March 2, 1937. H. A. SMITH ET AL 2,072,775

ELASTIC YARN AND FABRIC

Filed Feb. 25, 1936

Fig. 1.

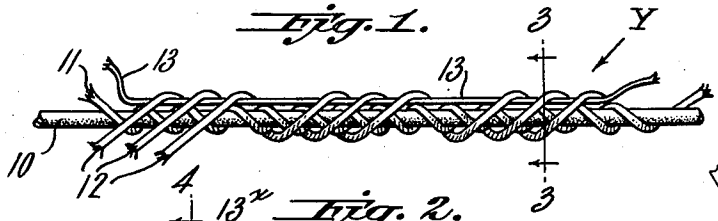
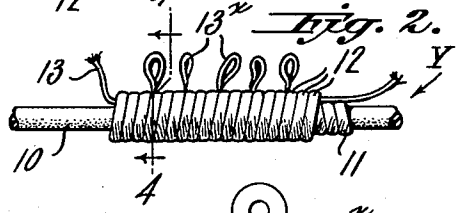


Fig. 2.



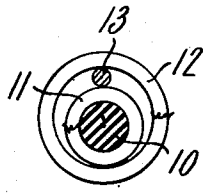


Fig. 3

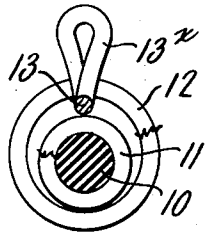


Fig. 4.

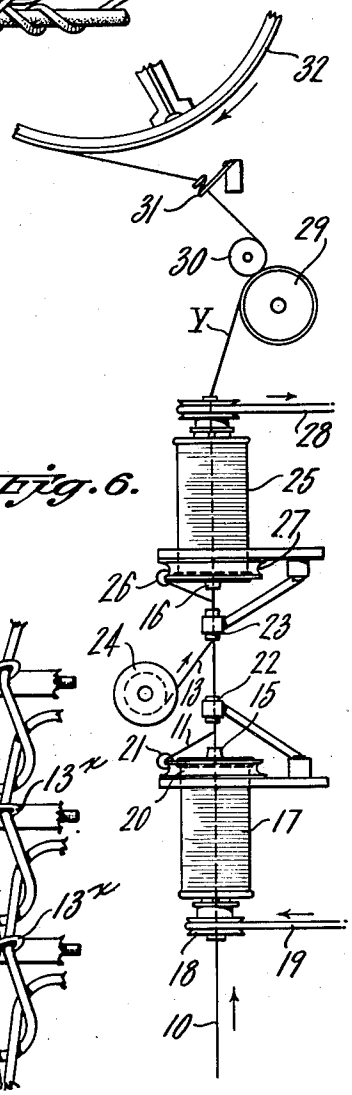


Fig. 6.

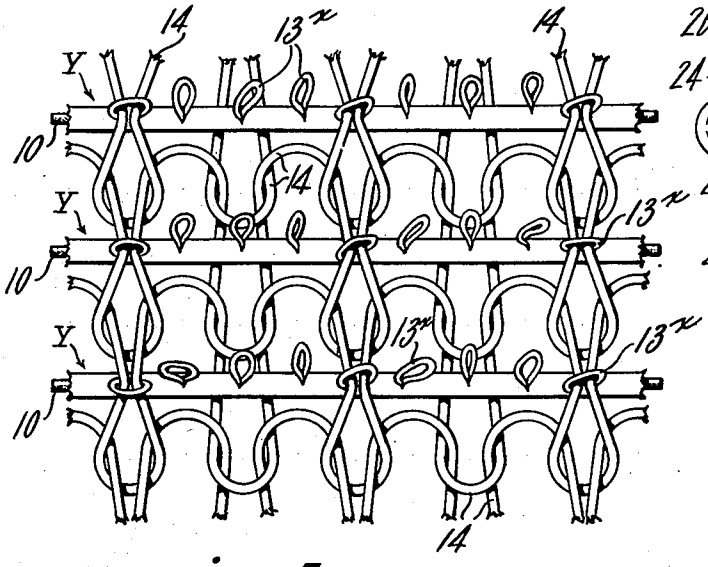


Fig. 5.

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ELASTIC YARN AND FABRIC

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12 Claims. (Cl. 66—190)

This invention relates to improvements in elastic yarn having a limited stretch and to a fabric employing this elastic yarn in its construction.

Elastic yarns consisting of a rubber core having one or more covers wound helically about the core are extensively used in knitted, woven and other fabrics to impart elastic properties to these fabrics, but since such yarns are usually capable of stretching from one to several times their length from the relaxed condition, difficulty is experienced in introducing these elastic yarns in fabrics under the desired tension.

Furthermore, when elastic yarn is introduced in the fabric so that it is maintained under tension in the finished fabric, as is the general practice in woven, elastic fabrics, difficulty is experienced if the fabric is cut transversely of the elastic yarn, due to the tendency of the tensioned elastic yarn to run or pull back in the fabric. Likewise, difficulty is experienced in sewing elastic fabric because if the sewing needle cuts the elastic yarn it will tend to run or pull back in the fabric. When an elastic yarn is cut and pulls back in the fabric it not only forms a defective place in the fabric or garment in which it is embodied but the loose rubber end is likely to protrude from the face of the fabric and form what is called a "black-head."

The present invention seeks to overcome these difficulties and one feature of the present invention resides in an elastic yarn having a stay or stop thread extending longitudinally of the elastic yarn and confined between its inner and outer helically wound covers. This stay thread serves to limit the stretch of the yarn as it is being introduced into the fabric and also to limit the stretch of the yarn in the finished fabric. An elastic yarn having a limited stretch is easier to weave or knit and the stay thread prevents the yarn from stretching sufficiently in the fabric to break the core or cover wound thereupon.

Another feature of the present invention resides in the construction whereby the stay thread above mentioned is arranged to form loops that bulge outwardly between helical coils of the outer cover when the elastic yarn is not fully extended. The effect of this is to give the elastic yarn a rough outer surface which causes it to be more firmly held in the fabric, thus decreasing the tendency of the elastic yarn to slip in the fabric. The stay thread further tends to hold the end of the core in the fabric when it is cut so that the rubber end will not protrude from the fabric to form an objectional "black-head."

A further and important feature resides in the construction whereby the projecting loop formed along the elastic yarn are utilized to positively lock the elastic yarn in place in a knitted fabric. This is accomplished by so forming these loops that some of the knitted loops may pass through the loops along the elastic yarns to lock the elastic yarns in place.

The above and other features of the invention will be more fully understood from the following description when read in connection with the accompanying drawing illustrating one good practical form of the invention.

In the drawing:

Fig. 1 is a side view of a piece of elastic yarn constructed in accordance with the present invention, the yarn being shown as fully extended;

Fig. 2 is a similar view showing the yarn relaxed.

Fig. 3 on a larger scale is a section on line 3—3 of Fig. 1;

Fig. 4 is a similar section taken on the line 4—4 of Fig. 2;

Fig. 5 is a face view of a piece of knitted fabric having the elastic yarn of Fig. 2 locked to the fabric in accordance with the present invention; and

Fig. 6 is a side elevation of a core covering machine which may be employed in manufacturing the yarn of the present invention.

The elastic yarn Y of the present invention has an elastic core 10 formed of rubber or rubber-like material. This core may be round or square or of any other desired shape in cross-section and may be made in any well known or preferred manner. The core illustrated is round in cross-section and may be formed by extruding or streaming latex into a coagulant.

The core 10 is shown as provided with an inner cover 11 and outer cover 12 and the cover 11 in the construction shown is formed of a textile thread wound helically about the core in one direction while the outer cover is formed of a group of textile threads 12 wound helically about the core in the opposite direction. The group 12 shown comprises three threads disposed side by side.

In accordance with the present invention a stay or stop thread 13 is provided longitudinally of the core 10 between the inner and outer covers as shown. In constructing the present elastic yarn the inner cover 11 is wound about the core 10 in spaced helical coils while the core is stretched to a substantial degree, and while this tension is maintained upon the core the stay

thread 13 is laid along the core against the open helical coils of the cover 11, and the second cover 12 is then wound in the opposite direction in open helical coils about the cover 11 and stay thread 13 as will be apparent from Fig. 1. The construction is such that when the tension upon the elastic yarn of Fig. 1 is relaxed the core will contract until the helical windings of the inner and outer covers are moved into contacting relation to each other as shown in Fig. 2, and these covers when in this position preferably maintain the core 10 under some tension.

Since the stay thread 13 is secured to the elastic yarn while the latter is in the stretched condition of Fig. 1, it is apparent that as the elastic yarn is permitted to contract the stay thread 13 will become relaxed and as a result the relaxed or slacked portions of the thread will bulge outwardly between the spaced helical windings of the group of outer threads 12 to form the loops 13x, as will be apparent from Figs. 2 and 4. These loops 13x will disappear each time the elastic yarn is stretched fully as shown in Fig. 1 and will reappear each time the elastic yarn is permitted to contract, and as a result the elastic yarn Y due to these laterally projecting loops 13x will have a relatively rough outer surface, except when the yarn is fully extended, which rough surface will cause the elastic yarn to be more firmly held in the fabric in which it may be embodied.

The present invention contemplates that the laterally projecting loops 13x may be employed to lock the elastic yarn Y in place in a knitted fabric when such yarn is employed as a laid-in elastic yarn extending in the direction of the courses. The manner in which these loops may be employed to lock the elastic yarn in place in a knitted fabric is clearly shown in Fig. 5 wherein an ordinary rib knitted construction is shown as formed of the knitted yarn 14, and it will be noted that some of the loops formed of the knitted yarn 14 are passed through the anchoring loops 13x of the elastic yarn Y. The effect of this is to firmly lock the laid-in elastic yarn in place in the knitted construction so that it is prevented from slipping or pulling back therein when the core 10 is cut.

It should be noted that by forming the outer cover of several yarns 12 laid side by side and wound helically about the core the stay thread 13 when relaxed will project outwardly along one side of the core between the adjacent turns of the helically wound group of threads so that the loops 13x will be spaced at regular intervals along one side of the elastic yarn Y as shown. This spacing of the loops 13x preferably bears a definite relation to the distance between the adjacent wales of the knitted fabric 14 so that as the fabric 14 is being knitted the chance of the knitting needles passing through some of the anchoring loops 13x will be increased, with the result that during the knitting operation at least some of the knitting loops will be passed through the anchoring loops 13x as shown in Fig. 5 to firmly anchor the elastic yarn Y in place in the knitted fabric. The loops 13x may be pressed or sized or otherwise treated to hold them open so as to facilitate the passage of the knitting needle therethrough. The elastic yarn Y may also be used in hand knitted work, in which case the knitting loops 14 may be directed by hand through the loops 13x.

When the elastic yarn of the present invention is employed in woven or other fabrics in which the anchoring action disclosed in Fig. 5 cannot be obtained, the rough outer surface imparted to the elastic yarn by the projecting loops 13x will enable this yarn to be more firmly held in the finished fabric and will lessen the tendency of the elastic yarn to run or pull back in the fabric when the core 10 is severed. Furthermore, if the core should be broken or cut, for example, by the needle employed in sewing the fabric, the stay thread 13 extending lengthwise of such core will tend to hold the core in place and lessen the likelihood of a cut rubber end projecting outwardly from a face of the fabric to form what is known as a blackhead.

The stay thread 13 is preferably so secured in the elastic yarn that it will prevent the core 10 and the covering yarns 11 and 12 from being extended to the breaking point. When this yarn Y is woven, knitted or otherwise introduced into a fabric, it may be placed therein under uniform tension, by simply exerting sufficient tension on the yarn during the weaving or knitting operation to hold the stay thread of the yarn taut. When, however, it is desired to produce the locking construction of Fig. 5 in which some of the knitted loops 14 pass through the anchoring loops 13x, the elastic yarn Y should be at this time only slightly extended so as not to cause the loops 13x to disappear.

Various forms of mechanism may be employed in constructing the elastic yarn forming the subject matter of the present invention and one form of mechanism to this end is shown more or less diagrammatically in Fig. 6, wherein the elastic core 10 is shown as passing upwardly through a hollow lower spindle 15 and a hollow upper spindle 16. The core is drawn upwardly through these spindles under tension by means to be described and the spindles are rotatably supported in vertical alignment with each other. Upon the lower spindle 15 is mounted a yarn supply spool 17. The spindle 15 is driven by a whirl 18 and belt 19 and surrounding the supply spool 17 is a ring 20 and traveler 21 of usual construction. The arrangement is such that as the yarn 11 for the inner cover of the core is unwound from the supply spool 17 it passes through the traveler 21 and is wound in open helical turns about the upwardly moving core 10, the spool 17 at this time being rotated by its supporting spindle 15. The core 10 having the inner cover 11 wound thereupon passes upwardly through a guide eye 22 and as it approaches a second guide eye 23 the stay thread 13 supplied by a spool 24 is led upwardly through the guide eye 23 alongside the covered core 10.

The upper spindle 16 which is shown as supported in inverted relation to the lower spindle 15 has mounted thereupon a supply spool 25. This spool may have the three threads 12 wound thereupon in side by side relation and as these threads are unwound from the spool they pass through the traveler 26 supported by the ring 27. The spindle 16 and spool 25 are rotated in the opposite direction by a driving belt 28 from that of the spool 17. The effect of this is to wrap the three threads 12 side by side in open helical coils about the covered core 10 and stay thread 13 in an opposite direction to the thread 11 of the inner cover.

The core 10 may be supplied to the winding mechanism of Fig. 6 from a spool, not shown, but the rotation of which is retarded to tension the core as it passed upwardly through the spindles 15 and 16. The finished elastic yarn Y may be drawn upwardly by a constantly rotating drum 29 having the yarn held thereagainst by a roller

30 and may then pass through a traversing guide 31 and be wound upon a drum or reel 32.

It will be seen from the foregoing that by so arranging the stay thread 13 and outer cover 12 that this thread when relaxed is permitted to project outwardly between the helical coils of the cover, the stay thread serves not only to limit the stretch of the elastic yarn Y but also to provide a rough surface upon the yarn which enables it to be more firmly held in the fabric as above pointed out. Some of the advantages of the present invention may be obtained if the inner cover 11 is omitted in which case the outer cover 12 will secure the stay thread 13 in direct contact with the core 10. In this case the loops 13x will be produced when the yarn Y is relaxed as in the construction illustrated.

Having thus described our invention what we claim and desire to have protected by Letters Patent is:

1. An elastic yarn comprising an elastic core, inner and outer covers wound helically about the core, a thread extending lengthwise of the core between the inner and outer covers and arranged to form loops projecting outwardly between the helical windings of the outer cover when the elastic yarn is in the relaxed condition.

2. An elastic yarn comprising an elastic core, inner and outer covers wound helically about the core, a stay thread extending along the core between the inner and outer covers to limit the stretch of the elastic yarn and arranged to project outwardly between the windings of the outer cover when the elastic yarn is in the relaxed condition.

3. An elastic yarn comprising an elastic core, a cover wound helically about the core, and yarn loops extending laterally outwardly from the elastic yarn and anchored thereto by the helically wound cover.

4. An elastic yarn comprising an elastic core, a cover wound helically about the core, and a row of yarn loops extending outwardly from one side of the elastic yarn and anchored thereto by the helically wound cover.

5. A yarn comprising a core, a cover wound helically about the core, and strand loops extending outwardly from the yarn and anchored thereto by the helically wound cover.

6. A yarn comprising a core, a cover of fibrous strand wound helically about the core, and strand loops extending outwardly from the yarn and anchored thereto by the helically wound cover.

7. An elastic yarn comprising an elastic core, an inner cover wound helically about the core in one direction and an outer cover wound helically about the core in the opposite direction, and a series of yarn loops extending laterally outward from the elastic yarn and secured thereto by the outer cover.

8. An elastic yarn comprising an elastic core, a cover wound helically about the core, and loops formed of a yarn much smaller in diameter than the elastic yarn and anchored thereto by said cover to project outwardly beyond the cover.

9. An elastic yarn comprising an elastic core, a cover upon the core formed of a helically disposed group of fibrous threads and a thread extending lengthwise of the core and forming loops projecting laterally outwardly from the core between the adjacent turns of said helical group of threads.

10. A knitted fabric embodying therein a plurality of elastic strands each formed with anchoring loops extending laterally therefrom, said strands being placed in the fabric in parallel relation to each other and having loops of the knitted fabric extending through the strand loops, whereby the elastic strands are locked in the fabric.

11. A knitted fabric embodying therein a plurality of elastic strands each comprising a core, a helically wrapped cover upon the core and anchoring loops secured to the core by the cover, said strands being placed across the fabric and having loops of the knitted fabric extending through said anchoring loops to lock the strands to the fabric.

12. An elastic fabric embodying therein a plurality of elastic strands each formed with a series of loops extending laterally therefrom to form upon the strands a rough outer surface, and other strands engaging said rough elastic strands and firmly holding them in the fabric.

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