PROCESS FOR MAKING CHENILLE-TYPE YARN

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ABSTRACT

Novel decorative yarns are prepared by laying up a nonwoven web comprising a series of parallel warp yarns bonded to filling yarns and thereafter separating the web into strips along lines substantially parallel to the warp yarns and twisting the resultant product to form chenille-type yarns. The filling yarns can be either continuous filament or random laid staple fibers. Separation of the web into strips is accomplished by slitting in the case of continuous filament filling yarns or by simple mechanical pulling apart in the case where staple fibers are used in the filling.

5 Claims, 9 Drawing Figures
PROCESS FOR MAKING CHENILLE-TYPE YARN

This application is a continuation-in-part of my earlier application U.S. Ser. No. 821,414, filed May 2, 1969 and published Dec. 30, 1969 as Defensive Publication No. T 669,020. This invention relates to a method of preparing a chenille-type yarn by slitting a nonwoven fabric.

Chenille yarns are specialty materials widely used in tufting and fringes. Such yarns are comprised of a yarn strand having a large number of short strands or pile protruding around its surface. They are normally prepared by slitting a woven fabric parallel to its longitudinal axis, between the warp threads to form narrow ribbons, and then twisting these ribbons to form a yarn with pile threads protruding from its surface at random angles.

According to this invention, a method has been found for forming chenille-type yarns without the necessity for using a woven fabric. Specifically, the invention is a method of preparing chenille-type yarn which comprises: (a) providing a nonwoven web comprised of a plurality of strands disposed in substantially the fill direction and a plurality of spaced-apart strands disposed in the warp direction said warp direction strands being located on the upper and lower surfaces of the fabric and being bonded to said fill direction strands; (b) separating said nonwoven web between adjacent warp direction strands and along lines substantially parallel to said warp direction strands to form a plurality of fibrous strips corresponding to the number of warp direction strands; and (c) twisting each of said fibrous strips individually to form yarns having a plurality of pile threads protruding from their surfaces at random angles.

The invention will be described with respect to the attached drawing, in which

FIG. 1 depicts one type of nonwoven web which can be employed in carrying out the invention;
FIG. 2 depicts another type of nonwoven web which can be employed in carrying out the invention;
FIG. 3 depicts the fibrous strip resulting from slitting the nonwoven web of FIG. 1;
FIG. 4 depicts the chenille-type yarn which results from twisting the fibrous strip shown in FIG. 3;
FIG. 5 depicts the chenille-type yarn which results from the nonwoven web of FIG. 2;
FIG. 6 depicts a method of making the fabric and chenille shown in FIGS. 2 and 5; and
FIG. 7 depicts, in part, an alternate method of preparing the fabric of FIG. 1.

The filling strands 1 of the nonwoven web shown in FIG. 1 are in running lengths such as monofilaments, continuous filament yarns, or spun synthetic or natural yarns. They are laid down in a relatively uniform pattern with a warp strand 2 located on the upper and lower surface thereof. The warp strands are then bonded to the filling strands at their cross-over points to form an integral structure. The filling strands in this type of fabric are usually present in a density of at least about five strands per inch depending upon, e.g., the denier of the filling strands and the pile density required in the finished yarn. Lower denier strands require relatively high thread density to yield a product of acceptable pile density, but they result in formation of softer chenilles, and are thus preferred in many cases.

In the nonwoven web shown in FIG. 2, the filling strands 1 are relatively fine denier staple fibers which are simply laid up at random to form an unbonded, nonwoven mat. Warp strands 2 are then bonded to each surface of this mat to form an integral structure.

The preparation of the nonwoven web does not, per se, form part of this invention. However, in the interests of completeness, several methods of doing so will be described.

As stated, the filling strands can be either in running lengths, or they can be staple fibers. The term running lengths is herein intended to indicate a strand whose length is at least equal to the entire width of the fabric.

One especially preferred form of filling strand which can be employed in the fabrics shown in FIG. 1 is the product prepared by fibrillation of a transversely striated, transversely oriented film. This product is comprised of a plurality of low denier monofilaments running the width of the film in substantially parallel disposition relative to one another. This type of product has an advantage in the process of this invention in that it can be unwound from a mill roll continuously and converted into the proper type of fabric with less handling than can any other known product form.

The preparation of a nonwoven fabric and a chenille-type yarn therefrom employing the aforesaid fibrillated transversely striated, transversely oriented film is depicted in FIG. 6. In this process, the fibrillated, transversely striated, oriented film is fed from mill roll 10, drawn off by nip rollers 11. Warp strands 2 are fed from individual spools 12 above and below the fill strand web. The warp strands are pressed against the fill strands by heated calender rolls 13 whereby the warp strands are melted or softened and either fuse with the fill strands or the fill strands become embedded in the softened warps and are bonded. The bonded structure is drawn by nip rolls 11 to slitter roll 14 positioned to contact the fabric between adjacent warp strands and slit it into a plurality of fibrous ribbons or strips corresponding to the number of warp strands present on the fabric. The selvedge 18 of the transversely striated film is also removed by the slitter and disposed of at this point. The fibrous strips are drawn over yarn guide 15 and immediately twisted and collected into packages by twister take-ups 16. Alternatively, the strips can be collected on spools 17 for twisting at a later time.

The filling strands can also be laid down as shown in FIG. 9. In this method, a plurality of spools 37 of yarn are mounted on a frame 38 adapted to orbit about an endless cable or belt 39, continuously feeding off the yarn as they travel. The cable 39, carrying the fill strands, is continuously advanced in the direction indicated by the arrow toward heated calender rolls 13 where the fill strands are engaged by warp strands 2 and become bonded thereto. Immediately upon passing through the calender rolls, the bonded web is drawn through edge slitters 40 to slit the edges thereof and free it from the cable. The cable then returns about pulleys 41 to its starting point while the non-bonded web continues on to the remainder of the process as described above.
The filling strands, in this embodiment, can be monofilaments or multifilaments such as yarns. Preferably, a number of strands can be laid down as a band from each spool. In this connection, a fibrillated striated film is a useful form of band to employ. The filaments or strands from successive spools are laid down adjacent to one another to form a series of parallel fill strands.

It will be apparent that, when using the method depicted in FIG. 9, to lay down the filling strands, the warp and filling strands cannot be precisely perpendicular to one another as is the case in the method depicted in FIG. 6. This is not detrimental to the quality or utility of the final product. The warp can deviate considerably from perpendicular, say down to about 60°, and the quality of the yarn will be satisfactory after the strand is twisted. Even if they are farther removed from perpendicular, the unique aesthetic effect which results is desirable in many cases.

The warp strands are usually placed about two to 20 strands per inch. The spacing of these strands determines the length of the pile strands on the surface of the yarn as will be apparent. This, in combination with the spacing of the filling strands, determines the density or denier of the chenille. The filling strands are present in a density of at least about five strands per inch up to as many as 200 or more strands or fibers per inch, depending upon their denier and the pile density desired in the chenille-type yarn. Lower denier threads or fibers require relatively high thread or fiber density to yield products of acceptable pile density, but they result in formation of softer products and thus are preferred in many cases.

FIG. 6 depicts the warp strands being bonded to the filling strands by heat sealing. As shown, the heat sealing is effected by means of heated calender rolls. In order to assure that adjacent warp strands remain substantially parallel and that corresponding strands on the upper and lower surfaces of the fabric are precisely superimposed, it is sometimes desirable to employ grooved calender rolls. The warp strands can be fed into the grooves for precise positioning. The use of grooved calender rolls also tends to localize the application of heat to the area of the warp strands so that the possibility of fusing the filling strands in undesired places is minimized. This latter advantage is, of course, particularly pertinent when the filling strands are of a thermoplastic material.

Ultra-sonic energy can also be employed to effect heat bonding of the warp strands to the filling strands. In FIG. 7 there is depicted a typical ultra-sonic horn and anvil arrangement for accomplishing this type of bonding. Warp strands are fed through guide boards and under the ultra-sonic horns where heating and bonding take place. Following the ultra-sonic treatment, the process is the same as described above in connection with the process employing the heated calender rolls.

Another alternative bonding method is the use of adhesives. Adhesive bonding is an attractive way to proceed when either the warp or fill strands, or both, are of natural, non-thermoplastic material such as cotton or wool. FIG. 8 depicts a typical process employing an adhesive. The warp strands are drawn over adhesive applicator rolls, adapted to rotate in a pool of adhesive composition in an applicator pan. The warps then contact the filling strands and are pressed together in contact with the filling strands by heated calender rolls. A sufficient curing of the adhesive is accomplished at this point to impart the integrity needed for further handling and the web is passed through curing oven to complete the cure of the adhesive.

In the embodiment depicted in FIG. 8, the filling strands comprise an unbonded, randomly laid web of staple fibers. This embodiment of the process prepares a nonwoven web of the type depicted in FIG. 2 and a chenille of the type depicted in FIG. 5. The randomly laid web of fibers can be prepared by techniques known to the nonwoven fabric art.

As stated, the warp strands are usually spaced at about two to 20 strands per inch of fabric width which determines the length of the pile strands on the surface of the yarn. As shown in the various figures of the drawing, a warp strand is placed on each surface of the fabric to assure complete bonding between the warp and filling strands. The process can be carried out with a warp strand on only one surface, but this is not preferred as the bonding step becomes more critical and less reliable with only one warp holding the fill strands. The density of the warp strands is not particularly critical so long as it is sufficient to hold the pile threads which will be bonded thereto following slitting.

In either of the embodiments suggested above, the warp strands can be either continuous filament synthetic yarns or synthetic or natural spun yarns. If continuous filament is employed, it can be either monofilament or multifilament. A monofilament is usually preferred as it can be heat scaled more easily to the fill strands than can a multifilament.

As an alternative to individual filament or yarn strands as shown in the drawing, an expanded network structure prepared by partial fibrillation of a longitudinally striated film can be employed as the source of the warp strands which are laid on the filling strands in either of the embodiments suggested above. Such a network structure comprises backbone strands of substantially parallel, finer denier monofilaments interconnected by a plurality of even finer denier fibrils which are remnants of thin web sections originally present between the relatively thick ribs of the striated film prior to fibrillation. This network structure can be expanded to the degree needed to give the proper spacing between warp strands. Upon slitting of the fabric to free the individual chenille strands, the fibrils become part of the pile structure on each yarn. The use of the fibrillated network structure offers the advantage of being a relatively easy way to lay down a number of very fine denier monofilaments in one relatively simple operation. The network structure and preparation thereof are shown and more fully described in U.S. Pat. No. 3,495,752 of Kim and Samluk.

The fabric is slit into fibrous strips or ribbons between each pair of adjacent warp strands so that each end of chenille-type yarn contains a single warp strand. Slitting can be accomplished by means of stationary cutter blades or, more preferably, by means of knife rollers which rotate as the fabric is drawn under them. Apparatus for accomplishing this step are well known in the art.
In most cases, the line along which the fabric is slit will not be perfectly straight—i.e., not precisely parallel to the warp strands. So long as the amount of wandering is not sufficient to cause the warps to be cut, this is not objectionable. In fact, this wandering can even be helpful in some cases as it causes randomness of length of the pile threads and a pleasing variability in the denier of the finished yarns.

In the embodiment of the invention employing a randomly laid staple fiber mat as the filling strands, slitting can sometimes be omitted and separation accomplished by simply pulling the fabric apart between the warp strands. This can be the case, e.g., when the staple fibers in the mat are short compared to the spacing between warp strands and are accordingly secured to the warp on only one end. This embodiment of the invention can also lead to a product of variable denier.

As the final step in the process the strands can be twisted. Twisting is needed to accomplish uniform distribution of protruding pile yarns around the longitudinal yarn axes. Apparatus for accomplishing twisting are well known in the art. Preferably, twisting is accomplished as an integral step with the slitting and winding of the yarns employing the conventional twister take-up. If desired, twisting can be deferred to a later time, e.g., to a time immediately preceding the use of the chenille in a fabric.

The process of the invention is applicable to yarns and strands of any of the materials customarily employed in the textile industry. This includes both synthetic materials such as acetate, rayon, nylon, polypropylene, polyethylene, polyesters, e.g., poly(ethylene terephthalate), and polycrylacs, as well as the natural materials such as wool and cotton. The choice of materials must, of course, be correlated with the bonding method selected but is otherwise dictated by the properties desired in the finished product.

The chenille-type yarns prepared by the method of this invention can be employed in any application where chenille yarns are presently employed. This includes, e.g., such applications as upholstery fabrics, knit fabrics, and hand knitting or crocheting. Moreover, while the main reference throughout this description has been to chenille-type yarns, it will be apparent that products prepared by this method can be used in other applications where a hairy or fibrous hand is desirable. For example, garlands of the type frequently employed as a Christmas tree decoration, and gift wrapping strips having a fibrous surface can also be prepared in this manner.

What I claim and desire to protect by Letters Patent is:

1. A method of producing a chenille-type yarn which comprises:
   a. advancing a nonwoven web having a plurality of strands disposed in substantially the fill direction;
   b. advancing a plurality of spaced apart strands in the warp direction onto at least one of the surfaces of said web;
   c. bonding said warp direction strands to the filling strands of said web;
   d. separating said nonwoven web between adjacent warp direction strands to form a plurality of fibrous strips; and
   e. twisting each of said fibrous strips to form yarns having a plurality of pile threads protruding from their surfaces at random angles.

2. The method of claim 1 where the filling strands of the nonwoven web are of a length at least equal to the width of the fabric.

3. The method of claim 2 where the filling strands comprise running lengths of low denier monofilaments disposed in substantially parallel relationship to one another.

4. The method of claim 1 where separation of the nonwoven web into fibrous strips is accomplished by slitting.

5. The method of claim 1 where the filling strands of the nonwoven fabric are staple fibers.