and **69** and two cylindrical brushes **64** and **68** rotating on shafts **66** and **67**. The brushes are driven by means not shown in the direction indicated by the arrows, the bristles lightly brushing the fabric in a direction contrary to the direction of travel as the web passes over and then under the brushes **64** and **68**. The brushed fabric is collected on a wind-up roll **70** which is driven in the clockwise direction by suitable means (not shown).

The action of the brushes **64** and **68** on the fabric is twofold: (1) it tends to open up the fabric structure by stretching it to a degree crosswise, with the results previously mentioned; and (2) it pulls a substantial number of the fibers loose from the binder areas, raising a uniform nap or down (**40**, Fig. 9) over the surface of the web. By passing the fabric over and under a series of bowed bristle brushes in tandem; or under and over a series of cylindrical brushes rotating on axes obliquely disposed to the direction of web travel; or by using cylindrical brushes whose bristles are inclined from the radial direction; or by various combinations of these, lateral extension of the web may be accomplished to a still further degree, with desirable results.

The napped web, produced by any one of the methods described above or its equivalents, is then cut to suitable size and wrapped about the absorbent core to form the napkin of Fig. 1 or any other absorbent dressing well known in the art.

Having now described the invention in specific detail and exemplified the manner in which we prefer to carry it into practice, it will be readily apparent to those skilled in the art that innumerable variations, applications, modifications and extensions of the basic principles involved may be made without departing from its spirit or scope. Thus, for instance, instead of stretching the fabric manually as shown in Figs. 4 and 5, mechanical stretching devices well known in the art, such as tenters, bowed rolls, "button breakers" or the like, may be used if desired. Likewise, although we have illustrated an application of our fabric as a sanitary napkin cover, it is apparent that many other applications may be made of our fabrics in the manufacture of surgical dressings wherein woven fabric or gauze is replaced in whole or in part by our improved fabric. Thus our napped fabric may be made from lightweight, medium weight, or heavy weight webs weighing, say, from about 100 to about 500, 500 to 1000, or 1000 to 5000 grains per square yard. The resulting fabrics may be used in such dressings as surgical combines, surgical sponges, hospital underpads, disposable diapers, adhesive bandages, atomic burn dressings, including mittens, blankets and other disaster, emergency or first aid bandages; or surgical dressings of all types wherein a soft, downy and inexpensive fabric is desired. We therefore intend to be limited only in accordance with the following patent claims.

The term "textile fibers" as used herein includes the conventional textile fibers which are capable of being spun into yarn and woven into cloth. Generally speaking, this includes fibers whose average length is about one-half inch or longer.

We claim:

1. A method of making a nonwoven fabric having a uniformly open, lacelike, reticular structure, which comprises providing a laterally extensible web of carded fibers bonded together by a discontinuous but articulated multiannulate binder pattern infused locally into the body of the web and occupying less than 35% of the lateral surface thereof; uniformly stretching said web transversely across said parallelized fibers beyond its elastic limit but not beyond its yield point until it develops a uniform downy surface; and then permitting the stretched fabric to relax.

2. A method of making a nonwoven fabric having a uniformly open, lacelike, reticular structure which comprises providing a laterally extensible web of carded fibers bonded together by a discontinuous but articulated multiannulate binder pattern infused locally into the body of the web and occupying less than 35% of the lateral surface thereof; uniformly stretching said web in a direction across said parallelized fibers beyond its elastic limits by an amount equal to at least 150% of its original width but not beyond its yield point, until it develops a uniform downy surface; and then permitting the stretched web to relax.

3. A method of making a nonwoven fabric having a uniformly open, lacelike, reticular structure which comprises providing a laterally extensible web of carded fibers bonded together by a symmetrical, discontinuous but articulated multiannulate binder pattern infused locally into the body of the web and occupying less than 35% of the lateral surface thereof; uniformly stretching said web transversely across said parallelized fibers, beyond the elastic limit of said web but not beyond its yield point, until it develops a uniformly open, lacelike, reticular structure; and then permitting said stretched web to relax and to develop a pronounced loft and softness.

4. A method of making a nonwoven fabric having a uniformly open, lacelike, reticular structure which comprises providing a laterally extensible web of carded fibers bonded together by a symmetrical, discontinuous but articulated multiannulate binder pattern infused locally into the body of the web and occupying less than 35% of the lateral surface thereof; uniformly stretching said web transversely across said parallelized fibers, beyond the elastic limit of said web but not beyond its yield point, until it develops a uniform downy surface; permitting said web to relax; and then utilizing said web in the manufacture of a surgical dressing.

5. A method of forming an absorbent dressing of the type comprising an absorbent pad and a pervious cover therefor, which method comprises: providing a laterally

extensible, lightweight web of substantially oriented fibers bonded together in sheet form by an articulated, multiannulate binder pattern coacting with said oriented fibers on the "lazy tongs" principle; stretching said web beyond its elastic limit across the direction of fiber orientation until it develops a uniform downy surface; and wrapping said stretched web about an absorbent pad.

6. A method of forming an absorbent dressing of the type comprising an absorbent core and a pervious cover therefor, which method comprises: providing a lightweight web of substantially oriented textile fibers bonded together in sheet form by an articulated, multiannulate binder pattern coacting with said fibers on the "lazy tongs" principle and covering only a minor portion of the lateral surface of said web; brushing said web until it develops a pronounced downy-like surface; and wrapping said brushed web about an absorbent core.

7. An absorbent dressing comprising in combination an absorbent pad and a pervious cover therefor, the cover being substantially inextensible in the direction of the length of the pad and substantially extensible in the direction of the width of the pad, said cover including a sheet of fibers oriented predominantly in the direction of the length of the pad, said fibers being secured together by an articulated multiannulate binder pattern occupying a minor portion of the lateral surface of said cover sheet, the individual annuli being separated from but hingedly connected to each other by substantially unbonded lengths of fibers, said cover sheet including a minor portion of non-oriented fibers whose ends extend out of the plane of the cover sheet proper, forming a nap or down on the surface thereof.

8. A sanitary napkin comprising in combination an absorbent pad and a pervious cover surrounding the pad, the cover being substantially inextensible in the direction of the length of the napkin and substantially extensible in the direction of the width of the napkin, said cover including a sheet of fibers oriented predominantly in the direction of the length of the napkin, said fibers being secured together by an articulated multiannulate binder pattern occupying a minor portion of the lateral surface of said cover and coacting with said annuli as interconnected parallelograms that are collapsible on the "lazy tongs" principle; said cover including a minor proportion of non-oriented fibers whose ends extend out of the plane of the cover proper forming a uniform nap or down on the surface thereof.

9. An absorbent dressing comprising in combination an absorbent pad and a pervious cover surrounding the pad, the cover being substantially inextensible in the direction of the length of the pad and substantially extensible in the direction of the width of the pad with the development of uniformly open, lacelike, reticular structure, said cover including a sheet of fibers oriented predominantly in the direction of the length of the pad, said

fibers being secured together by a discontinuous but articulated multiannulate binder pattern infused locally into the body of said cover and occupying less than 35% of the lateral surface thereof, said cover including a minor portion of non-oriented fibers whose ends extend out of the plane of said cover proper, forming a uniform nap or down on the surface thereof.

10. An absorbent dressing comprising in combination an absorbent pad and a pervious cover surrounding the pad, the cover being substantially inextensible in the direction of the length of the pad and substantially extensible in the direction of the width of the pad, said cover including a multiplicity of substantially sinuous fiber bands disposed side by side in opposition to each other and in a common plane, each band being the substantial reflection of the adjacent band on either side, with their points of opposition in juxtaposition; each of said bands comprising a multiplicity of unspun textile fibers substantially oriented with the axis of the sinuous band in which they are disposed; said bands being bonded together by annular binder areas infused locally into the fibers of each pair of adjacent bands at their juxtaposed points of opposition.

11. A sanitary napkin comprising in combination an absorbent pad and a pervious cover surrounding the pad, the cover being substantially inextensible in the direction of the length of the napkin and substantially extensible in the direction of the width of the napkin, said cover including two series of uniformly spaced, substantially symmetrical, sinuous bands of fibers arranged in opposed pairs that are approximately the reflection of each other; a third series of bands of fibers one member of which series is interposed between each of said opposed pairs of sinuous bands, a portion of the length of said third band intermediate said points of opposition lying out of the plane of said opposed pairs; each of said bands comprising unspun textile fibers substantially oriented with the axis of the band in which they are disposed; said bands being bonded together by discrete, areas of binder infused locally into said bands at their points of opposition; said cover including a minor portion of non-oriented fibers whose ends extend out of the plane of said cover proper, forming a uniform down or nap on the surface thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

2,039,312	Goldman	May 5, 1936
2,207,279	Alderfer	July 9, 1940
2,235,682	Hawley	Mar. 18, 1941
2,407,548	Goldman	Sept. 10, 1946
2,429,177	Young	Oct. 14, 1947
2,525,003	Smith	Oct. 10, 1950
2,564,689	Harwood et al.	Aug. 21, 1951