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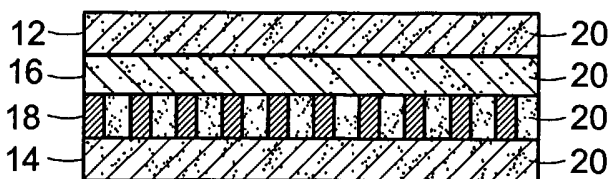
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(54) Title: STRETCH FABRIC



(57) Abstract: A laminated elastic fabric includes a first carrier layer of non-elastic, open fabric, and a second layer which is elastic in a direction extending longitudinally of the fabric; a first outer fabric layer and a second outer fabric layer on opposing sides of the first carrier and second elastic layers, and a binder bonding the layers together. The carrier layer can be a warp knit/weft insertion fabric having knit yarns and fill yarns and oriented with the knit yarns thereof extending longitudinally of the fabric,

the knit yarns being non-elastic, each of the knit yarns extending longitudinally of the fabric including a plurality of longitudinally-spaced knitted loops, and each of the fill yarns extending transversely of the fabric and through loops of the knit yarns.

STRETCH FABRIC

Field of the Invention

This invention relates to a composite material with controlled elasticity. More particularly, the invention relates to stretch fabrics having an elastic layer laminated to an
5 open carrier layer.

Background of the Invention

Various kinds of sheet materials having flexibility, elasticity or resiliency have been used for producing the elastic portions of sportswear, clothes for working and surgical operations, working gloves, gathers of caps and hats, diapers, suspenders, belts
10 and the like. In the past, elastic materials have been made elastically extensible using elastic elements disposed, e.g., woven, in the clothes such that the openings are at least partially encircled with elasticized bands. Still other methods include attaching stretchable fabric to the side edges of the main body of the garment. The stretchable fabric can be made by stretching an elastic or stretchable layer to a selected elongation,
15 placing a nonstretchable layer, such as a nonwoven on the stretched layer, bonding the layers together and allowing the layers to relax so that the nonstretchable layer is gathered.

There remains a need for an inexpensive, elastic fabric that has a good appearance, is soft and comfortable to wear and that, despite its low cost, has a high
20 longitudinal strength.

Summary of the Invention

The present invention features a stretch fabric including a layer that is elastic in the longitudinally extending direction laminated to one side of a carrier layer. The elastic layer/carrier layer laminate is sandwiched between and bonded to top and bottom outer

fabric layers that impart the desired properties of appearance, softness and comfort to the elastic fabric.

In one or more embodiments, the elastic layer is a plurality of longitudinally-extending elastic strands. In one or more embodiments, the carrier layer is a warp-knitted fabric, also referred to as a warp knit/weft insertion fabric, oriented with the knit yarns extending longitudinally. The warp knit/weft insertion fabric has a weight of less than about 50 grams per square meter (about 1.5 oz. per square yard) and most preferably less than about 25 to 30 grams per square meter (about 0.7 to 0.9 oz. per square yard). The top and bottom outer layers can be a lightweight spun-blown synthetic or natural fiber nonwoven, a knitted, or a woven fabric.

The stretch fabric has a good appearance and is soft and comfortable to the touch, yet has 2a longitudinal strength and is less expensive than its woven or knitted competitors where the elastic yarns are woven or knitted into the fabric as an integral part of the woven or knitted cloth.

Brief Description Of The Drawings

FIG. 1 is top view, partially broken away, of a stretch fabric according to one or more embodiments of the present invention.

FIG. 2 is a cross-sectional view, taken at line 2--2 of FIG. 1.

FIG. 3 is a top view of a warp knit/weft insertion layer for use in one or more embodiments of the present invention.

Detailed Description Of The Invention

FIGS. 1 and 2 illustrate a laminated elastic fabric **10** having a top layer **12** and a bottom layer **14** of an outermost woven, knit or nonwoven fabric that imparts the desired properties of appearance, softness and comfort to the fabric. Positioned between the top and bottom layers is a carrier layer **16**, shown here as a warp knit/weft insertion fabric,

and an elastic layer **18** of longitudinally-extending, transversely spaced (about 12 per inch) elastic strands. The four-layer structure is laminated together with a binder **20** that impregnates the inner warp knit/weft insertion fabric, coats the elastic layer, and penetrates into a portion of the top and bottom outer layers.

5 The adhesive does not saturate the full thickness of the top and bottom outer layers, so that the outermost surface of the elastic fabric is essentially free of binder. The binder can penetrate up to about 95% of the thickness of outer layers, and in some embodiments, the binder penetrates into about 25% to about 75% of the outermost fabric. Typically, the binder penetrates into about 50% of the outermost fabric.

10 The outermost fabric contacts the wearer and, as such, is a fabric that is comfortable and provides a pleasing appearance. There is no requirement of a particular weight, weave or thickness for the outer layer. The top and bottom layers can be the same or different. In some embodiments, it is breathable and/or capable of gathering. The outer fabric is a woven, knit, weft knit/warp insertion or nonwoven fabric prepared
15 from synthetic or natural fibers. For example, they may be selected from the naturally occurring animal and vegetable fibers, including cotton and wool, or synthetic (chemical) fibers such as nylon, cellulose, rayon, polyesters, polyamides, acrylics, polypropylene, polyethylene and the like, including blends of such fibers. In a nonwoven substrate backing, the fibers are intimately entangled with each other to form a coherent breathable
20 fibrous nonwoven backing. The particular fiber composition that is used as the nonwoven backing substrate is selected from those known in the prior art, according to the web property desired. Exemplary nonwovens having a desirable soft or comfortable feel include polypropylene, polyester, polyethylene, and cotton nonwovens. In one or more embodiments, the nonwoven fabric is lightweight, and can typically be about 10 grams

per square meter (about 0.3 oz. per square yard) or about 17-20 grams per square meter (about 0.5-0.6 oz. per square yard).

The carrier layer supports the elastic layer and acts as a carrier for the binder. The carrier layer can be any lightweight and open woven, knit or nonwoven fabric, or it can be
5 a warp knit/weft insertion fabric. The carrier layer is selected to reinforce the assembled structure, while retaining the openness (which is a function of thread count and yarn denier, etc.) of the fabric. It is also selected to provide sufficient adhesive surface area to establish a strong adhesive contact with the outer fabric layers and the elastic layer. The fabric can be up to about 95% open, i.e., the fabric makes up about 5% of the surface
10 area, and is typically about 70% open.

Referring to FIG. 3, a warp knit/weft insertion fabric **300** is shown on outer fabric **310**. The warp-knit/weft insertion fabric **300** includes one or more weft yarns **320** inserted through a knit loop **325**. The weft insert yarns may include one or more filaments, the number and size of which are selected to have a desired tensile strength.
15 By way of example only, the weft yarns are shown having three filaments; however, the weft yarns may be monofilament or multifilament, for example, the weft yarns can have a number of filaments, for example, 3-15 filaments. Because the fabric is warp knit/weft insertion rather than conventionally woven, the knitted warp yarns **325** form rather loose warp yarn "loops" around the fill yarns **320**, and the knitted warp structure also provides
20 that each row of the knitted warp includes three yarns extending in the warp direction. This three-yarn warp knit /weft insertion construction results in a lightweight fabric having high tensile strength (about 12.8 lbs/inch) in the warp direction.

The fully extended warp knit/weft insertion fabric **300** includes spaces **330** between adjacent weft yarns **320**. This spacing, coupled with the loose, non-twisted,
25 filamentary structure of the weft yarns themselves, permits the weft yarns to move

towards and away from each other in response to stretch and relaxation of the longitudinal elastic strands **18**, which is of course accompanied by elongation and relaxation of the warp yarns.

In one or more embodiments, the warp knit/weft insertion fabric has a weight of less than about 50 grams per square meter (about 1.5 oz. per square yard) and most preferably less than about 25 to 30 grams per square meter (about 0.7 to 0.9 oz. per square yard), and may be as low as 5 grams per square meter. An exemplary warp knit/weft insertion fabric has a weight ranging from about 25 to about 10 grams per square meter, and a warp/weft thread count ranging from about 18 x 12 to about 9 x 9. The knitted warp yarns are about 40 denier polyester; the about 150 denier fill or weft yarns are loose, nontwisted, texturized polyester filaments. Similar warp knit/weft insertion fabrics are available elsewhere, e.g., warp knit/weft insertion greige fabric available from Milliken & Company of Spartanburg, S.C. A lightweight fabric maintains the porosity of the stretch fabric and relaxes to a smooth, comfortable gather.

The elastic strands **18** used in the present invention for the elastic layer include thermoplastic elastomers, synthetic and natural rubbers. An exemplary elastic strand is a 280 denier strand, which is sold under the trademark GLOSPAN by Radici spandex Inc. of Fall River, Mass. Depending on the amount of elasticity desired in the elastic fabric **10**, both the denier and number of elastic strands per inch (measured transversely) of the fabric may vary. For example, the denier of the elastic strands may vary from less than 100 to about 1000, and there may be from about 5 to about 15 elastic strands per inch. In some embodiments, the elastic yarns provide an elastic fabric having a degree of stretch (elongation) ranging from approximately 40% to 275%.

Typically, the elastic fabric **10** is formed by laminating the warp knit/weft insertion fabric **16** when fully extended or taut over stretched elastic strands **18**. The

binder-impregnated elastic layer/warp knit/weft insertion layer is then contacted, while still fully extended, with the upper and lower outer layers. Binder **20** impregnates or coats the inner two layers and penetrates into a portion of the top and bottom outer layers. The particular binder **20** used to laminate the four layers together to form the finished product depends, principally, on whether and what kind of adhesive properties are desired. The binder can be a thermosetting or thermoplastic adhesive that remains flexible when set or cured. Typically, the binder is a self-curing laminating adhesive. Exemplary binders include carboxylated styrene butadiene (SBR) latexes, acrylic emulsions, copolymer acrylic emulsions, and the like.

10 An exemplary fabric includes a lightweight nonwoven polypropylene top and bottom outer fabric having a weight of 10 g/m². The carrier layer is a warp knit/weft insertion fabric having a 9 x 12 warp/weft thread count with a 40 denier monofilament polyester warp yarn and a multifilament warp yarn of 70 denier. The elastic layer is 280 denier spandex rubber. All four layers are bonded together using Rovene® 4150
15 carboxylated SBR emulsion. The resultant fabric has a strength in the longitudinal warp direction of about 12 pounds per inch of width, yet it is light and comfortable to wear. As compared to the commercially available elastic fabrics made by weaving or knitting elastic yarns into a woven fabric, the laminated elastic fabric of the present invention provides a feel and an appearance that is at least equal and often superior to comparable
20 elastic fabrics.

The foregoing detailed description includes many specific details. The inclusion of such detail is for the purpose of illustration only and is non-limiting of the invention. In addition, features in one embodiment may be combined with features in other

embodiments of the invention. Various changes may be made without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. A elastic fabric comprising:
 - a first carrier layer of a non-elastic, open fabric;
 - a second layer, which is elastic in a direction extending longitudinally of the fabric;
 - 5 a first outer fabric layer and a second outer fabric layer on opposing sides of the first carrier and second elastic layers; and
 - a binder bonding the layers together.
2. The elastic fabric of claim 1, wherein the carrier fabric comprises a warp knit/weft insertion fabric having knit yarns and fill yarns and oriented with the knit yarns
10 thereof extending longitudinally of the fabric, said knit yarns being non-elastic, each of said knit yarns extending longitudinally of the tape and including a plurality of longitudinally-spaced knitted loops, and each of the fill yarns extending transversely of the fabric and through loops of the knit yarns.
3. The elastic fabric of claim 1, wherein the carrier layer is selected from the group
15 consisting of woven, nonwoven, warp knit/weft insertion and knitted fabrics.
4. The fabric of claim 1 or 2, wherein the binder is in adhesive contact with all layers of the fabric.
5. The fabric of claim 1 or 2, wherein the binder impregnates the first carrier layer and coats the second elastic layer.
- 20 6. The fabric of claim 5, wherein the binder penetrates a partial thickness of the first and second outer layers.
7. The fabric of claim 5, wherein the binder penetrates up to about 95% of the thickness of the first and second outer layers.
8. The fabric of claim 5, wherein the binder penetrates in the range of about 25% to
25 about 75% of the thickness of the first and second outer layers.

9. The fabric of claim 5, wherein the binder penetrates up to 50% of the thickness of the first and second outer layers.
10. The fabric of claim 1, wherein the top and bottom outer layers are selected from the group consisting of nonwoven materials, woven materials, knitted materials, and warp knit/weft insertion fabrics.
11. The fabric of claim 10 wherein said nonwoven is selected from the group consisting of nylon, rayon, cellulosics, cotton, polyester, polyamide, acrylics, polyethylene, and polypropylene.
12. The fabric of claim 1, wherein said second layer comprises individual elastic strands spaced transversely of the fabric relative to each other and extending longitudinally of the fabric.
13. The fabric of claim 12, wherein said elastic strands have a denier less than about 1000.
14. The fabric of claim 12, wherein said elastic strands are spaced at a density in the range of 5 to 15 per inch measured transversely of the bandage.
15. The fabric of claim 2, wherein the knit yarns of the warp knit/weft insert fabric comprises polyester.
16. The fabric of claim 2, wherein the fill yarns of the warp knit/weft insertion fabric comprise a plurality of yarns.
17. The fabric of claim 1 or 2, wherein the carrier fabric has an openness of up to about 95%.
18. The fabric of claim 1 or 2, wherein the carrier fabric has an openness of up to about 70%.
19. The fabric of claim 1, wherein the binder comprises a self-curing adhesive.

20. The fabric of claim 1, wherein the binder is a thermosetting adhesive.

21. The fabric of claim 1, wherein the binder is a thermoplastic adhesive.

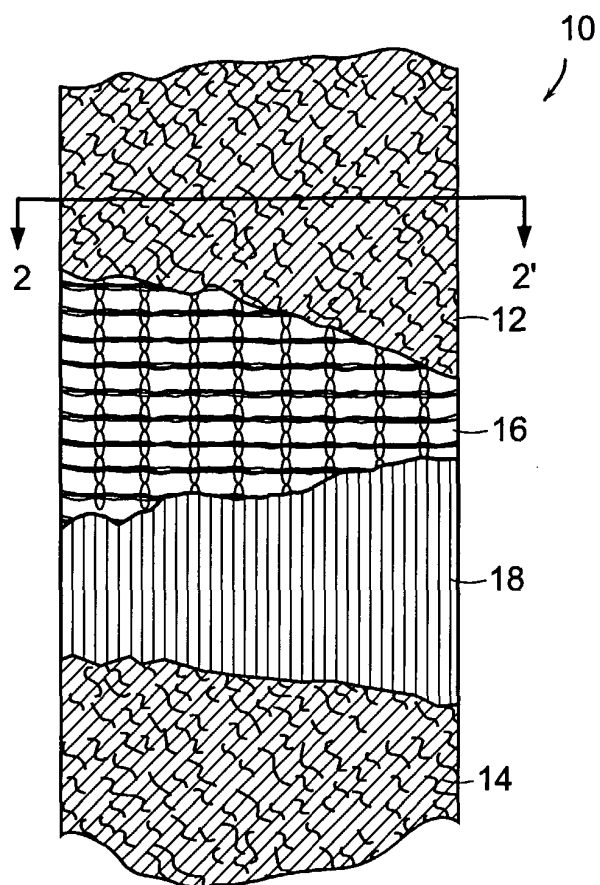


FIG. 1

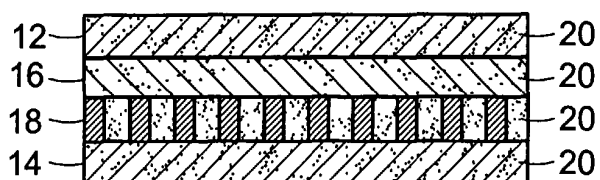


FIG. 2

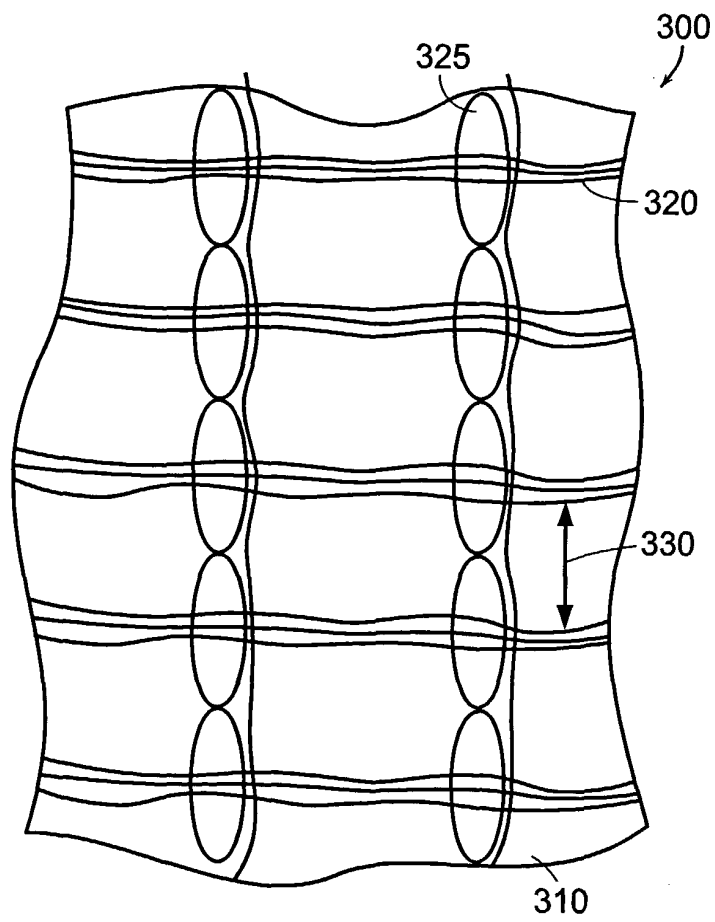


FIG. 3