This invention relates to an elastic yarn comprising an elastic core such as rubber and a fibrous or textile cover for the core. Elastic yarn consisting of a rubber core having one or more covers helically wound thereupon or having a braided about the rubber core are well known and are extensively used in elastic fabrics. It is found, however, that when elastic yarn having a cover that is either helically wound or braided upon the core is used and the core thereof breaks or is severed, the cover adjacent the broken end of the core tends to unwind or otherwise expose the broken end and permit the broken core to contract in the fabric. This tendency of the cover to pull loose from or otherwise release the severed end of the core presents serious difficulties particularly when it occurs after the elastic yarn is introduced in a tensioned condition in an elastic fabric. This difficulty is due largely to the fact that the textile cover upon the rubber core is relied upon to hold the core in place in the elastic fabric in a tensioned condition. If the cover fails to hold the core in the desired tensioned condition in the fabric then the contractive force of the fabric is decreased. Furthermore, if the rubber cores are not held in place in the fabric or if one or more cores becomes severed or broken, these ends tend to pull back in the fabric, and if the cover does not remain upon the broken end of the core this end is likely to project from a face of the fabric and form a defect commonly known as a "black-head".

One of the principal causes of the rubber core becoming cut or broken in the fabric and pulling back, resulting in loss of tension in the fabric and the production of "black-heads" is due to needle cutting caused by the rubber core being cut or nicked by the sewing machine needle when the elastic fabric is sewed.

The primary feature of the present invention resides in an elastic yarn having the cover knitted thereupon. One important advantage of an elastic yarn having the cover formed thereupon in this manner is due to the fact that the operation of knitting the cover upon the core serves to tightly lock the knitted loops about the rubber core. As a result, when the rubber core is severed or breaks the cover due to the manner in which it is tightly locked thereupon will not pull back or expose the end of the rubber core. Another important advantage of the present construction resides in the fact that when the cover is knitted upon the rubber core the knitted loops thus formed serve as anchoring loops adapted to hold the elastic yarn in place in the fabric. These anchoring loops are also well adapted to be interengaged and held by the loops of a row of stitches introduced by the sewing machine needle when the elastic fabric is sewed.

A further advantage of the present construction resides in the fact that the knitted cover is well adapted to limit the stretch of the rubber core, and the outer surface of the knitted cover is somewhat rough and this helps to prevent the elastic yarn from slipping in the elastic fabric in which it may be laid or otherwise introduced. Elastic yarn constructed in accordance with the present invention may have a single cover knitted thereupon or it may have two or more covers knitted upon the elastic yarn and these knitted covers may be put on simultaneously or in separate operation. When two knitted covers are used it will be found desirable in many cases to knit these two covers simultaneously and at substantially the same point upon the rubber core so that the loops of one knitted cover will more or less interlock with those of the other cover to thereby more securely fasten both covers in place.

If desired, one cover may be knitted upon the rubber core and a second cover may be helically wound or braided over this knitted cover thus securing the advantages of the knitted cover with the smoothness of the outer surface characteristic of a helically wound or braided cover.

The above and other features of the elastic yarn of the present invention and a manner of constructing the same will be more fully understood from the following description when read in connection with the accompanying drawings; wherein—

Fig. 1 is a section shown more or less diagrammatically of mechanism for producing elastic yarn in accordance with the present invention and comprising a rubber core having a single cover knitted thereupon.

Fig. 2 is a view similar to Fig. 1 but discloses mechanism whereby two covers are knitted upon the rubber core by a single needle.

Fig. 3 is a view similar to Fig. 2 but discloses mechanisms for employing two needles for knitting two covers upon the elastic core.

Fig. 4 on a relatively large scale is a plan view of the elastic yarn constructed in accordance with Fig. 1.

Fig. 5 is a plan view showing the yarn constructed in accordance with Fig. 2.

Fig. 6 is a plan view showing the elastic yarn constructed in accordance with Fig. 3 and
Fig. 7 is a plan view of a piece of elastic webbing formed of the elastic yarn of the present invention and shown as sewed to another piece of fabric.

The elastic yarn of the present invention can be readily produced on a warp knitting machine of well known construction. About the only change that need be made in such machine is to provide take-up means for each strand of elastic yarn being produced, and tensioned let-off means for supplying the rubber core and covering yarn to the knitting point under the proper tension.

The ordinary warp knitting machine is provided with a series of knitting needles arranged in a row along a supporting frame. If desired each of these needles may be employed in accordance with the present invention to cover a separate rubber core or other elastic thread provided the needles are not too close together. If, however, the cores of the warp knitting machine are quite close together it may be desirable to remove every other needle to thereby provide more room for the present core covering operation.

If it is desired to apply only one knitted cover upon the elastic or rubber core and to use only a single needle to form such cover, then a rubber core to be covered may be supplied to each needle. But on the other hand, if it is desired to utilize two needles to form the cover upon each rubber core then a core may be supplied to each pair of needles.

In either case it will be apparent that one ordinary warp knitting machine having the usual large number of needles will serve to produce simultaneously a large number of elastic yarns each consisting of a rubber or elastic core having one or more covers knitted thereupon.

While various forms of knitting mechanism may be employed in manufacturing the elastic yarn of the present invention, the mechanism of Fig. 1 and which for the most part is of well known construction will now be described. It will be understood however that in the transverse section shown, only one elastic yarn is illustrated as being covered whereas this machine is or may be capable of producing many elastic yarns at the same time.

The machine is shown as provided with the usual latch knitting needles 10 mounted in the holder 1 which is bolted or otherwise secured to the needle bar 12. This bar 12 is raised and lowered as usual to operate the needles 10 and adjacent the bank of needles 10 is provided the fixed bar 13 which serves to support the work and to define the point at which the cover is formed about the core.

The core 4 which may be formed of any suitable rubber or elastic material is supplied by a spool 15. This spool is provided with brake means 16 for retarding its rotation to thereby tension the rubber core. The core 4 passes downwardly from the spool 15 through the guide eyes 17 and 18 provided at the opposite extremities of the guide 19, and the series of guides 19 are secured to the guide bar or cradle bar 20.

The covering yarn 21 which may be silk, cotton, wool or any other suitable textile or fibrous material is supplied by a spool 22 having the brake means 23 for retarding the unwinding operation of this spool. The yarn 21 as it is led downwardly passes through the guide eyes 24 and 25 at the opposite ends of the guide 26 secured to the guide bar 27.
The elastic yarn as it is formed passes downwardly between the spaced fixed bars 44 and 45 and at the outer face of one of these bars is the needle 10 whereas at the outer face of the other bar is the needle 40. These needles are so operated that one is up while the other is down.

The guides 19 and 37 are preferably so operated that they pass the yarns 41 and 42 about the core 14 in opposite direction as will be apparent from Fig. 6.

When as elastic yarn is to be knitted or used in a shuttle it is important that it be balanced; that is that it be so constructed that it will hang free and straight in the shuttle without twisting or kinking. The elastic yarn of Fig. 4 is likely to be unbalanced. The elastic yarn of Fig. 5 may be well balanced and will not readily unravel. The elastic yarn of Fig. 6 may have even a better balance than the construction of Fig. 5 and the loops of the construction of Fig. 6 are so well interlocked that this construction is difficult to unravel. Furthermore the construction of Fig. 6 produces an outer cover that is nearly round.

While three forms of elastic yarn having the cover knitted theretopon are shown in the drawings it will be apparent that various other constructions may be made within the scope of the present invention. When the core is provided with more than one knitted cover these may take the form of separate and distinct covers applied one over the other in separate and independent operations. It will also be understood that the elastic yarn constructed as herein shown and described may be provided with one or more additional covers wound, braided, or otherwise formed on the knitted cover.

In Fig. 7 of the drawings is shown a piece of elastic webbing 47 having the elastic yarns 48 constructed in accordance with the present invention extending longitudinally thereof and this elastic webbing is shown as secured to a piece of fabric 49 having the row of sewing stitches 50 extending transversely of the elastic yarn. This view will serve to illustrate how the loops of the sewing stitches 50 are adapted to interlock with and positively hold the knitted loops of the elastic yarn 48.

It will be seen from the foregoing that in the present elastic yarn the cover is well locked upon the core and will not unravel or slip back to expose the end of the core as in the prior constructions. Furthermore the core will not slip in the cover when the core breaks or is cut and as a result the uncut cover will serve to hold a broken core in place in the fabric, and since the cover of the present elastic yarn which is formed of interlocked loops is somewhat rougher than the covers employed heretofore, it will have a less tendency to slip in the fabrics than the construction used heretofore.

Having thus described my invention what I claim and desire to protect by Letters Patent is:

1. An elastic yarn having a core elastic material and a textile cover formed of two strands of yarn each knitted about the core in successive loops but in opposite directions so that each yarn is locked about the core by its own loops and also by the similarly knitted loops of the other yarn.

2. An elastic yarn having a core of elastic material and a cover formed of two strands of yarn knitted about the core in opposite directions so that the knitted loops of one strand interlock with the knitted loops of the other strand at widely spaced points circumferentially about the core and each holds the other from unraveling.

3. An elastic yarn having a core of elastic material and a cover formed of two strands of yarn knitted tightly about the core in opposite directions so that the knitted loops of one strand interlock with the knitted loops of the other strand.

4. An elastic yarn having a core of elastic material and a cover formed of a plurality of strands of yarn knitted in opposite directions about the core in crossing, interlocking loops extending one over the other in tightly embracing relation with the core.

5. An elastic yarn having a core of elastic material and a cover formed of a plurality of separate strands of yarn knitted tightly about the core in opposite directions so that these strands interlock one with the other at a plurality of points circumferentially about the core.

6. An elastic yarn having a core of elastic material and a cover formed of two separate strands of yarn knitted about the core in opposite directions so that the knitted loops of the two strands of yarn interlock one with the other.

7. An elastic yarn having a core of elastic material and a cover formed of two strands of yarn knitted in opposite directions about the core so that their loops interlock and maintain the elastic yarn in a balanced condition.

8. An elastic yarn having a core of elastic material and a cover formed of two strands of yarn knitted in opposite directions about the core in interlocked loops arranged so that corresponding portions of the loops of the two strands cross the core at opposite sides thereof.

9. An elastic yarn having a core of elastic material and a cover adapted to maintain the core under substantial tension and formed of a plurality of separate strands of yarn tightly knitted in opposite directions about the core in interlocking loops.