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METHOD OF MAKING THERMOPLASTIC SEWING THREAD

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This invention relates to sewing thread composed of continuous filament yarns of thermoplastic material, preferably nylon, with respect to which the invention will be described in detail.

Among the major objects of the invention are the provision of a sewing thread of improved abrasion resisting quality and so treated as to give increased strength, resiliency and flexibility to seams sewn with the thread. While by no means limited thereto, a thread made in accordance with one form of the invention has been found to be of particular value in the sewing of stocking seams, it having been demonstrated that, lengthwise, such seams may have a breaking strength as high as twenty-five pounds as compared with a breaking strength of only ten pounds for similar seams sewn with ordinary nylon thread as heretofore used for the purpose.

The invention is applicable to threads incorporating any desired number of cords or yarns, usually 2, 3 or 4, and of any given denier, the continuous filaments composing the yarns being of thermoplastic material and, as stated, preferably nylon.

In the manufacture of the thread, the multiple filament yarns are first twisted individually and then given an opposite finishing twist. It has been found that in order to achieve the desired results the yarn twist applied should be relatively high. While not deemed high for cotton yarns, for example, the twists indicated in the present instance will be recognized as being relatively high for nylon and like synthetic yarns. Specifically, the number of turns of yarn twist applied is represented by the formula

$$3.45\sqrt{\frac{5313}{D}}$$

wherein D represents the denier of the yarn. For example, in the case of 40 denier threads commonly used in the sewing of hosiery, the applied yarn twist is about 40 turns, say, right.

Next, the yarns are assembled with a finishing twist appropriate to produce a balanced twist thread and, again, the twist is relatively high. This finishing twist incorporates approximately the number of turns given by the formula

$$3.35\sqrt{\frac{5313}{D\times Y}}$$

wherein D again represents the denier and Y the number of yarns or cords in the thread. In the case of 40 denier 2/cord thread the finishing twist is about 27 turns, say left; and in the case of 40 denier 3/cord thread the finishing twist is about 22 turns, left.

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The following table is illustrative of the applied twists determined by the above formulae for various thread sizes and numbers of cords or yarns:

Denier	Cord	Yarn Twist	Finishing Twist
30	2	46 turn right	31 turns left.
30	3	46 turns right	25 turns left.
40	2	40 turns right	27 turns left.
40	3	40 turns right	22 turns left.
70	2	30 turns right	19 turns left.
70	3	30 turns right	17 turns left.
70	4	30 turns right	14 turns left.
105	3	25 turns right	14 turns left.
105	4	25 turns right	12 turns left.
210	3	17 turns right	10 turns left.
210	4	17 turns right	8 turns left.

After the yarns have been so twisted and assembled, the thread is subjected to what for convenience is termed an aqueous boil, as with soap and caustic, in order to remove any soil and to preshrink the thread, and thereafter is further shrunk and set, preferably by steam and at a temperature of about 245° F. Steam at 15 lbs. pressure is appropriate. According to this preferred method, the thread must be in a relaxed condition throughout, in skeins, for example, or loosely wound, in order to accommodate the shrinkage which results and which, it will be understood, increases the twist previously applied and thereby increases the extensibility of the thread.

In the manufacture of nylon stockings the use of the thread manufactured as above described gives rise to sundry advantages and imparts to the finished stocking certain novel characteristics which are highly desirable. In accordance with common practice, nylon stockings are seamed and afterward subjected to what is known as a preboarding process, which consists in placing the stocking on an appropriately shaped board and then steam treating it(say, for two minutes at a temperature of 245° F.) to shrink the stocking to its intended final shape. Ordinarily, the seam thread shrinks with the stocking. According to my preferred procedure, the stocking seam is sewed with preshrunk, pre-set thread produced as above described; and, in the result, the seam thread is, to all intents and purposes, quite unaffected by the preboarding process. In a nylon stocking so made, the resulting seam is found to be substantially as elastic or extensible, lengthwise of the stocking, as the body of the stocking and, consequently, the stresses to which the stocking is subjected in use are no longer concentrated in the seam. Undue strain of the seam is thereby avoided.

A balanced structure results in which the strength of the seam is greatly enhanced, being no longer dependent, as was virtually the case heretofore, upon the strength of the seam thread alone. It has been found that, due to the elasticity of the described seam, the stocking as a whole is very much more elastic in the direction of its length, thereby adapting any given stocking to varying leg lengths without undue strain on the stocking or its means of support. Also, the stocking presents a better appearance when worn in that it fits better, especially around the ankles, where the normal seam thread is apt to "pull" and present a more or less wrinkled appearance; and its elasticity is conducive to maximum comfort for the wearer.

Where a thread of lower extensibility but of non-shrinking characteristics is required, as for the sewing of fabrics or material calling for heavy stitching, such as corsets, men's clothing, leather goods and so forth, the process is modified in certain particulars.

The yarns are separately twisted and given a finishing twist as above described. In the next step, however, the thread is treated to a partial setting step which substantially reduces subsequent shrinking. This step (corresponding in general to the final step of the first described method) involves subjecting the thread to steam pressure at about 245° F.; but, in this modified process, the thread is so wound or rigidly held as to restrain shrinkage. Thereafter, the thread is subjected to the aqueous boil in a relaxed condition, resulting in a slight shrinkage. It will be understood that during the autoclaving step, the thread need not be rigidly held to its full twisted length, although that is preferred. If the thread is autoclaved while held to something less than its full twisted length, the final thread will be of somewhat greater extensibility.

As indicative of the results achieved by the modification of the process, it has been found that if the thread, twisted as described, is first boiled in a relaxed condition, the shrinkage which results (in the case of nylon) is of the order of 10–11%; whereas, if the thread is first autoclaved while held substantially to its twisted length, the subsequent boil in a relaxed condition results only in shrinkage of the order of 2%.

Such a thread will not shrink if boiled only. If, however, it is subsequently autoclaved at fifteen pounds pressure, it will experience a shrinkage of about 4%.

Where threads of this lower extensibility but of non-shrinking characteristics are to be used for producing seams which are to be subsequently autoclaved, a final autoclaving of the thread in a relaxed condition should follow the aqueous boil.

The following is claimed:

1. The method of making sewing thread which consists in applying to each of a number of thermoplastic, continuous filament yarns a twist of approximately

$$3.45\sqrt{\frac{5313}{D}}$$

turns, twisting the yarns together with a finishing twist of approximately

$$3.35\sqrt{\frac{5313}{D\times Y}}$$

turns, D being the denier of each yarn and Y the number of yarns in the thread, and, while in a relaxed condition, subjecting the thread to an aqueous boil and then to the action of steam at an elevated temperature.

2. The method of making thermoplastic sewing thread of nylon or the like, which consists in applying to each of a number of continuous filament yarns a twist of approximately

$$3.45\sqrt{\frac{5313}{D}}$$

turns, twisting the yarns together with a finishing twist of approximately

$$3.35\sqrt{\frac{5313}{D\times Y}}$$

turns, D being the denier of each yarn and Y the number of yarns in the thread, subjecting the thread to an aqueous soap boil while in a relaxed condition, and then, while still in a relaxed condition, subjecting the thread to the action of steam at a pressure of about 15 lbs. per square inch and at a temperature of about 245° F.

3. The method of making thermoplastic sewing thread of nylon or the like, which consists in applying to each of a number of continuous filament yarns a twist of approximately

$$3.45\sqrt{\frac{5313}{D}}$$

turns, twisting the yarns together with a finishing twist of approximately

$$3.35\sqrt{\frac{5313}{D\times Y}}$$

turns, D being the denier of each yarn and Y the number of yarns in the thread, subjecting the thread to steam pressure at a temperature of about 245° F. while rigidly holding the thread to restrain shrinkage, and subsequently subjecting the thread to an aqueous boil while in a relaxed condition.

4. The method of making thermoplastic sewing thread of nylon or the like, which consists in applying to each of a number of continuous filament yarns a twist of approximately

$$3.45\sqrt{\frac{5313}{D}}$$

turns, twisting the yarns together with a finishing twist of approximately

$$3.35\sqrt{\frac{5313}{D\times Y}}$$

turns, D being the denier of each yarn and Y the number of yarns in the thread, subjecting the thread to steam pressure at a temperature of about 245° F. while rigidly holding the thread to restrain shrinkage, subsequently subjecting the thread to an aqueous boil while in a relaxed condition, and then, while still in a relaxed condition, subjecting the thread to steam pressure at a temperature of about 245° F.

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