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METHOD OF MAKING SEWING THREAD AND PRODUCT THEREOF

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This invention relates to the art of making sewing threads which are particularly of value in joining cloth pieces as in the manufacture of men's slacks.

It is known to ply multi-fil yarns of the so-called synthetic fibers such as linear polyamides with recurrent carbon chain groups (nylons), polyesters such as ethylene glycol:terephthalate polymers (e.g., the commercial product sold under the trademark Dacron), polyacrylonitriles, etc., and employ the same for sewing. In practice, such threads tend to spread apart when cut, and difficulty is encountered in placing them in needles, etc. Such sewing threads are fed, in commercial sewing machines, at very high speeds: and frictions at the guides and needles can cause fusion, with breakage and separation of filaments and the plied strands. The relatively high tensions contribute to this, and also cause stretching of the thread with a later recovery which causes a puckered effect at the seam.

Sewing threads are generally made from such fibers by twisting the individual multi-fils, and then plying two or more such strands. The amount of plying twist varies with the fabric to be sewn and the type of sewing machine used. For example, forty denier yarn is usually twisted about 30 turns per inch of S twist, and then plied by about 20 turns per inch for three ply, or 24 turns per inch with two-ply; the plying twists being in the Z direction. Correspondingly, with seventy denier multi-fils, the individual strands are given 15 to 20 turns per inch of S twist, then two or three are brought together with 14 to 18 turns per inch of Z twist: with a few seventy denier composites made by 28 turns per inch in the S direction for each strand, with 24 turns per inch in the Z direction for plying twists. For 210 denier composites, the individual strands are given 13 to 17 turns per inch of S twist, and then plied with 9 to 13 turns per inch of Z twist.

It has been a practice to pass a multi-fil yarn through an air jet to effect bulking or texturing: for example, as taught in the Breen Patent 2,852,906, and the Griset Patents 2,874,445 and 2,924,000.

In practice, an untwisted yarn undergoes bulking satisfactorily: but requires plying twists for service in sewing, e.g. when several yarns are plied together to form the sewing thread. When individually bulked yarns are plied, the yarns do not interlock to a desired extent in the thread, even with plying twists. A tightly twisted yarn does not bulk satisfactorily.

It has been found that a thread excellently adapted for use in high speed machinery for sewing heavy garments, such as men's slacks, can be made by individually twisting yarn ends, then plying such ends together with a lesser reverse twist to form a thread, then bulking or texturing to cause the individual filaments to form loops which interlock the yarns with one another, and then twisting further in the said reverse direction, preferably with a setting of the twisted thread.

Also, it has been found that preferred effects can be attained by applying a lubricant to the set, bulked and twisted thread. Likewise, for some sewing purposes, it is preferred to impose a bonding effect upon the set thread before lubrication.

A preferred manner of bulking or texturing the plied yarns is by an air jet, for example as in the Breen Patent

2,852,906. Therewith, the twisted, plied and ply-twisted yarn is passed through a jet of fluid moving at such velocity as to exert force upon the yarn essentially without tension along the thread, so that the filaments are caused to form individual convolutions or loops from point to point, with a loop of one filament therewith interlocking with one or more filaments of the same or other yarn ends, and then gathering the filaments. Therewith, the action of the air jet serves to draw the yarn into the jet, and the bulking effect appears at the exit from the jet nozzle. The bulked yarn passes from the nozzle to a guide and takeup device, e.g., a roller or pulley which turns at a lesser peripheral speed than a corresponding roller or pulley which controls the advancement of the yarn into the jet device, with the bulking being present between the jet nozzle and the takeup device as an incident of the overfeeding into the jet device. In practice, the takeup device applies a tension upon the yarn, which increases the stability by pulling out or straightening the loops which are most loosely formed, but the difference in speed rate prevents the total restraightening of the loops formed at the jet. The result is a decrease in overall length of the yarn, with a corresponding increase in denier. The ratio of the speeds of advancement to the jet device and at the take-up can be employed to determined the "hardness" or "fluffiness" of the thread: when the ratio is around 100:95 (with a 5 percent increase in denier), the thread is tight and hard; when the overfeed is 20 percent, e.g., as in Example 1 below, the thread appears fluffy, but is strong and resistant to stretching. In each case, the thread appears to have a rougher surface than one made without bulking: but passes readily through guides and needles without fusion or breakage. It is preferred to employ a succeeding operation, after the bulking, to cause the filaments to become more firmly fixed with the loops effective to interlock them relative to one another: which preferably is by setting and may be a sizing.

Specific examples of practice are:

Example 1

Seventy denier polyester multi-fil (of commercial Dacron material) composed of 34 filaments was twisted 20 turns per inch in the S direction. Two such strands were then brought together and twisted 5 turns per inch in the Z or opposite direction. This plied thread was then passed through an apparatus having a bulking jet, to increase the denier by about 20 percent, i.e., to about 84: and the apparatus then applied 12 turns per inch of Z twist, by a down-twister device, to the bulked thread. The thread was wound in coils, and the twist was set at 150 degrees F. in moisture-saturated air. The thread was then rewound onto a spool after passage through a device for applying lubricant.

Example 2

One hundred denier linear polyamide multi-fil (of nylon) composed of 34 filaments was twisted 20 turns per inch in the S direction. Three such strands were brought together and plied 5 turns per inch, with Z twist. The plied thread was passed through a bulking jet to increase the denier 12 percent, to about 112. Nine turns per inch of Z twist were applied to the thread, in a down-twister, as it left the bulking jet. The thread was wound and twist-set at 150 degrees in moisture-saturated air. A water dispersion of alcohol-soluble nylon resin was applied, in amount of about 7 percent by weight of the twist-set and dried thread. This was followed by appplying lubricant, and winding on a sewing bobbin.

Example 3

Forty denier linear polyamide multi-fil (of nylon) composed of 13 filaments was twisted 30 turns per inch in

the S direction. Two such strands were brought together and plied 20 turns per inch, with Z twist. The plied thread was passed through a bulking jet to increase the denier 5 percent, that is, to about 42. Ten turns per inch of Z twist were added in the same apparatus, and the thread was wound. It was then twist-set at 150 degrees F., in moisture-saturated air: and a lubricant was applied.

Example 4

Two hundred and ten denier linear polyamide multi-fil (of nylon) composed of 34 filaments was twisted 13 turns per inch with S twist. Three such strands were plied 5 turns per inch, with Z twist. The plied thread was passed through a bulking jet to increase the denier about 15 percent, to about 242. Five turns per inch of Z twist were added, as the thread left the jet. The twist was set at 150 degrees F. in mosture-saturated air: and a lubricant was applied.

Example 5

The practices of the above examples can be employed, with a first twist setting of the plied and twisted thread before it is passed through the bulking jet: e.g. by setting in moisture saturated air at 150 degrees F. the thread is bulked and further reverse-twisted; and then subjected to a second twist-setting operation after packaging, at 180 to 212 degrees F. wherewith a shrinkage of about 2 to 4 percent occurs.

In the examples, the setting effect occurs largely in the first five minutes of exposure to the heated moist air: but the time can be extended to 30 minutes or more without harmful effect. It is preferred to employ a setting temperature which is at least as rigorous as those which will be encountered in subsequent operations. Thus, the settings can be at 150 to 212 degrees F., or above, e.g. by steaming at temperatures below the softening point of the material, dependent upon the later schedule: e.g. when a later dyeing of the garment in boiling water is in prospect, the setting can be at 212 degrees F. In generel, when the thread is to be set before and after bulking, the final setting should be more rigorous, that is, at higher temperature, than the first setting.

Example 6

The practices of the above examples, of twisting the yarn ends individually, plying and ply-twisting in the opposite direction, bulking, and further untwisting, can be employed without the preferred setting, and a sizing agent such as the alcohol-soluble linear polyamide is then applied: noting that the total original twist effect is essentially compensated by the untwistings and that the thread exhibits little liveliness during sewing.

The alcohol-soluble nylon resin of Example 2 acts as a sizing agent: and the foregoing practices may be performed without the preferred setting, and by the use of such sizing agents. The alcohol-soluble nylon sold under the trade name Zytel 61 (du Pont) has been found satisfactory: it is preferably employed in a water dispersion to attain quick application.

With yarns of the deniers employed for sewing threads, that is, 40 to 400, the twisting of the individual strands or ends should be from 12 to 30 turns per inch. The initial plying twist, in the opposite direction, should be from 5 to 20 turns per inch, and the final plying twist after the bulking or texturing should be 5 to 20 turns in the said opposite direction. In each case, the lower number of turns are employed with high denier yarns, and the higher numbers with low denier yarns.

The ratio of the reverse twisting before and after bulking can be varied. For high denier threads, it is preferred to effect the bulking with half or less of the original yarn twist being removed by the plying twist: with threads of less than 100 denier (e.g., of two 40 denier yarns), a greater reverse plying twist may be employed before bulking. The total plying twist, before and after bulking, should leave the filaments of the single strands or ends approaching a parallel condition, with the loops or convolutions randomly scattered along their lengths: e.g., up to 5 turns per inch differential of original yarn twists and of total plying twists is preferable.

Among the filament materials, which can be prepared into sewing threads by the procedure are the commercial nylons having carbon chains of 6 to 10 carbon atoms with recurrent connective amide links; polyesters such as terephthalate: ethylene glycol polymers; and vinyl resins including polyvinyl chlorides, polyvinyl; vinylidene copolymers such as the chlorides, vinyl chloride:acetate copolymers, modified vinyl chloride:acetate copolymers with OH groups, polyvinyl alcohols, and acylonitrile polymers.

The invention is not restricted to the illustrative examples, and can be practiced in many ways within the scope of the appended claims.

What is claimed is:

1. The method of preparing a sewing thread from multi-fil yarn of synthetic fiber, which comprises individually twisting strands of multi-fil yarn in the same direction, bringing the strands together and applying a plying twist in the opposite direction so that the thread has a lesser number of turns per inch than that of the original twist, passing the plied thread through an air-jet bulking operation so that the individual filaments are caused to form loops and inter-engage and the thread attains an increased denier of 5 to 25 percent, and again twisting the bulked thread in said opposite direction.

2. The method as in claim 1, in which the bulked and thereafter twisted thread is subjected to a setting operation in hot moist air.

3. The method as in claim 2, in which the set bulked and twisted thread is provided with a lubricant.

4. The method as in claim 1, in which the thread with plying twist is subjected to a twist-setting in hot moist air before the bulking operation.

5. The method as in claim 4, in which the bulked thread is subjected to a second twist-setting operation in hot moist air after the bulking and final twisting operation.

6. The method as in claim 5, in which the bulked and twisted thread has applied thereto a bonding dressing of a water dispersion of an alcohol-soluble linear polyamide, and a lubricant is thereafter applied thereto.

7. A sewing thread of multi-fil yarn of synthetic fiber, comprised of strands of multi-fil yarn having twists in the same direction, the strands being joined by a plying twist in the opposite direction, the individual strands having loops in their filaments effective to connect the several strands, the loop-containing thread having loops interlocking the strands by a third twist effect in said opposite direction and having the loops held against untwisting.

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