United States Patent

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[33] **Czechoslovakia**
[31] **40 06-68**

[54] **COMPOSITE NONWOVEN FABRIC**
8 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **161/50,** 28/72.2, 156/148, 161/62, 161/80, 161/154
[51] **Int. Cl.** **B32b 5/06**
[50] **Field of Search** ..... 161/50, 80, 59, 166, 72, 154, 62, 67; 28/72.2, 72 NM; 66/85; 156/148

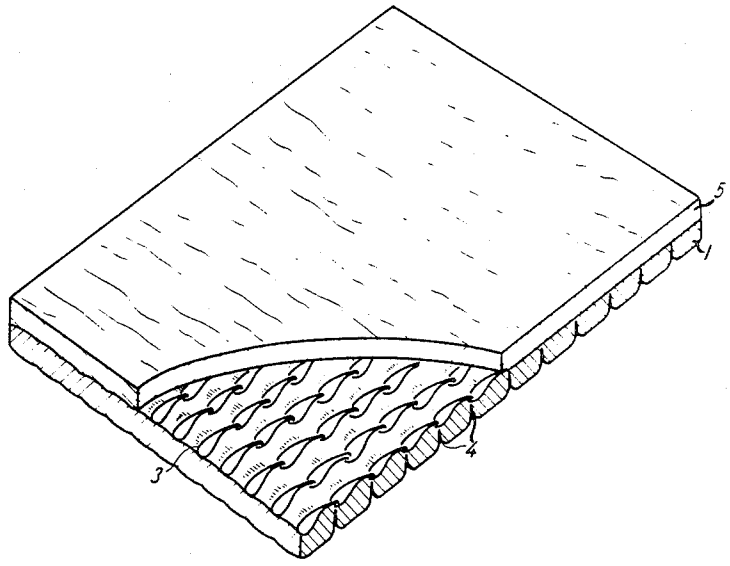
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ABSTRACT: A composite nonwoven fabric composed of a plurality of superimposed nonwoven fibrous textile layers. This fabric includes spaced-apart rows of chain-loops of threads consisting of the same type of fibers as the respective outer layer; these threads serving for reinforcing the respective outer layer. The fabric also includes a plurality of spaced needling connections passing through the fabric layers, securing the same to each other so as to form a coherent composite nonwoven fabric.



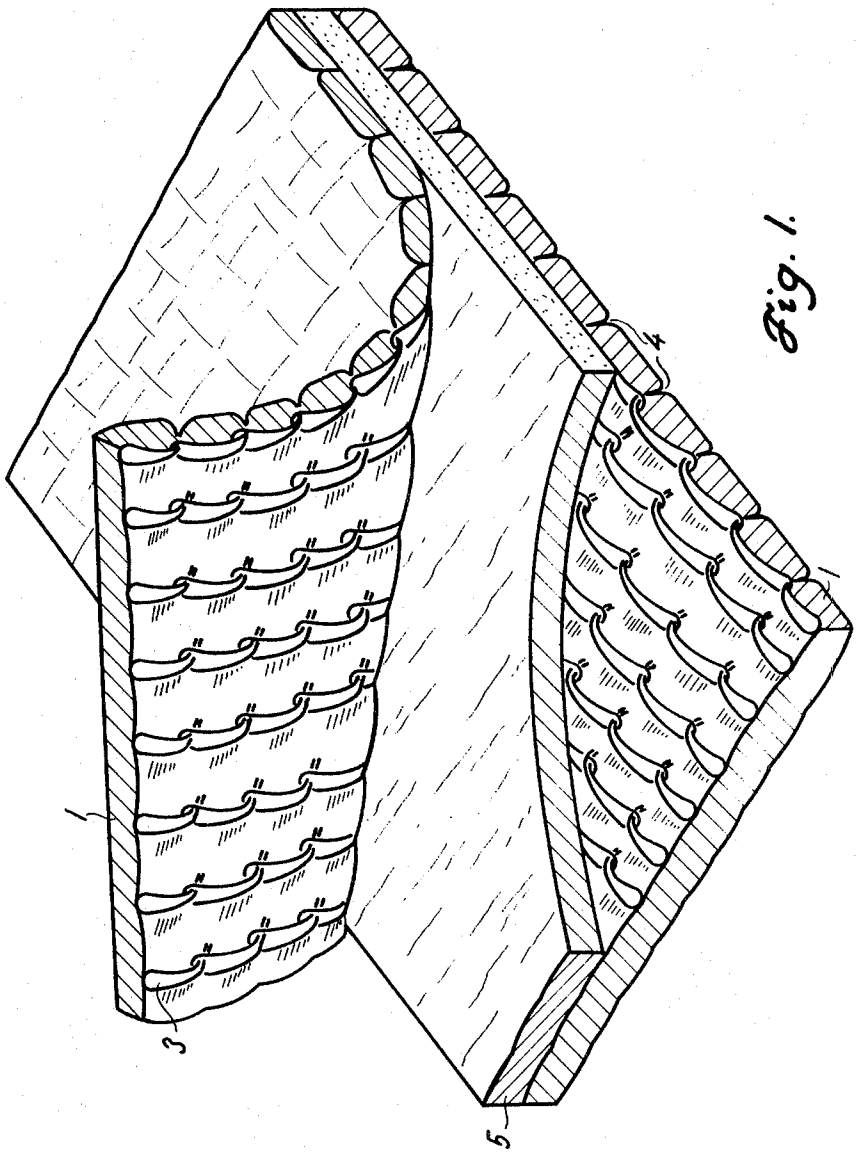


Fig. 1.

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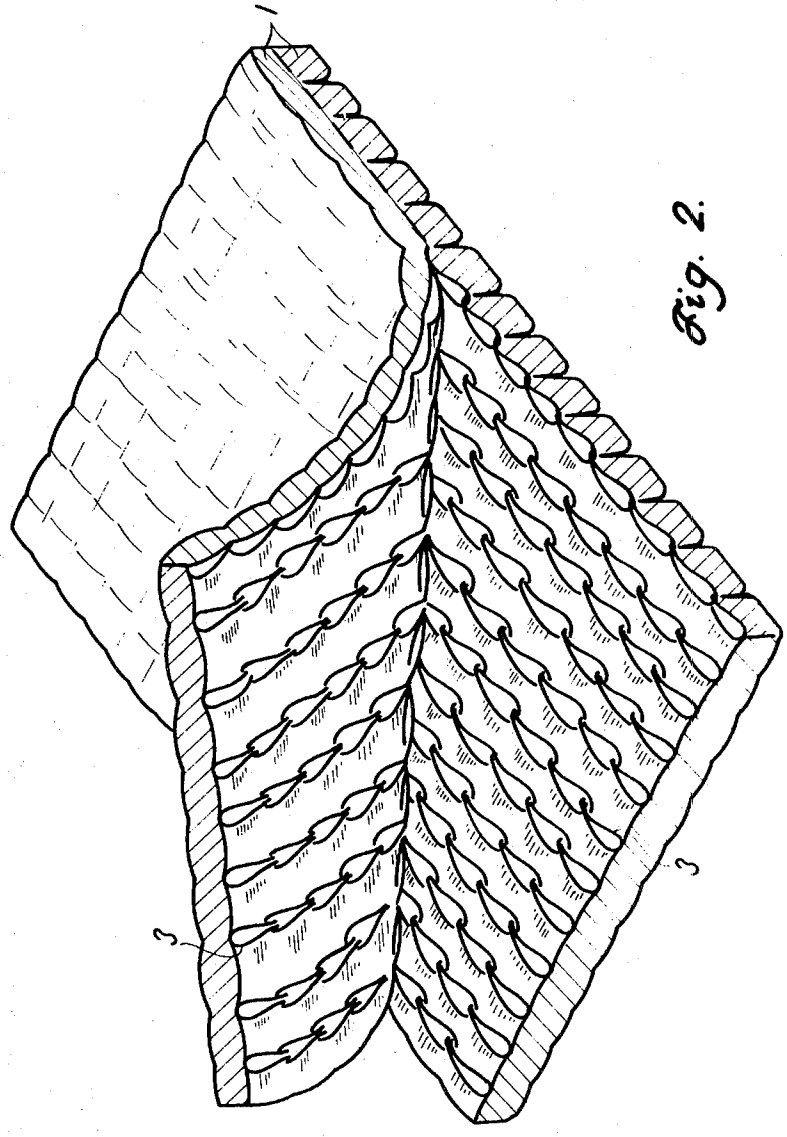


Fig. 2.

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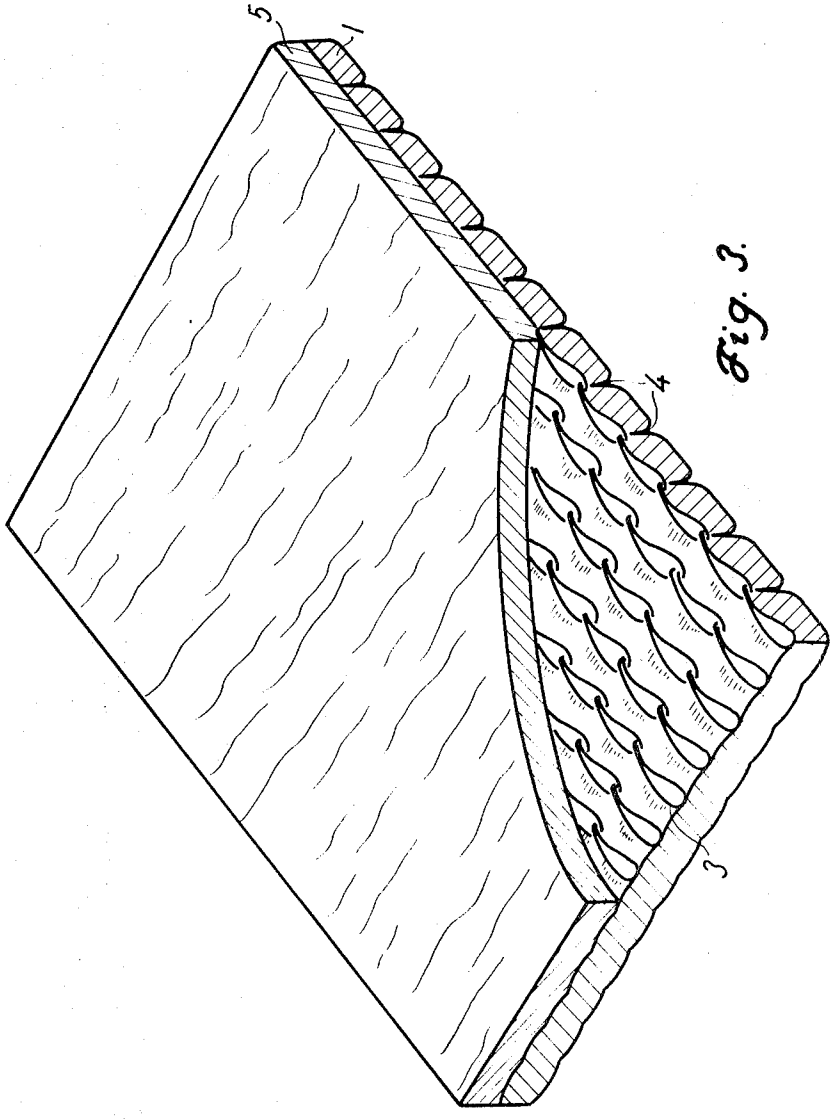


Fig. 3.

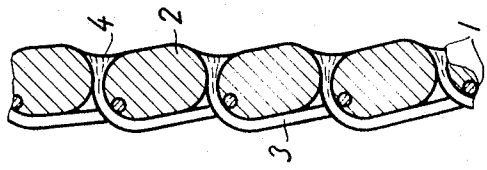


Fig. 4.

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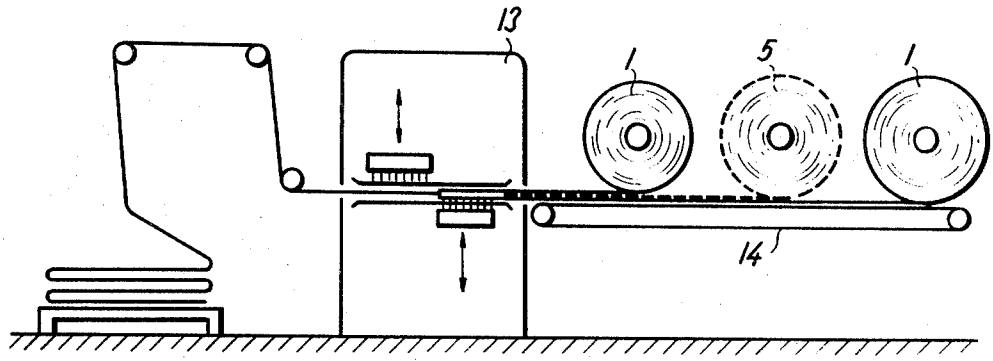


Fig. 6.

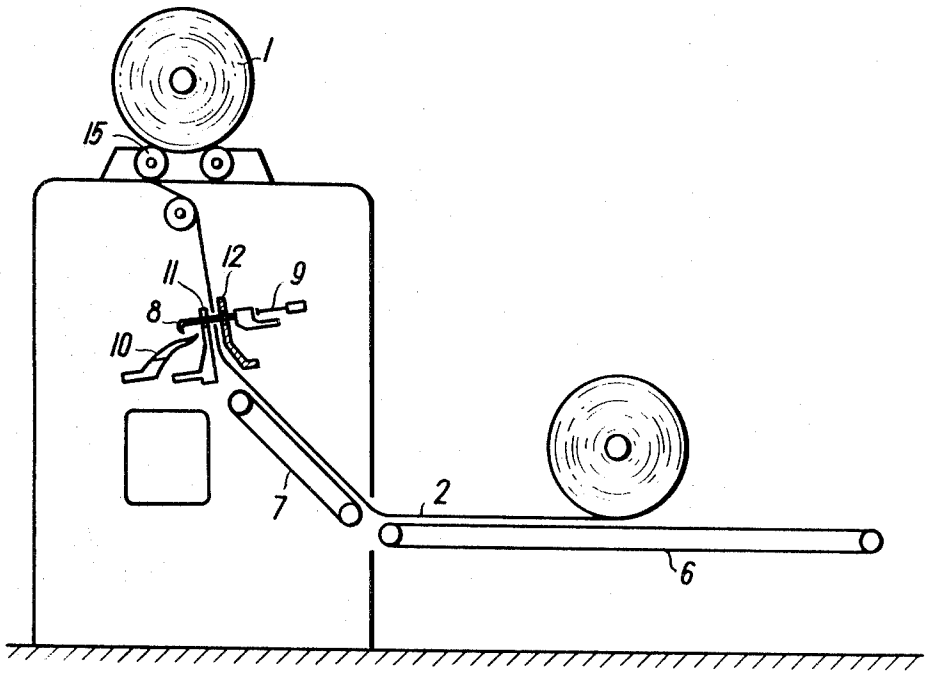


Fig. 5.

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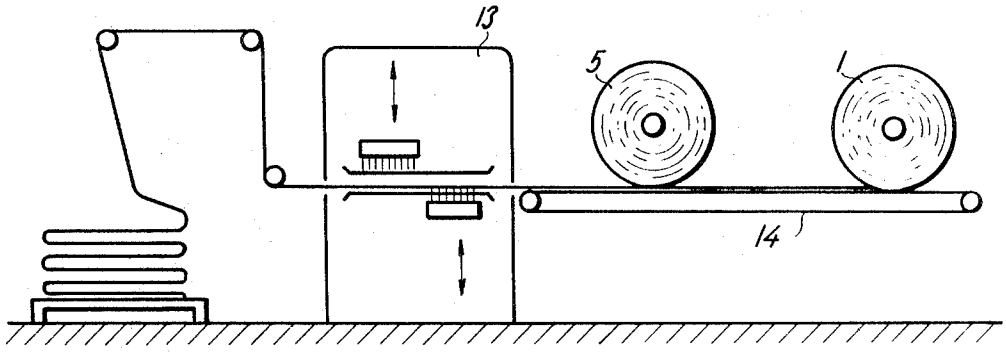


Fig. 7.

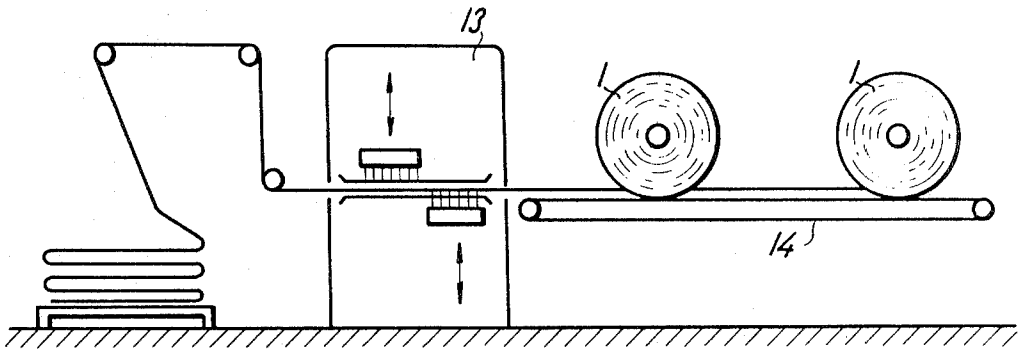


Fig. 8.

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COMPOSITE NONWOVEN FABRIC

The object of the invention is a multilayer nonwoven fabric from at least two fibrous layers and the method of making it.

There are known multilayer nonwoven fabrics consisting of a single ground fabric, made by weaving, knitting, stitch-bonding a web with binding thread, bonding a fibrous web, or of a plastic sheet covered from one or both the sides by webs, which are connected with the ground fabric by needling.

The production, processing and use of the known multilayer nonwoven fabrics exhibit certain disadvantages. The said ground fabrics are rather costly. During needling, the structure of the fabric is interfered with, resulting in reduced mechanical properties of the product. Further, the layers are often imperfectly bound with the ground fabric, particularly if the number of needle punches is low, and they may consequently separate.

The fibers on the surface of the known fabrics are for some end-uses insufficiently anchored and they easily shed, especially if the fabrics are subsequently raised.

The woven ground fabric tends to unravel at the cut line during making up.

If the knitted fabric is used for the ground fabric, the handling during the production is more difficult because of the high extensibility and selvedge rolling.

In stitch-bonded fabrics, the binding warp gets damaged by needling.

The material used in the layers—plastic sheets, woven fabrics, webs, knitted fabrics, binding warps—being nonhomogeneous, mechanical properties of the product cannot be improved by subsequent and uniform shrinking.

Nonwoven fabrics comprising at least two layers connected by needling have already been disclosed. The application of such fabrics is very limited because of the reduced strength. They are therefore used mainly for interlinings. Substantially higher strength is exhibited by nonwoven fabrics consisting of three web layers, the middle layer being reinforced by loops made from the fibers of the same layer, all the layers being interconnected by needling. By raising both the outer layers of the fabric, a blanket is obtained.

It is a disadvantage of nonwoven fabrics of this type that the cohesion of the surface texture of outer layers is insufficient so that the fibers easily shed or are pulled out. For some end-uses, if for example the outer layer is subsequently raised or if the outer layer is the fabric face, such loose structure of the outer layer is unsatisfactory.

The above disadvantages are eliminated by the multilayer nonwoven fabric according to the invention characterized by the fact that of all the layers interconnected by needling, at least a single outer layer is reinforced by stitch-bonding, with loops formed from fibers of the same outer layer.

In multilayer nonwoven fabrics according to the invention, it is of special advantage if the side of the outer layer provided with the loops is positioned inside the fabric.

Multilayer nonwoven fabrics according to the invention, with higher cohesion, density and better usage properties, can further be obtained by strengthening the layer bonding by heat or chemical shrinking.

Very fine gradation of cohesion, density and usage properties of the multilayer nonwoven fabric according to invention can be obtained by incorporating 5 to 100 percent of shrinkable fibers in at least a single layer.

For a number of end-uses, such as for domestic textiles, it is of advantage to raise at least one of the outer layers of the multilayer fabric according to the invention.

For some special uses, such as for outerwear or for shoe tops, it is of particular advantage to incorporate in at least a single layer, of the fabric according to the invention, differently shrunk fibers.

Multilayer nonwoven fabrics are made according to the invention on a needle punching machine by needling from one or both sides, thus connecting at least two fibrous layers, one of them having been reinforced by loops made from the fibers of the same layer by stitch-bonding on a stitch-bonding machine.

After connecting the layers by needling, the multilayer nonwoven fabric, made by the method according to the invention, is with advantage shrunk by heat or by chemical means.

In the production of some multilayer nonwoven fabrics according to the invention, e.g. for domestic textiles, it was found useful to raise the multilayer fabric after needling and/or shrinking, on a raising machine, on one or both the fabric sides.

Fibrous bodies from a single or more webs, reinforced by stitch-bonding loops made from the same fibers, are known e.g. as arabeva. Multilayer nonwoven fabrics according to the invention can be made from various combinations of such fabrics, e.g. arabeva with loose-fiber webs, or a number of such fabrics, e.g. arabeva without further layers of loose-fiber webs.

A great scope has also been found for blankets made from fabrics according to the invention, consisting e.g. of two arabeva fabrics, connected by needling, with the face sides with the loops in juxtaposition, the back sides being raised forming the pile surface of the blanket.

Fabrics according to the invention can be successfully used for backing artificial leather. Such backing comprises e.g. two arabeva fabrics sandwiching a loose web, made of a blend of collagen and synthetic fibers, the three layers being interconnected by needling from both the sides and subsequently shrunk to get the required volume density. In the same way blankets can be made, from layers of appropriate fiber blend, by needling and raising on both the fabric sides.

A similar fabric, consisting of a single arabeva fabric only and of a single layer of loose-fiber web, connected by needling from one or both the sides, represents excellent backing for flooring in its unshrunk state, after raising on both the sides it can be used for blankets, and after shrinking it can substitute classical felts for clothing and industrial outlets.

The fabric according to the invention can also be used for apparel fabrics of astrakhan appearance. It is made from an arabeva fabric, containing high-shrink fibers, by needling with a fibrous web of unshrinkable fibers, whereupon the whole fabric is shrunk.

In all the said cases, the fibers of all the layers are well bonded due to the fact that in the arabeva fabric, as compared with other fabric types, the fibers are arranged more loosely and the number of loose fiber ends is greater. The fibers can thus be better interlaced by needing with fibers of other layers, and the fibers of the ground fabric are not damaged by needling.

If the arabeva fabric forms the surface of such multilayer nonwoven fabric, with the face side with loops inside the multilayer fabric, the anchorage of surface fibers is very good because besides needling, the majority of fiber ends are bound in the stitch-bonding loops and do not consequently shed even in subsequent raising.

The multilayer fabric according to the invention consists of fibers only and it can therefore be either uniformly and perfectly shrunk, or differential shrinkage in the various layers can be obtained by using fibers of different shrinkage, as required.

By shrinking the shrinkable part of the fibers, high fabric density is attained, the fibers are firmly anchored and the layers are firmly connected, as required for the exacting end-uses.

The method of producing fabrics according to the present invention is described in detail in the following examples.

EXAMPLE 1

A sandwich is made of two arabeva fabrics from a blend of 75 percent PVC fibers, 4 den, 60 mm., black color, and 25 percent of rayon fibers, 3.5 den, 60 mm., white color, 35 courses per 10 cm. and 40 wales per 10 cm., weighing 120 g./sq.m., and a fibrous web which is placed between the two fabrics. The web is made of the same fibrous web and its real weight is 80 g./sq.m.

The sandwich is needled on a needle punching machine with one head operating downwards and the other head upwards. The machine is set out with felting needles of the type 15×18×36×3RB NKU. The layers of the three-tier sandwich are reinforced by two passes through the needling machine at 240 needle punches per sq. cm. The sandwich is further shrunk by steam in two passes over a steaming table at 98 ° C. This brings about surface shrinkage of about 60 percent. The fabric is finally steam-blown. The product is used for shoe tops and its weight is 800 g./sq.m.

EXAMPLE 2

Two arabeva fabrics of about 170 g./sq.m., 35 courses per 10 cm., 40 wales per 10 cm., made from pure acrylic fibers, 6 den, 80 mm. are positioned facing each other with their face sides with loops and connected by needling. The process and the machine are the same as in example 1. After needling the two-layer fabric is raised on both sides. It is used for blankets.

EXAMPLE 3

A fabric which can be used as felt, e.g. for collar lining, decorative and industrial uses, is made from a layer of arabeva fabric from a blend of 15 percent of highly shrinkable copolyester fibers, 2.75 den, undyed, and of 85 percent of rayon fibers, 3 den, 60 mm., black-dyed, of 100 g./sq.m., 40 courses per 10 cm., 40 wales per 10 cm. A fibrous web, made of pure rayon fibers, 3.5 den, 60 mm., black-dyed, is laid on the face side (with loops) of the arabeva fabric. The web is first needled into the arabeva ground, followed by four to six passages through a needle punching machine for needling alternately from back and face side, yielding 200 to 300 needle punches per sq. cm. cm. The fabric is then preshrunk on the steaming device of a rotary press and it is then pressed on the same press at 150° C. contact temperature and 3-ton pressure. The area shrinkage is 23 percent.

EXAMPLE 4

Fabric for plastic leather backing with smooth surface. Two arabeva fabrics and a web of collagen fibers are used. Both the arabeva fabrics are of the same constitution, containing 70 percent rayon fibers, 3.5 den, 60 mm. and 30 **percent highly shrinkage polypropylene fibers**, 3 den, 90 mm. Weight 90 g./sq.m., 35 courses per 10 cm., 45 wales per 10 cm. The web incorporates 70 percent collagen fibers and 30 percent high-shrink polypropylene fibers, 3 den, 40 mm., weight 200 g./sq.m. The arabeva fabrics cover the collagen web from both sides in such a way that their face sides, with the loops, face the web. The three layers are then connected by needling from both sides by the felting needles of a needle punching machine. In this operation, the felting needles carry the fibers from both the arabeva fabrics and thus interlace all the three layers in the direction of fabric thickness. In the given case, the density of needle penetrations is 340 punches per sq.cm., afterwards the multilayer fabric is shrunk by 20 percent by means of hot air on perforated drums at 145 ° C. for 2 minutes. The final volume weight is 0.28 g./cub.cm. The volume density can be adjusted by the number of needle punches per sq.cm.

EXAMPLE 5

A two-layer nonwoven fabric with lambskin effect on the face side. The fabric is made from an arabeva fabric and a fibrous web. The arabeva fabric with 80 g./sq.m. from a blend of 60 percent high-shrink copolyester fibers, 1.5 den, 45 mm., and of 20 percent polypropylene fibers, unset, 1.2 den, 55 mm., and of 20 percent rayon fibers, 2.27 den, 40 mm. Course density 40/10 cm., wale density 40/10 cm. The web of 140 g./sq.m. is made from a blend of 50 percent rayon fibers, 3.5 den, 60 mm. Both the components are black dyed. The fabric is needled from the web side only, using coarse felting needles 15×18×32×3½ RB, greater traverse length, i.e. 10 mm. per stroke, and length of penetration 15 mm. The fabric is then exposed to hot air at 150° C. which causes the ground arabeva fabric to shrink 70 percent in its area, the excess of the web forming a relief effect similar to lambskin.

The object of the invention follows the enclosed drawings, wherein:

FIG. 1 shows a multilayer fabric corresponding to the above examples 1, 4;

FIG. 2 illustrates a multilayer fabric according to the invention, corresponding to the above example 2;

FIG. 3 depicts a multilayer fabric according to the invention corresponding to the above example 3, 5;

FIG. 4 is a cross section through an arabeva fabric i.e. through a fibrous layer stitch-bonded by loops formed from the layer fibers, before it is connected by needling with other fabric layers according to the invention.

FIG. 5 is a drawing of the machine for producing the arabeva layer according to FIG. 4.

FIG. 6, 7, 8 illustrate diagrammatically the machine equipment for producing multilayer textiles according to the invention, wherein FIG. 6 shows a device according to example 1, 4, FIG. 7 shows a device according to example 3, 5 and FIG. 8 shows a device for producing fabrics according to example 2.

FIG. 1 referring to the drawings there is shown in FIG. 1 a perspective view of the multilayer fabric which consists of two arabeva fabrics, broadly indicated by the reference number 1 and one layer of fibrous web 5 which is sandwiched between the outer facing layers of arabeva fabrics 1.

The arabeva fabrics 1 cover and sandwiched layer of fibrous web 5 from both sides in such way that their face sides with loops 3 face the sandwiched fibrous web 5. The sandwich of layers 1 and 5 then united by needling passing through a conventional needling machine 13 shown schematically in FIG. 6, 7, 8.

FIG. 2 shows a multilayer fabric which consists of two arabeva fabrics 1 according to FIG. 4 united together by needling on a conventional needling apparatus 13 in such way that their face sides with loops 3 are facing each other.

FIG. 3 is a perspective view of the multilayer fabric which consists of one arabeva fabric 1 facing with its face side with loops 3 the second layer of the fibrous web 5. These two layers are united by needling passing through a conventional needling machine 13.

FIG. 4 is a cross-sectional view of the arabeva fabric 1 which is formed by reinforcement of the cross-lapped batt of fibers 2 by stitch loops 3 laying on the face side of the fabric which are formed from fibers 4 pulled from the backside of the batt of fibers 2. The loops 4 are connected into whales of chain stitches which appear on the face side of the arabeva fabric 1.

FIG. 5 is an equipment known according to U.S. Pat. No. 3,309,901 for making arabeva fabric 1. The batt of cross-lapped fibers 2 formed on conventional opening and feeding device, cards or other fiber opening apparatus with cross-lapping device, is conveyed by means of a horizontal conveyor 6 to the inclined conveyor 7 which moves the batt of fibers 2 into a stitching mechanism which consists of working needles 8, latches 9, feeding hooks 10, closing table 11 and a knock-over table 12. The stitched batt of fibers 2 is wound on the winding rollers 15 into a roll as an arabeva fabric 1.

FIG. 6 shows the apparatus on which it is suitably possible to unite two arabeva fabrics 1 and the sandwiched fibrous web 5. The sandwiched layers 1 and 5 are conveyed through a conventional needling apparatus 13. After passing through apparatus a multilayer fabric according to FIG. 1 is formed.

FIG. 7 shows the apparatus for forming the multilayer fabric according to FIG. 3. One layer of arabeva fabric 1 and a fibrous web 5 are conveyed through a conventional needling apparatus 13 where both layers are bonded together and form a fabric according to FIG. 2.

FIG. 8 is an apparatus utilized for making of multilayer fabric shown in FIG. 2. Two arabeva fabrics are fed by conveyor 14 into the needling mechanism of a conventional needling machine 13 where both arabeva fabrics 1 are united.

The above examples do not by far exhaust the potential range of multilayer nonwoven fabrics within the scope of this invention. Multilayer nonwoven fabrics according to the present invention can be finished by the usual textile methods, including dyeing and printing. They are economical because yarn is not required for producing them and because they are made on highly efficient stitch-bonding and needling machines.

We claim:

1. Composite nonwoven fabric composed of a plurality of superimposed nonwoven fibrous textile layers, at least one of the outer nonwoven fibrous textile layers including spaced-apart rows of chain loops formed of fibers of the respective outer layer and serving for reinforcing the same; and a plurality of spaced needling connections passing through said layers and securing the same to each other so as to form a coherent composite nonwoven fabric.

2. Composite nonwoven fabric as defined in claim 1 wherein said spaced-apart rows of chain loops lie on one side of said outer layer, and said one side of said outer layer is positioned toward the inside of said nonwoven fabric.

3. Composite nonwoven fabric as defined in claim 1 wherein the outer face of at least one of said outer layers is raised.

4. Composite nonwoven fabric as defined in claim 1, wherein at least one of said layers comprises fibers possessing the characteristic of shrinkability.

5. Composite nonwoven fabric as defined in claim 4, wherein at least one of said layers comprises a plurality of types of fibers, at least two of said types of fibers, at least two of said types of fibers possessing the characteristics of shrinkability to different extents.

6. Composite nonwoven fabric as defined in claim 1, wherein the number of said spaced needling connections is between 200 and 340cm.^{2} of fabric.

7. Composite nonwoven fabric as defined in claim 1, wherein said textile layers comprise at least two substances selected from the group consisting of natural and synthetic organic fibers.

8. Composite nonwoven fabric as defined in claim 1, wherein said textile layers comprise at least two substances selected from the group consisting of polyvinyl chloride, rayon, collagen, high-shrunk polypropylene, and copolyester fibers.

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