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BENDABLE, HIGH LOFT, BONDED, NON-WOVEN, TEXTILE FABRIC

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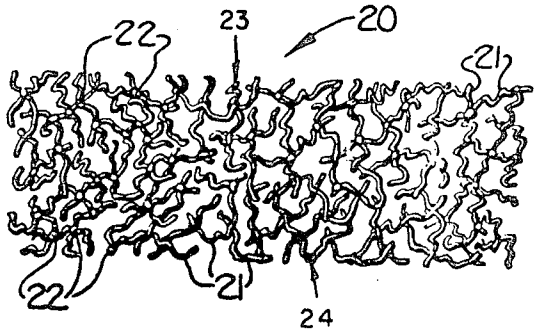


Fig. 1

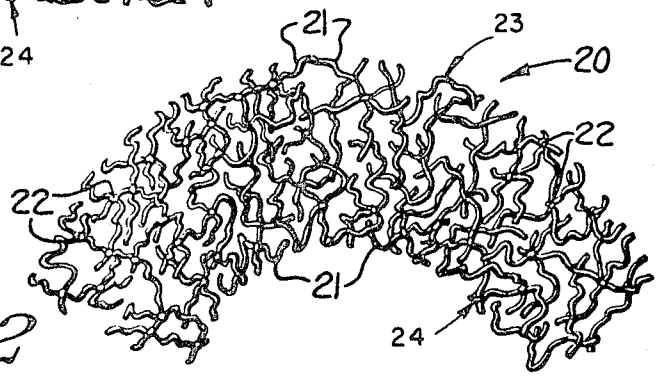


Fig. 2

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BENDABLE, HIGH LOFT, BONDED, NON-WOVEN, TEXTILE FABRIC

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ABSTRACT OF THE DISCLOSURE

An improved bendable, high loft, bonded, non-woven, textile fabric adapted particularly for use in the outer wear and insulated garment fields due to improved bending characteristics. The fabric comprises a plurality of elastic fibers disposed in the form of a batt having upper and lower surfaces and being in intermingled third dimensional arrangement. The fibers are bonded together at spaced points by flexible, elastomeric bonding material to form an integral non-woven structure having a network of intercommunicating voids between the fibers. The fibers are of a length of about one-eighth inch to one inch and shorter than the distance between the upper and lower surfaces of the batt and highly crimped to form an elastic fabric structure which may be bent under pressure with resulting smooth curved surfaces on the outer and inner faces thereof, inasmuch as the fibers are capable of expanding on the outer surface and of compressing on the inner surface and inasmuch as the compressing and expanding forces transferred along the lengths of the individual fibers will be shortened.

This invention relates to an improved bendable, high loft, bonded, non-woven textile fabric adapted particularly for use in the outer wear and insulated garment fields and specifically to this type of non-woven fabric which has improved bending characteristics.

High loft, non-woven fabrics as produced in the trade today, particularly for use in the outer wear and insulating garment fields, are essentially constructed from textile length fibers ranging in length from about one inch to several inches. These products are normally classified as (1) unbonded fabrics utilizing quilting, chemical or heat sealing to achieve stability, (2) lightly bonded fabrics utilizing quilting, chemical or heat sealing to achieve stability, and (3) heavily bonded fabrics with or without additional reinforcements such as quilting, chemical or heat sealing. Each of these fabrics has distinct limitations, particularly in the outer wear and insulating garment fields, which are discussed below.

In the unbonded fabrics, the batting is not functional without additional reinforcing because of poor launderability and durability. This type of fabric is normally limited to a quilted, stitched structure and the facing fabrics must be of a special weave to prevent the fibers from passing therethrough or migrating therebetween. The needle holes utilized in quilting or stitching the facing fabrics to the batt causes loss of insulating qualities. During normal use of this fabric the fibers will shift, felt, and realign themselves in a more compacted and thinner structure which also contributes to poor insulating value.

In the lightly bonded fabrics, the main purpose of utilizing the light bonding is to eliminate fiber leakage or fiber loss through shell type fabrics and hence enable the garment designer to use less expensive and broader ranges of covering fabrics. The disadvantages discussed above in regard to an unbonded fabric are also in essence present in a lightly bonded fabric with only slight improvement in such factors as fiber shifting, fiber felting or matting, durability and launderability.

The products resulting from the lamination of unbonded and lightly bonded fabrics to other media, such as fabrics, paper, foil, etc., have met with limited success because of the inherent weaknesses of these fabrics. These types of fabrics are extremely poor in delamination resistance of the fabric itself.

In the heavily bonded fabrics, some or a major portion of the disadvantages of unbonded and lightly bonded fabrics, such as fiber shifting, fiber leaking, poor durability, poor launderability, etc., are overcome. However, while the use of additional bonding material overcomes some of these disadvantages, it creates the additional disadvantages of poor drapability, suppleness and pliability. The heavily bonded fabrics have a relatively harsh hand and when subjected to bends of low radius, the contour of the bend is not a smooth curve but irregular, jagged and angled. The outer and inner faces of the fabric along the surfaces of the bend are more like the chords of a circle formed by the radius of the bend rather than the complete curve or circle itself. This effect is reflected in the over-all appearance and function of finished garments utilizing these heavily bonded fabrics and detracts from the aesthetic qualities of the garments.

It is, therefore, the object of this invention to provide an improved bendable, high loft, bonded, non-woven textile fabric which will overcome the disadvantages of prior fabrics and which will have improved bending characteristics particularly adapting the fabric for use in the outer wear and insulating garment fields.

According to this invention, it has been found that the above object may be accomplished by providing a high loft, bonded, non-woven textile fabric comprising a plurality of elastic fibers disposed in the form of a batt having upper and lower surfaces and in intermingled, high loft, three-dimensional arrangement throughout the length, width and depth of the batt. The fibers are bonded together at spaced points by a flexible, elastomeric bonding material to fixedly join the fibers together to form an integral non-woven fabric structure having a network of intercommunicating voids between the fibers. The fibers forming the batt are shorter than normal staple length and are highly crimped and preferably having a length less than the distance between the upper and lower surfaces of the batt to form an elastic fabric structure which may be bent under pressure with resulting smooth curved surfaces on the outer and inner faces thereof, inasmuch as the fibers are capable of expanding on the outer face and of compressing on the inner face and inasmuch as the compressing and expanding forces transferred along the lengths of the individual fibers will be shortened, and which will return to the original state when the pressure is removed.

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

FIGURE 1 is a schematic, side elevational view of a bonded non-woven textile fabric constructed according to this invention; and

FIGURE 2 is a schematic, side elevational view of the bonded non-woven fabric of this invention, shown in FIGURE 1, in a bent condition.

Referring now to FIGURES 1 and 2, there is shown a high loft, bonded, non-woven textile fabric constructed according to this invention, generally indicated by the reference numeral **20**. The non-woven fabric **20** comprises a plurality of elastic fibers **21** disposed in the form of a batt in intermingled, high loft, three-dimensional arrangement throughout the length, width and depth of the batt. The fibers **21** are bonded together at spaced points where

they cross by a flexible, elastomeric bonding material, generally indicated by the reference numeral **22**, to fixedly join the fibers together to form an integral non-woven fabric structure having a network of intercommunicating voids between the fibers as may be seen in the drawings.

The fibers **21** are shorter than normal staple length, preferably one-eighth inch to one inch, and highly crimped to form an elastic fabric structure which may be bent under pressure with resulting smooth curved surfaces on the outer face, generally indicated at **23**, and the inner face, generally indicated at **24**.

The short, highly crimped elastic fibers behave markedly like coil springs in that if extended in one direction, which would occur on the outer face during bending, they will yield in that direction, or if compressed in one direction, which will occur on the inner face during bending, they will readily conform or assume a new temporary position. Being elastic in nature, these fibers will nearly always return to their original position as soon as the load or stress is removed.

It is preferable that the fibers do not extend from one surface of the fabric to the other or from the inner face **24** to the outer face **23** because the bending characteristics of each face is markedly different and the compressing and expanding forces applied to each of the individual fibers **21** will generally be conveyed along the length of the fibers. When using normal textile length fibers, these compressing and expanding forces will be transferred along the entire length of the individual fibers and thus more easily transferred from one face of the fabric to the other face and cause the fabric to have an irregular, jagged or angled contour on each face along the bend thereof. When short highly crimped fibers are utilized, the compressing and expanding forces transferred along the length of the individual fibers will be shortened and will not be easily transferred from one face of the fabric to the other face of the fabric.

Another distinct advantage of a non-woven fabric constructed with the short highly crimped fibers is the extra fibers which may be placed in the same size batt when compared to a batt formed of normal textile length staple fibers. A textile fiber is conventionally cut after crimping. During cutting of the crimped fiber, the tow-band is under tension at which point the length of the cut is established. Immediately after cutting the fiber is returned to its crimped state which in effect produces the over-all length of the fiber at rest. For a fabric containing three ounces per square yard of 15 denier per filament fibers, there would be approximately 1,339,026 fibers if they were 1½ inches in length. However, if the fibers were cut ½ inch in length, there would be 1,339,026 fibers times 3 or 4,017,078 fibers in a square yard of fabric. These extra fibers allow for a much more uniform structure. Similarly, the shorter fibers, if processed on an air laying device, are laid down as discreet coils of fibers and their disposition is not influenced by the next fiber in close proximity to it as would be the case with a long fiber.

The fibers **21** used to form the non-woven fabric **20** may be any type of elastic fibers and particularly the fibers selected from the group consisting of—polyester, polyamides, acrylic, modacrylic, rayon, acetate, triacetate, olefin, polyvinyl chloride, or combinations thereof.

To achieve maximum benefit from the curled or coiled fiber construction, the bonding material utilized should be sufficiently flexible and elastomeric so as not to distract from the ability of the bonded coils to extend or compress as the case may be. In some cases individual fibers may be completely coated with bonding material and this makes the selection of the bonding material even more important in that it could interfere with the extension and compression characteristics of the individual fibers. Generally, any type of flexible, elastomeric bonding material is suitable for use in this invention and particularly those bonding materials selected from the group consisting of acrylic monomers and polymers, i.e., Rohm & Haas HA–16, HA–20, E–32; nitrile latices, i.e., Hycar 1572; butadiene acrylonitrile copolymers, i.e., Hycar 1571; butadiene styrene latices, i.e., Good Rite 2750 x 15; polyvinyl chloride, i.e., Geon 576, or combinations thereof.

The following specific examples of non-woven fabrics constructed according to this invention are given by way of illustration and not limitation.

Example I

A non-woven fabric is formed from a highly crimped polyester fiber, known in the trade as "Kodel" Type II, and having 5.2 denier per filament. These fibers are specially cut to ½ inch in length. The effective length or over-all length of these fibers is essentially ¼ to 5/16 inch if measured from point to point with the fibers at rest. These fibers are formed into an open, non-woven three-dimensional web in any conventional manner, such as by a "Rando-webber" machine commercially available from the Curlator Corporation of Rochester, N. Y., or a "Duo-Form" machine produced by Proctor and Schwartz, Philadelphia, Pa.

The fibers in this web are bonded together at spaced points with a co-polymer acrylic bonding material, such as Rhoplex HA–16 commercially available from Rohm and Haas Company of Philadelphia, Pennsylvania. The bonding operation may be performed by passing the web through one or more spray booths and spraying the bonding material thereon, immersing the web in a bath of bonding material and extracting the excess, etc. This bonded non-woven fabric has a thickness of 38 mils and a weight of 9.4 grams per square foot, including a fiber weight of 6.7 grams per square foot and a bonding material weight of 2.7 grams per square foot.

EXAMPLE II

A non-woven fabric is formed from a highly crimped polypropylene fiber, type 22 Hercules Powder Company, having 6.0 denier per filament. These fibers are specially cut to one-half inch in length and are formed into an open non-woven three-dimensional web in any conventional manner, such as by a "Rando-webber" machine commercially available from the Curlator Corporation of Rochester, N.Y. or a "Duo-Form" machine produced by Proctor and Schwartz Company of Philadelphia, Pa.

The fibers in this web are bonded together at spaced points with a polyvinyl chloride bonding material, such as Geon 576 commercially available from B. F. Goodrich Company of Cleveland, Ohio. The bonding operation may be performed by passing the web through one or more spray booths and spraying the bonding material thereon, immersing the web in a bath of bonding material and extracting the excess, etc. This bonded non-woven fabric has a thickness of 42 mils and a weight of 21.0 grams per square foot, including a fiber weight of 12.6 grams per square foot and a bonding material weight of 8.4 grams per square foot.

As may be seen, this invention has provided a high loft, bonded, non-woven textile fabric which is particularly adaptable for use in the outer wear and insulated garment fields due to improved bending characteristics obtained therein.

What is claimed is:

1. An improved bendable, high loft, bonded, non-woven, textile fabric adapted particularly for use in the outer wear and insulated garment fields due to improved bending characteristics; said fabric comprising a plurality of elastic fibers disposed in the form of a batt having upper and lower surfaces and in intermingled, high loft, three-dimensional arrangement throughout the length, width and depth of the batt, said fibers being bonded together at spaced points by a flexible, elastomeric bonding material to fixedly join said fibers together to form an integral non-woven fabric structure having a network of intercommunicating voids between said fibers, said fibers being of a length of about one-eighth inch to one inch and

shorter than the distance between said upper and lower surfaces of said batt and highly crimped to form an elastic fabric structure which may be bent under pressure with resulting smooth curved surfaces on the outer and inner faces thereof, inasmuch as said fibers are capable of expanding on the outer face and of compressing on the inner face and inasmuch as the compressing and expanding forces transferred along the length of the individual fibers will be shortened, and which will return to the original state when the pressure is removed.

2. An improved bendable, high loft, bonded, non-woven textile fabric, as set forth in claim **1**, in which said fibers are selected from the group consisting of polyesters, polyamids, acrylic, modacrylic, rayon, acetate triacetate, olefin, polyvinyl chloride, or combinations thereof.

3. An improved bendable, high loft, bonded, non-woven textile fabric as set forth in claim **1**, in which said

bonding material is selected from the group of acrylic monomers and polymers, nitrile latices, butadiene acrylonitrile copolymers, butadiene styrene latices, polyvinyl chloride, or combinations thereof.

References Cited

UNITED STATES PATENTS

2,972,554	2/1961	Muskat et al.	161—157
2,978,785	4/1961	Wenzell et al.	161—157
3,117,055	1/1964	Guandique et al.	161—157
3,259,539	7/1966	Katz et al.	161—157
3,326,740	6/1967	Hand et al.	161—170

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