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BONDED BATTING, OR NON-WOVEN FABRIC

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This invention relates to a bonded batting, or non-woven fabric, and relates more particularly to a bonded batting of a strong, coherent structure.

An important object of this invention is to provide a novel process for the production of a bonded batting that will yield a product having a strong, coherent structure.

A further object of this invention is to provide a novel batting.

Other objects of this invention will be apparent from the following detailed description and claims.

According to this invention, there is formed a batting of staple fibers. Thereafter, the batting is needled mechanically to interlock the fibers with one another. This operation consists of plunging a bank of barbed needles into the batting as it passes under the needles. The needled batting is then treated with a bonding agent further to interlock the said fibers with one another. There is obtained in this manner a product having an unusually high strength, durability, and resilience. This batting is suitable for permanent flexible insulation, shock padding, filtration, and in general uses requiring a durable, bonded batting.

In forming the batting, there may be employed staple fibers of any suitable type, for example, cotton, rayon, nylon, polyacrylonitrile, linear polyesters, polyurethanes, glass, and polyaminotriazoles. Valuable results are obtained when there are employed for this purpose staple fibers of lower aliphatic acid esters of cellulose such as, for example, cellulose acetate, cellulose propionate, cellulose butyrate, cellulose acetate propionate and cellulose acetate butyrate. These staple fibers have the common property of being incapable of felting by conventional techniques.

The staple fibers may range in length from 0.5 to 4 inches and may have a denier per filament of between 1 and 75. Advantageously, the staple fibers should be crimped and should have between 2 and 15 crimps per inch, with the fibers of higher denier having fewer crimps per inch. The staple fibers may be converted into a batting in any suitable manner, for example, by means of a batting card or the like. Another way in which the batting may be formed is by suspending the staple fibers in a stream of fluid such as air or water, and depositing said fibers from the stream onto a suitable supporting structure, for example, a foraminous member through which the stream can flow. The batting should have a thickness of at least 1/64 inch or, preferably, between 1/32 and 3 inches. The weight of the batting if cellulose acetate staple fibers are used, should be at least 1 ounce per square yard or, preferably, between 2 and 14 ounces per square yard.

The batting is then passed through a needle loom where it is needled by means of a reciprocating board carrying a plurality of barbed needles. As the batting passes through the loom, the board is moved to force the needles perpendicularly through the batting thereby driving a portion of the fibers through the batting perpendicular to the remaining fibers. This produces an interlocking effect, strengthening the bonds between the staple fibers in the batting. Best results are obtained when the needling is carried out so as to drive between 10,000 and 200,000 needles through each square yard of the batting.

The needled batting is then treated with a bonding agent which will produce a bond between the staple fibers at their points of contact. Examples of suitable bonding agents that can be used for this purpose are polyvinyl acetate, nitrile rubber, polyvinyl chloride, polyesters, and others, as water emulsions or solvent solutions. Valuable results are obtained, particularly when there are employed lower aliphatic acid ester of cellulose staple fibers, when the bonding agent is a polyvinyl ester resin such as polyvinyl acetate. The bonding agent may be applied to the batting in solution, or as an emulsion in a liquid that is inert to the staple fibers, by spraying, dipping, or the like. The amount of bonding agent, as solids remaining in the final product, should range between 2 and 75% by weight based on the weight of the finished batting. When the amount of bonding agent lies within this range, the batting obtained will be strong, but will have an open, porous, springy structure. Following the application of the solution or emulsion of the bonding agent to the batting, the batting is dried in any desired manner, for example, through the use of heated air to drive off the solvent.

The following examples are given to illustrate this invention further.

Example I

A batting having a weight of 6 ounces per square yard is made by air flotation on a moving metal mesh screen from dull cellulose acetate staple fibers 2 inches long, having a denier of 3 with 6 crimps per inch. This batting is passed through a needle loom employing an 18 x 30 x 3 close barb felting needle (Torrington) at such a rate that the batting receives 157,500 needle punches per square yard. The needled batting is then passed to an immersion saturator where it is impregnated with an aqueous emulsion of polyvinyl acetate having a solids content of 27.5% by weight. As it leaves the saturator, the batting is passed between a pair of squeeze rolls which are set to give a 100% by weight wet pickup. The wet batting is then passed through a two zone hot air drier. In the first zone, in which the batting remains for 1.5 minutes, air at a temperature of 120° C. passes downwardly through the batting. In the second zone, in which the batting also remains for 1.5 minutes, air at a temperature of 175° C. is blown at both the top and bottom surfaces of the batting. The dried batting is then taken up on rolls. The batting is drafted down at the saturator to a weight of 5.5 ounces per square yard and picks up sufficient polyvinyl acetate to give a final weight of 7.0 ounces per square yard.

Example II

A batting having a weight of 8.5 ounces per square yard is made by air flotation on a moving metal mesh screen from dull cellulose acetate staple fibers 2.5 inches long, having a denier of 35 and 2 crimps per inch. This batting is passed through a needle loom as described in Example I at such a rate that the batting receives 97,000 needle punches per square yard. The needled batting is then passed to an immersion saturator where it is impregnated with an aqueous emulsion containing:

	Parts by weight
Nitrile rubber (Hycar 1571)	100.0
Zinc oxide	5.0
Sulfur	2.0
Butyl zincate	2.0
Wetting agent (Triton X-200)	6.0

together with sufficient water to bring the solids content to 25% by weight. As it leaves the saturator, the batting is passed between a pair of squeeze rolls which are set to give a 113% by weight wet pickup. The wet batting is then passed through the two zone drier described in Example I, being dried in the first zone for 1.7 minutes with air having a temperature of 107° C. and in the second zone for 1.7 minutes with air havng a temperature of 175° C. The batting is drafted down at the saturator to a weight of 7.3 ounces per square yard and picks up sufficient bonding agent to give a final weight of 9.4 ounces per square yard.

Example III

A batting having a weight of 6 ounces per square yard is prepared in the manner described in Example I from a mixture of equal parts by weight of dull cellulose acetate stape fibers and semi-dull nylon (polyhexamethylene adipamide) staple fibers, both having a length of 2 inches, a denier of 3 and 8 crimps per inch. The batting is needled in the manner described in Example I and is then passed through an immersion saturator where it is impregnated with an aqueous emulsion containing:

	Parts by weight
Polyvinyl acetate	6.7
Nitrile rubber (Chemigum Latex CHS 235)	18.3
Water	75.0

following which it is passed between squeeze rolls and dried. The batting is drafted down at the saturator to a weight of 5.5 ounces per square yard and picks up sufficient bonding agent to give a final weight of 6.3 ounces per square yard.

It is to be understood that the foregoing detailed description is merely given by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. Process for the production of a batting, which comprises needling a batting of staple fibers, and applying a polymeric bonding agent to said batting to bond the staple fibers together at their points of contact, said bonding agent being applied in an amount sufficient to produce an open, porous, springy bonded structure, said amount being between 2 and 75% by weight based on the weight of the final product.

2. Process for the production of a batting, which comprises needling a batting of crimped stable fibers having between 2 and 15 crimps per inch, a denier of between 1 and 75, and a length of between 0.5 and 4 inches, said batting having a thickness of at least 1/64 inch and a weight of between 2 and 14 ounces per square yard, and applying a polymeric bonding agent to said batting to bond the staple fibers together at their points of contact and to produce an open porous springy bonded structure, there being applied to the batting between 2 and 75% by weight of bonding agent based on the weight of the finished product.

3. Process for the production of a batting, which comprises needling a batting of crimped staple fibers having between 2 and 15 crimps per inch, a denier of between 1 and 75, and a length of between 0.5 and 4 inches, said batting having a thickness of at least 1/64 inch and a weight of between 2 and 14 ounces per square yard, immersing said batting in an emulsion of a polymeric bonding agent, then compressing the batting to squeeze out a portion of the emulsion from the batting, and thereafter drying the batting, after release of said compression, to bond the staple fibers together at their points of contact and to produce an open porous springy bonded structure, there being applied to the batting between 2 and 75% by weight of bonding agent based on the weight of the final product.

4. An open porous springy needled batting consisting of staple fibers in which the staple fibers are bonded together at their points of contact by a polymeric bonding agent different from said fibers, there being present between 2 and 75% by weight of bonding agent based on the weight of the final product.

5. A needled batting of crimped staple fibers having between 2 and 15 crimps per inch, a denier of between 1 and 75, and a length of between 0.5 and 4 inches, in which a proportion of the fibers extend through the batting perpendicular to the remaining fibers to interlock the fibers, and a polymeric non-fibrous bonding agent bonding the staple fibers together at their points of contact, there being present between 2 and 75% by weight of bonding agent based on the weight of the final product the said batting having an open porous, springy structure.

6. Process for the production of a batting which comprises needling a batting of crimped cellulose acetate staple fibers having between 2 and 15 crimps per inch, a denier of between 1 and 75, and a length of between 0.5 and 4 inches, said batting having a thickness of between 1/32 and 3 inches and a weight of between 2 and 14 ounces per square yard, and applying polyvinyl acetate to said batting to bond the staple fibers together at their points of contact, there being applied to the batting between 2 and 75% by weight of polyvinyl acetated based on the weight of the final product.

7. An open porous springy needled batting of cellulose acetate staple fibers in which the staple fibers are bonded together at their points of contact by a polymeric non-fibrous bonding agent, there being present between 2 and 75% by weight of bonding agent based on the weight of the final product.

8. A needled batting of crimped cellulose acetate staple fibers having between 2 and 15 crimps per inch, a denier of between 1 and 75, and a length of between 0.5 and 4 inches, in which a proportion of the fibers extend through the batting perpendicular to the remaining fibers to interlock the fibers, and polyvinyl acetate bonding the staple fibers together at their points of contact, there being present between 2 and 75% by weight of polyvinyl acetate based on the weight of the final product the said batting having an open porous, springy structure.

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