ABSTRACT OF THE DISCLOSURE

A needled, composite, integrated, multi-layer, nonwoven fabric adaptable for use as bed coverings, garments and the like and specifically characterized by improved strength and durability. The fabric comprises a supporting layer of self-bonding fibers, preferably synthetic organic fibers, extending in random directions throughout the layer and being bonded to each other at the crossing points of the fibers; upper and lower three-dimensional, self-sustaining, facing layers of nonwoven textile fibers superimposed on opposite sides of and being contiguous with the supporting layer to completely cover the supporting layer and form the multi-layer fabric; and a multiplicity of needled fiber entanglements extending from each outer face of the fabric, through the superimposed layers, to the outer other face of the fabric and interlocking the fibers of the outer facing layers with each other and with the self-bonded fibers of the supporting layer to form the composite, integrated, multi-layer fabric. The resulting composite, nonwoven fabric may include napped fiber outer surfaces thereon to provide desired characteristics.

This invention relates to a needled, composite, integrated, multi-layer, nonwoven fabric.

Previously, in the manufacture of needled nonwoven fabrics for use as bed coverings, garments and the like, problems have been presented with respect to strength and durability due to excessive wear, strain, etc. These previously known needled nonwoven fabrics have included supporting layers formed generally of loosely woven material, warpwise extending yarns, etc., which have failed to provide the desired strength and stability to the fabric.

Accordingly, it is the object of the present invention to provide a needled nonwoven fabric, which is particularly adaptable for use as bed coverings, garments and the like and which is specifically characterized by improved strength and durability so as to overcome the above problems presented in prior needled nonwoven fabrics.

By this invention, it has been found that the above object may be accomplished by providing a fabric comprising a supporting layer of a three-dimensional batt of self-bonding fibers, preferably heat-reactive, synthetic, organic fibers, extending in random directions throughout the batt and being bonded to each other at the crossing points of the fibers. The fabric further comprises upper and lower three-dimensional, self-sustaining facing layers of nonwoven textile fibers superimposed on opposite sides of and being contiguous with the supporting layer to completely cover the supporting layer and to form the multi-layer fabric. Preferably, the fibers of the facing layers may be oriented in the widthwise direction of the fabric. The fabric further comprises a multiplicity of needled fiber entanglements extending from each outer face of the fabric, throughout the superimposed layers, to the outer other face of the fabric, and the needled fiber entanglements interlock the fibers of the outer facing layers with each other and with the self-bonded fibers of the supporting layer to form the composite, integrated, multi-layer fabric.

This composite, nonwoven fabric with superior strength and durability characteristics may include desirable surface treatments on one or both faces thereof. These surface treatments may include napped, raised fibers on one or both faces thereof which are of sufficient height and density to cover the needled fiber entanglements and provide the desired finish on the fabric. While only one surface treatment of the fabric is illustrated in the drawings and described in detail hereinafter, it is to be understood that this invention is intended to cover various surface treatments of the novel nonwoven fabric defined herein.

It may be seen from the above general description and from the more specific description to follow that the composite, needled, nonwoven fabric of this invention utilizes the features of a self-bonded supporting layer for providing improved and superior strength and stability to the fabric in all directions, along with outer facing layers which are needled to the supporting layer to form a composite fabric with superior strength and stability.

Some of the features and objects of this invention having been stated, other objects and features will appear as the description proceeds, when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an enlarged, fragmentary, partially-explored, broken-away, perspective view of the needled, composite, multi-layer, nonwoven fabric of this invention illustrating the fabric in the two basic stages of its construction;

FIG. 2 is an enlarged top view of a portion of the supporting layer utilized in the nonwoven fabric of FIG. 1 illustrating the random orientation of the fibers and the crossing of the fibers;

FIG. 3 is an enlarged cross-sectional view of a portion of the needled nonwoven fabric of FIG. 1 illustrating more clearly the needled fiber entanglements therein; and

FIG. 4 is a reduced, perspective view with one corner turned up of the needled nonwoven fabric of FIG. 1 having napped, raised fibrous surfaces on each of the outer faces thereof.

Referring now to the drawings, there is illustrated in FIG. 1 the needled, composite, nonwoven fabric constructed according to this invention and generally indicated by the reference numeral 10. FIG. 1, as described above, is broken away and includes generally an exploded portion on the left-hand side of the figure illustrating the various layers of the composite fabric and a portion on the right-hand side of the figure illustrating the composite fabric after the same has been needled together.

The composite, nonwoven fabric 10 comprises a supporting layer 11 of a batt of self-bonding fibers 12 extending in random directions throughout the batt and being bonded to each other at the crossing points of the fibers, as more clearly illustrated in FIG. 2. These self-bonding fibers are preferably heat-reactive, synthetic, organic fibers which are capable of bonding to each other under the influence of heat. Suitable fibers 12 have been found to be isotactic polypropylene, linear polypropylene, polyethylene, terephthalate, polyhexamethylene, adipamide, polycarboxamide, copolyester of ethylene glycol, etc.

It has been found by this invention that suitable material for forming this supporting layer 11 is of the "self-bonded" type commercially manufactured by E. I. du Pont de Nemours and Company of Wilmington, Del., under their trademark "Reemay" and disclosed in their U.S. Pat. No. 5,276,944, issued Oct. 4, 1966. This type of self-bonding, randomly oriented fibrous material provides excellent strength and stability in all directions and has been found by this invention to be particularly suitable for use as a supporting layer 11.

The composite, nonwoven fabric 10 further comprises upper and lower three-dimensional, self-sustaining, facing layers 13 and 14 of nonwoven fibers. These upper and lower facing layers are preferably formed from fibers similar to those forming the supporting layer 11.

In the present invention, the facing layers 13 and 14 are needled to the supporting layer 11 to secure the upper and lower facing layers 13 and 14 to the supporting layer 11. In addition, the facing layers 13 and 14 may be napped or textured to provide desired outer surface characteristics.

This invention is preferably utilized for providing improved and superior strength and durability to bed coverings, garments, and the like, as well as other articles for which needled nonwoven fabrics may be employed.
What is claimed is:

1. A needled, composite, integrated, multi-layer, nonwoven fabric adaptable for use as bed coverings, garments and the like and specifically characterized by improved strength and durability, said fabric comprising:
   - a supporting layer comprising a three-dimensional batt of self-bonding, heat-reactive, synthetic, organic fibers capable of bonding to each other under the influence of heat and extending in random directions throughout said batt and being bonded to each other at the crossing points of the fibers to provide strength and stability to said fabric in all directions;
   - upper and lower three-dimensional, self-sustaining, facing layers comprising nonwoven fabrics being between approximately 750 fiber entanglements per square inch and 850 fiber entanglements per square inch; and
   - outer treated surfaces on each of said outer faces of said fabric comprising napped, raised fibers of sufficient height and density to cover said needled fiber entanglements penetrating said superimposed layers and providing a desired finish on both faces of said fabric.

2. A needled, composite, integrated, multi-layer, nonwoven fabric adaptable for use as bed coverings, garments and the like and specifically characterized by improved strength and durability, said fabric comprising:
   - a supporting layer comprising a three-dimensional batt of self-bonding, heat-reactive, synthetic, organic fibers capable of bonding to each other under the influence of heat and extending in random directions throughout said batt and being bonded to each other at the crossing points of the fibers to provide strength and stability to said fabric in all directions;
   - upper and lower three-dimensional, self-sustaining, facing layers comprising nonwoven textiles fibers and being superimposed on the opposite sides of and being contiguous with said supporting layer to completely cover said supporting layer and to form said multi-layer fabrics; and
   - a multiplicity of needled fiber entanglements extending from each outer face of said fabric, through said superimposed layers, to the other outer face of said fabric and interlocking said fibers of said outer facing layers with each other and with the self-bonded fibers of said supporting layer to form said composite, integrated, multi-layer fabric, the number of said needled fiber entanglements penetrating said superimposed layers being between approximately 750 fiber entanglements per square inch and 850 fiber entanglements per square inch.

References Cited

UNITED STATES PATENTS

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