

Feb. 23, 1960

E. C. PFEFFER, JR

2,925,642

SEWING THREAD

Filed Feb. 14, 1955

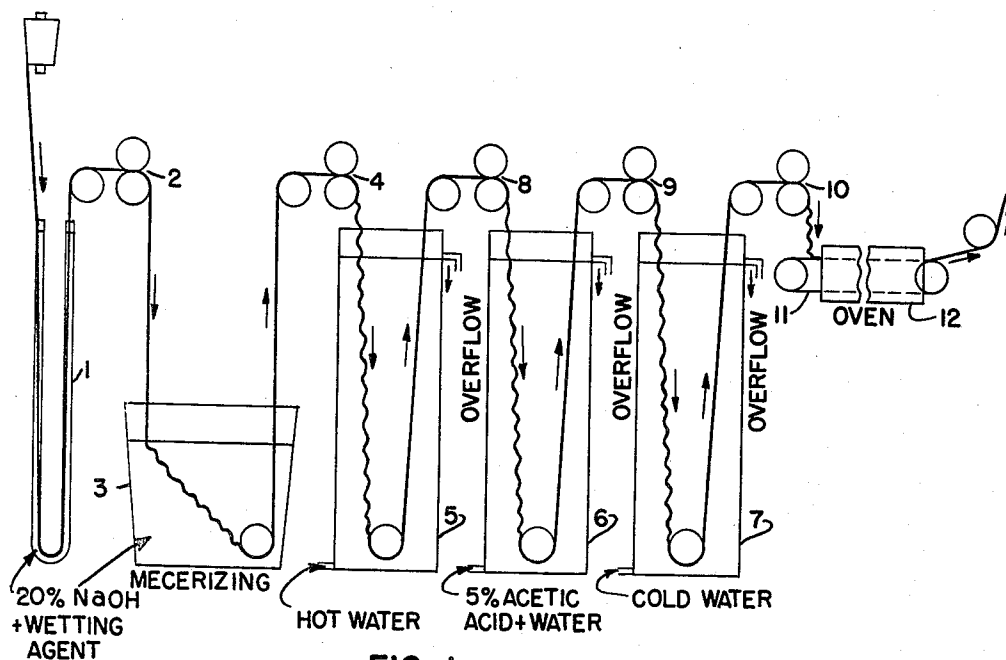


FIG. 1

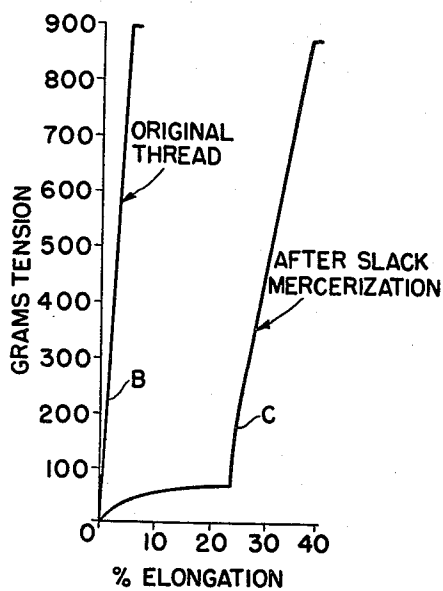


FIG. 2

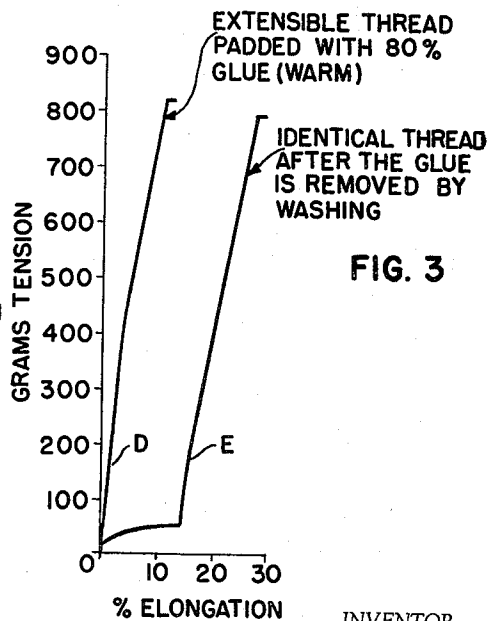


FIG. 3

INVENTOR
EDWARD C. PFEFFER JR.

BY

Max D. Farmer

ATTORNEY

1

2,925,642

SEWING THREAD

Edward C. Pfeffer, Jr., Troy, N.Y., assignor to Cluett, Peabody & Co., Inc., Troy, N.Y., a corporation of New York

Application February 14, 1955, Serial No. 487,773

4 Claims. (Cl. 28—80)

This invention concerns a sewing thread which obviates or at least alleviates the problem of seam shrinkage. When two or more fabrics which are perfectly stable, that is which show no tendency to shrink are sewn together, and then laundered, they will inevitably shrink and shorten along the seam. Seam shrinkage is the pucker or contraction which occurs upon laundering at seams, especially at those seams in which several plies of fabric are joined. It is a well-known and much studied problem in the textile industry. The pucker is unsightly and unattractive and seriously detracts from the appearance of a garment but more than that and perhaps more important, it represents a dimensional change which causes fitted garments to become too tight or too short.

It is self-evident that in a seam the several plies are squeezed tightly together and will, when conditions permit, tend to resume their normal plump equilibrium condition. The swelling effects of water on the cellulosic fabrics permit this readjustment, and the swelling, plasticizing and lubricating effects of water and heat promote similar release for the more hydrophobic fabrics. The small quantity of fabric encircled by a single stitch becomes thicker and the vertical (normal to the seam) diameter of the stitch must become greater, which it can only do at the expense of the horizontal diameter that is the length of the stitch. Obviously as each stitch becomes shorter, the seam becomes shorter. The theoretical cure is also obvious, excess thread is necessary. If there is excess thread, the stitch and the seam can become thicker without becoming shorter. A loose seam would, therefore, be an answer, but it is impossible to form a loose seam in machine sewing. There are some indirect approaches to the loose seam, such as sewing a piece of cardboard or heavy paper into the seam and then tearing it out. This makeshift adequately prevents seam shrinkage, but is not efficient for high speed mass production efforts. In addition, a loose seam is less attractive and less reliable than a tight seam.

A better answer is to sew a tight seam with a thread which will become longer when laundered. One such thread suggested is a composite of a water soluble yarn and the normal sewing thread twisted together. When the water soluble component is removed as by laundering, there is excess thread in the seam by reason of the now unnecessary spirality. This is a reasonable answer to the problem, but the original thread is bulky and unsightly, it is difficultly adaptable to high speed sewing operations and it is extremely expensive.

I have discovered a potentially extensible sewing thread which avoids or minimize the difficulties listed for the aforementioned composite thread. In brief, my sewing thread comprises an ordinary cotton thread, which has been made highly extensible by any one of several known methods, which extensibility is locked into the thread by the application of a water soluble adhesive.

The starting thread can be made highly extensible by any of several methods of causing it to contract. It can

2

be highly twisted which will cause it to contract in length, then back twisted without allowing it to extend. The result is a loose spiral, like a coiled spring, and such a thread can be extended very readily. The thread can also be compressively shrunk, that is, forced together mechanically exactly as fabric is compressively shrunk in the textile industry. This puts a kind of microscopic crimp in the thread, and slight tension will pull it out to its original length. A third method of making the thread extensible is to mercerize it without tension. Caustic of mercerizing strength causes cotton thread to shrink up very considerably. Such caustic shrunk thread is very easily stretched. Thread made to contract by the procedures listed or other similar treatments will show up to 30% extensibility.

The method used to contract the thread is not a critical feature of the invention, and any suitable procedure can be used. I prefer the method of tensionless mercerizing as most practical, and describe and illustrate such a method in this disclosure, but it is to be understood that this does not limit the scope of the invention.

In the accompanying drawing:

Fig. 1 is a schematic view of apparatus that may be used in employing this discovery; and

Figs. 2 and 3 are graphs illustrating the action of the improved thread.

In the drawing, Figure 1 shows a laboratory apparatus for the tensionless mercerizing of thread. The thread is first drawn through a U-shaped tube (#1) filled with 20% caustic containing a suitable wetting agent such as one of the higher phenols by passing the thread between a pair of contacting, driven rolls 2. The U construction insures that the thread will be drawn under the surface of the caustic solution and thoroughly wetted. It is then drawn in a tensionless condition through a mercerizing tank (#3) by another pair of driven rolls 4, which tank is filled with the same strength of caustic solution. Here the thread is permitted to shrink freely and extensively, and is drawn off at only about 50 to 80% of the rate at which it is fed in. Then the thread is fed in succession into tanks #5, 6 and 7 by successive pair of driven rolls 8, 9 and 10 for the usual washing and neutralizing steps except that minimum tensions are used throughout. The thread is first washed with hot water in tank 5, then any caustic adhering to the thread is neutralized in tank 6 with a weak acetic acid solution, and then washed with water in tank 7 to remove any adhering acid. The thread is then dried and is ready for the next treatment. The thread which is thus mercerized without tension, shrinks substantially, and this shrinkage is not lost by the drying of the thread. From the last pair of driven rolls 10, the thread is delivered loosely upon an endless conveyor 11 and carried thereby through an oven 12 where the thread is dried while free of tension. The dried thread is then wound on a cone for storage until it is treated with the water soluble adhesive and redried.

The highly extensible thread prepared according to any of suggestions above is not satisfactory for efficient sewing, and in that condition is of no value for the elimination of seam shrinkage. The tensions incidental to even the slowest and most careful machine sewing, would pull all the extensibility out of these extensible threads and the seam would shrink as much as one sewn with an ordinary cotton thread.

If, however, this mercerized or other readily extensible thread is treated in its contracted condition with a solution of a water soluble adhesive and allowed to dry, its extensibility at moderate tensions is greatly reduced and it is an adequate sewing thread with stress-strain behavior very closely like ordinary cotton sewing thread. When a seam sewn with the so treated thread is laundered,

3

the potential extensibility of the thread is made real again by the removal of the adhesive, the thread elongates as necessary to compensate for the swelling stresses in the seam, and the seam does not pucker or shrink.

The stress-strain behavior of a sewing thread based upon this invention, in the various stages of its preparation and use are shown in Figs. 2 and 3. Fig. 2 shows the stress-strain curve of the original sewing thread or material B before any treatment, and in this example it is a common cotton sewing thread, in this instance a 70/2 cord. It stretches .5 to 1.5% in the range of ordinary sewing tensions, i.e. 100-300 g. The other stress-strain curve C in Fig. 2 shows the behavior of the same thread after slack mercerization. The mercerized thread now shows a stretch of 22 to 27% under tensions of 100 to 300 g. After treatment of the slack mercerized sewing thread, while in a slack condition, with a water soluble adhesive, in this instance a solution of ordinary animal glue, and dried, it again is a useful sewing thread as shown by the stress-strain curve D of Fig. 3. Curve D closely approximates curve B, especially in the range of ordinary sewing tensions. Curve E shows the extensibility of the thread after the adhesive has been removed, and therefore represents the behavior of the thread in a seam after laundering. It is obvious that there is 10 to 15% extension available to prevent seam pucker or shrinkage.

Any water soluble adhesive which adheres well to cellulose and dries to a tack-free condition is operable in this invention. It is obvious that some adhesives would be more preferred than others by reason, for instance, of minimum effect upon the stiffness or color of the thread or for reasons of economy, but all of them operate to some useful degree if they adhere to cellulose and dry to a tack-free finish.

The procedure for applying the water soluble adhesive is a simple coating operation, followed by drying, both without substantial tension on the thread, so that no apparatus for such a simple operation has been illustrated.

A preferred group of water soluble adhesives might be limited as follows:

They must adhere strongly to cellulosic material. The treated yarn preferably should not extend more than 2 to 5% through the normal tensions of sewing, such tensions being up to 300 g. The adhesive should be one which converts the contracted but extensible yarn into one which will not stretch appreciably under this sewing tension. In general, this requires a fairly high concentration of adhesive in and on the thread. Therefore, the adhesive must be one which dissolves in water to form a solution of at least about 20% solids. In addition, since during the immersion in the adhesive the thread is extremely stretchable, it cannot easily be pulled through a solution of extreme viscosity without loss of extensibility. Therefore, preferably the adhesive should be one which as a 20% solution shows a viscosity of less than about 10,000 cp.

Example 1

70/2 cotton sewing thread subjected to slack mercerization as described above was the starting material for all of the coating experiments listed here. The resin used in this instance was a low viscosity, 88% hydrolyzed polyvinyl alcohol (Du Pont, Elvanol 51-05). The thread was roller coated with a 25% aqueous solution of this polyvinyl alcohol at room temperature. It was then wound in an open spiral on a polyethylene coated frame and dried at 100° C. for about five minutes. The finished thread was smooth and supple and satisfactory for high speed sewing.

Example 2

Another sample of the same slack mercerized thread was coated with a 40% aqueous solution of a starch ether (Morningstar-Nicol, Solvitose H). It was dried

4

in the same manner as the sample of Example 1 at 100° C. It showed no abnormal extensibility and was satisfactory for high speed machine sewing.

Example 3

Another sample of the same mercerized cotton thread was roller coated with an 80% solution of an animal glue warmed to 50°. This glue was a commercial formulation (Paisley Adhesive #6986) having only about 50% solids and an 80% solution thereof which was used contained only about 40% solids. The glue coated thread was then dried as explained above for Examples 1 and 2. It was a completely satisfactory sewing thread, soft and smooth and with adequate resistance to stretch.

Example 4

Another sample of the same thread was coated with a 75% solution of a boron sorbitol complex. This too was a commercial preparation of about 50% solids (Atlas G-750). The solids of the treating bath were therefore actually about 30 to 40%. The thread was dried as above explained for Examples 1 and 2, and again it was a completely satisfactory sewing thread under ordinary conditions. However, it showed a tendency to become undesirably stretchable with long exposure to high humidity above about 80%. Therefore, if used under humid conditions, it would require some kind of protection.

Example 5

Another and similar sample of the slack mercerized cotton thread was coated with a 40% solution of a modified starch ether (Morningstar-Nicol, Solvitose HDF). The product after drying on the polyethylene coated frame at 100° C. for about five minutes was a satisfactory sewing thread. It was smooth and soft, resistant to stretch and not sensitive to humidity.

To test the utility of these potentially extensible threads for the reduction of seam shrinkage, plaques were prepared as follows: Four plies of a cotton broadcloth shirting, about 4 yards to the pound showing less than 1% potential shrinkage, were sewed together with two parallel seams about one-quarter inch apart and about two feet long. The lock stitch was used and the machine set for 18 stitches per inch and 4000 stitches per minute. An eighteen inch space was marked off on the seam. The seams were then subjected to one standard white cotton wash (CCC-T-191A) and pressed on a flat bed press. Several similar control seams of similar fabric sewed together with unmodified 70/2 cotton sewing thread were prepared at the same time in the same way and washed and measured along with the test seams.

The results:

Sewing Thread	Seam Shrinkage	
	In 16ths of an In./Yd.	Percent
Ex. 1.....	2.0	0.5
Ex. 2.....	15.0	2.6
Ex. 3.....	7.5	1.3
Ex. 4.....	10.0	1.8
Ex. 5.....	8.0	1.4
Control (Average of 5).....	30.0	5.2

The results clearly establish that the use of the improved thread will greatly reduce seam shrinkage.

The following additional water soluble adhesives were also found satisfactory in converting contracted, readily extensible thread into one which does not stretch more than a few percent under the tensions used in sewing.

Example 6

A 30% aqueous solution of polyvinyl pyrrolidone.

5

Example 7

A 25% aqueous solution of polyvinyl methyl ether.

Example 8

A 20% solution of the polyvinyl alcohol of Example 1 to which 1% boric acid had been added.

Example 9

A saturated solution of sodium metasilicate.

Example 10

A 30% solution of the sodium salt of polyacrylic acid.

Example 11

A 25% solution of polymethacrylic acid.

Example 12

A 25% solution of polyacrylic acid.

Among the cellulosic sewing threads that may be treated in accordance with this discovery, the cotton sewing threads are far superior to other cellulosic sewing threads now available because the cotton threads can be contracted in different ways, and the cotton does not become harsh or rough when mercerized.

It will be understood that various changes in the details, materials, apparatus and steps, which have been herein described and illustrated, in order to explain the nature of the discovery, may be made by those skilled in the art within the principle and scope of the discovery, as expressed in the appended claims.

I claim:

1. The method of making a sewing thread which will not stretch or elongate under tension when dry but which will stretch and elongate under tension upon immersion in water, thereby to eliminate seam pucker when a seam is sewn with the thread, which method includes increasing the stretchability of a cellulose thread by contracting the same in a lengthwise direction while free of tension, an amount sufficient to produce under seam tension the degree of elongation that will prevent seam pucker when placed in water, said contraction being effected by applying to said thread caustic soda of mercerizing strength, thereafter removing the caustic soda from the contracted thread by rinsing the same with water while still free of tension, drying the rinsed thread while still free of tension, coating the dried contracted thread with a water soluble and substantially non-elastic adhesive which will dry to a tack-free condition while still free of tension, and drying the adhesive and thread while the latter still is free of tension.

6

2. The method of treating a finished cotton sewing thread so the thread will not stretch or elongate under tension when dry but will stretch and elongate under tension upon immersion in water, thereby to eliminate seam pucker when a seam is sewn with thread, which method includes contracting said thread in a lengthwise direction by immersion while free of tension in a bath of an aqueous solution of caustic soda of mercerizing strength, said contraction being an amount sufficient to produce under seam tension the degree of elongation that will prevent seam pucker when placed in water, thereafter removing the caustic soda from the contracted thread and drying the same while the thread still is free of tension, coating the dried contracted thread with a substantially non-elastic water soluble resin while still free of tension, and drying the thread to a non-tacky condition while it still is free of tension.

3. An article of manufacture, comprising a cellulose sewing thread which is resistant to elongation while dry but free to elongate under tension upon immersion in water, thereby to eliminate seam pucker when a seam is sewn with the thread, said sewing thread being contracted in length and being coated with a water soluble adhesive which holds said thread in said contracted condition, said contraction being an amount sufficient to produce under seam tension the degree of elongation which will prevent seam pucker when placed in water, said adhesive having strong adhesive to cellulose, low stretching elasticity, and non-tacky characteristics under normal atmospheric conditions.

4. A cotton sewing thread for producing a machine sewn seam which will not shrink and pucker when subsequently laundered, said cotton sewing thread being temporarily contracted in length and held in that temporarily contracted condition by a dried coating of a non-tacky water soluble and substantially non-elastic resin, said contraction being an amount sufficient to produce under seam tension the degree of elongation that will prevent seam pucker when placed in water.

References Cited in the file of this patent

UNITED STATES PATENTS

677,450	Gros	July 2, 1901
1,799,230	Harron	Apr. 7, 1931
2,539,244	Halden	Jan. 23, 1951

FOREIGN PATENTS

9,988 of 1911	Great Britain	July 13, 1911
------------------	---------------	---------------