March 11, 1952 H. E. COOPER 2,588,361

SINGLE COVER ELASTIC YARN

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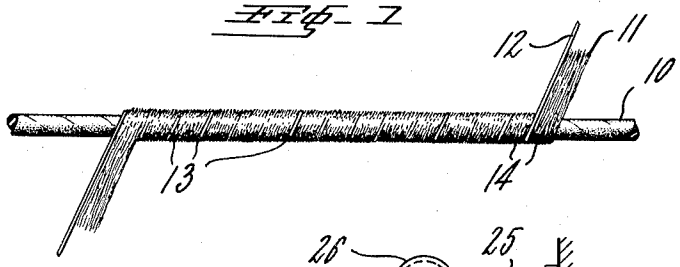
Fig. 1



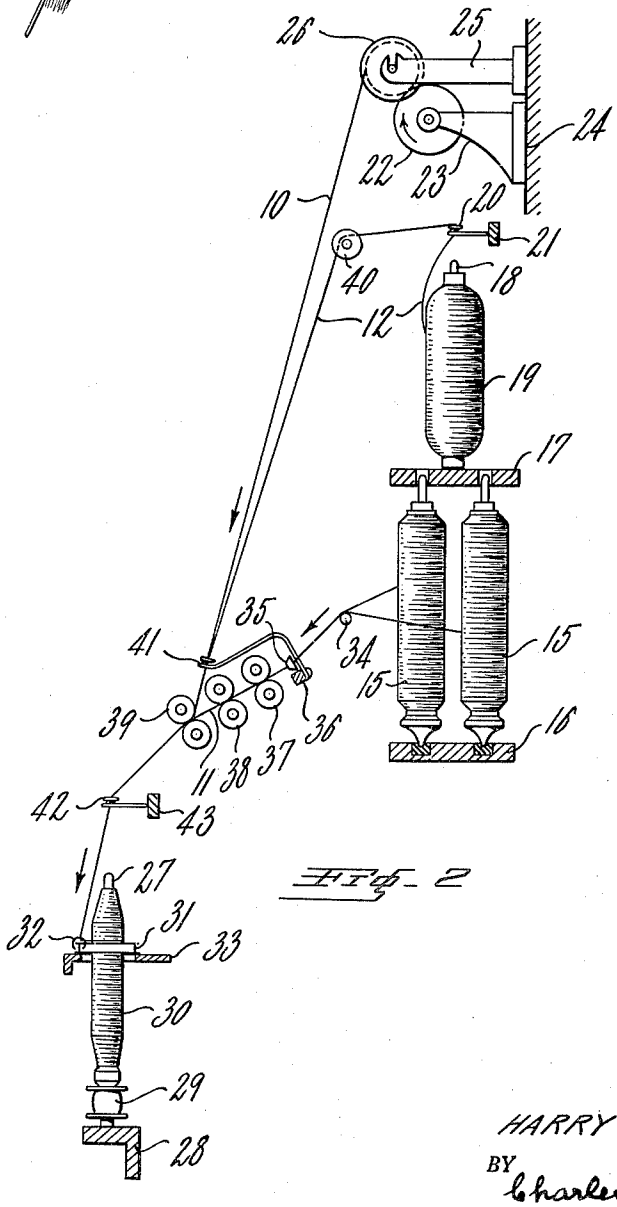


Fig. 2

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SINGLE COVER ELASTIC YARN

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5 Claims. (Cl. 57—152)

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This invention relates to a single cover elastic yarn, and more particularly to a fine, strong, single cover elastic yarn in which the cover is very firmly secured to the rubber core.

In the Foster Patent No. 2,024,156, for Elastic Yarn and Process of Making the Same, there is shown, described and claimed a good practical single cover elastic yarn which has been manufactured and sold in large quantities. It is desired however, in some cases, to increase the strength of the elastic yarn of said patent and increase its resistance to wear and abrasion.

These objects are secured in a very satisfactory manner by the construction of the present invention, wherein an elastic yarn of the type disclosed in said patent is improved by associating with a cover formed of a thin wrapped ribbon of substantially parallel fibers, a very small high-tenacity continuous filament yarn that is wound in spaced coils about such thin ribbon, whereby the wrapped ribbon of fibers is firmly held in place by the continuous filament yarn, and the strength of the elastic yarn is materially increased.

The above mentioned cover formed of a thin wrapped ribbon of fibers may be made of cotton or other non-continuous fibers, such as spun fibers formed from silk or various artificial filaments by cutting or breaking the filaments into short lengths. It is important that this ribbon cover be formed of drafted non-continuous filaments such as cotton fibers or the so-called spun fibers because a drafted cover of short fibers is relatively soft and flexible and does not disturb greatly the balance of the enclosed rubber core; whereas if the cover is formed primarily of yarn made up of continuous filaments such for example, as rayon or nylon it is difficult to make a fine well-balanced single cover elastic yarn, because continuous filament yarn or yarns form a relatively stiff, spring-like cover that is hard to balance by twisting the fine rubber core in the opposite direction to the helical wrapped cover.

I have found however that if a fine, strong continuous filament yarn, such for example as nylon, is laid helically with the cover formed of a thin ribbon of non-continuous fibers, so that its weight is only a small fraction of the weight of the ribbon cover, then it is easy to make a well-balanced single cover elastic yarn. The fine, strong continuous filament yarn, in accordance with the present invention, is laid in spaced coils about the ribbon and is preferably more or less buried in such ribbon, so that the finished elastic yarn will have a smooth uniform outer surface. This helically wound continuous filament yarn serves (1) to increase the strength of the elastic yarn, (2) to hold the cover of non-continuous fibers firmly in place and (3) to ornament or otherwise vary the appearance of the finished elastic yarn when this is desired. If it is desired to impart a two-tone appearance to the elastic yarn this may be done by supplying the continuous filament yarn to the covering point under slight tension so that it will show at the outer surface of the elastic yarn. On the other hand if it is desired to conceal this continuous filament in the cover, then it should be delivered to the covering point under enough tension to bury it in the fibrous cover. Since the continuous filament yarn may take dyes differently from the non-continuous fibers it may be desired to conceal the former in some elastic yarns that are to be dyed.

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It is found in practice that by employing the construction of the present invention, wherein a high tenacity continuous filament yarn of much less weight than the ribbon cover is laid with the ribbon around the rubber core, a well-balanced elastic yarn can be produced, and the fine strong continuous filament yarn will materially increase the strength of the elastic yarn, and will serve also to hold the ribbon firmly in place on the rubber core.

The above and other features of the present invention will be further understood from the following description when read in connection with the accompanying drawing; wherein

Fig. 1 on an enlarged sale is a side elevation of an elastic yarn constructed in accordance with the present invention; and

Fig. 2 is a conventional diagrammatic view of one form of apparatus for producing the elastic yarn shown in Fig. 1.

In Fig. 1 of the drawing there is shown a rubber core 10 formed of any suitable rubber or rubber-like material, and the same is preferably twisted as shown before the cover is applied, thereto. This bare rubber core 10 is shown as greatly enlarged, since in actual use its diameter may be a hundredth of an inch or less.

The cover for the rubber core 10, in accordane with the present invention, is formed of a thin flat ribbon 11 of substantially parallel drafted fibers laid helically around the core in a direction reversed to the twist of the core. This ribbon 11 has associated therewith a very fine high-tenacity continuous filament yarn 12. The yarn 12 is laid about the rubber core in spaced coils and these coils may be completely buried or only partly buried in the ribbon cover as desired. In the construction shown a few

of these coils indicated by 13 are clearly shown on the drawing and others are hardly visible, depending upon the extent to which such coils are buried in the fiber cover.

The drafted ribbon 11 which forms the fiber cover 14 upon the rubber core may be formed of cotton fibers or of short fibers obtained from silk, rayon, nylon or other so-called spun fibers. The fine high-tenacity continuous filament yarn 12 may be a mono-filament yarn or it may be made up of several such mono-filaments depending upon the strength and size of the same desired. It may, for example, have a denier of 15, 30 or 45 as desired but its weight should be only a small fraction of the weight of the ribbon 11 in order that it will not make the elastic yarn difficult to balance.

The apparatus for producing the elastic yarn of Fig. 1 may be varied extensively, and as shown resembles rather closely the apparatus shown and described in the above mentioned Foster patent.

The spinning apparatus shown in Fig. 2 is provided with two roving bobbins 15 which are rotatably supported by the lower plate or rail 16 of a spinning machine and by the upper rail or plate 17, and on each of these bobbins is wound a roving of cotton or other spun fibers. Upon the upper rail 17 is mounted the fixed spindle 18 adapted to support a cop or bobbin having wound thereupon a supply 19 of fine high-tenacity continuous filament yarn such as indicated by 12 in Fig. 1. This yarn 12 is unwound from its package 19 by pulling it endwise off of the package to pass through a pig tail 20 supported in alignment with the spindle 18 by a bracket 21.

Above the package 19, in the construction shown, there is mounted a power driven cork roll or sand roll 22 that is rotatably supported by the brackets 23 carried by the supporting structure 24, and above these brackets 23 are provided the brackets 25 supported by the structure 24. These brackets 25 rotatably support a spool 26 on which is wound a supply of rubber thread 10 which thread is previously twisted as shown in Fig. 1. The arrangement is such that the spool 26 rests by gravity upon the cork or sand roll 22. That is the thread wound upon this spool engages the roll 22 and is unwound by this roll at the desired speed.

The rovings supplied by the bobbins 15, the yarn 12 supplied by the package 19, and the rubber thread 10 supplied by the spool 26 are all advanced as shown along converging lines to the drafting rolls of a ring and traveler type of spinning machine. This spinning mechanism as shown has the spinning spindle 27 which is rotatably supported by the machine frame or rail 28 and the spindle is driven by the pulley 29. On this spindle 27 is mounted the usual take-up bobbin 30. This bobbin is surrounded by the usual ring 31 upon which is slidably mounted the traveler 32. The ring 31 is mounted upon the ring rail 33 which is raised and lowered by traverse mechanism in the usual manner to wind the elastic yarn in the desired manner on the bobbin 30.

In the construction shown two roving supply packages 15 are shown as two rovings will produce a more uniform product than will a single roving. These rovings upon leaving their supply packages pass over a guide rod 34 and then through a guide eye 35 mounted upon a traverse rod 36. From this guide eye 35 the rovings pass to the usual pairs of drafting rolls indicated by 37, 38 and 39 which operate to draft or attenuate the rovings into a thin ribbon 11 of parallel fibers.

The fine continuous yarn 12 is shown as passing laterally from the pig tail 20 over the guide and tensioning device 40 and then downwardly through a guide eye 41 secured to the traverse bar 36. It then passes to the nip of the front rolls 39. The tensioning device 40 may be of well known construction and preferably consists of two convex disks mounted on a supporting spindle and which are yieldingly pressed one towards the other by a spring and adjusting nut to vary the friction pressure on the yarn 12. The rubber thread 10 passes from the let-off spool 26 to the guide eye 41 and then to the nip of the front rolls 39. The purpose of the traverse bar 36 is to traverse the rovings, yarn and thread slightly relatively to the drafting rolls so as to lessen the wear upon such rolls. The speed at which the cork or sand roll 22 is driven should bear a definite ratio to the surface speed of the front rolls 39, so that this rubber thread 10 will be stretched a predetermined amount by the time it reaches the nip of these rolls, where it contacts the yarn 12 and the attenuating rovings or ribbon 11.

As the ribbon 11, yarn 12 and thread 10 leave the nip of the rolls 39 they pass together through the pig tail 42 supported directly above the upper end of the spindle 27 by a bracket 43. They then pass downwardly through the traveler 32 and then to the bobbin or take-up package 30. The rotation of the spinning spindle 27 twists these various strands in a well-known manner so that the rubber thread 10 will form the central core with the ribbon 11 and yarn 12 wound helically thereupon to form the construction shown in Fig. 1.

The attenuated rovings 15 form the thin ribbon 11 that has so little strength that it will hardly support its own weight. When this ribbon is placed about the rubber core 10 by the spinning operation it forms a soft flexible cover that is low in strength. The associated fine strong yarn 12 materially increases the strength of the elastic yarn, helps to hold the cover 14 in place and may modify the appearance of the elastic yarn if it shows on the cover. If it is desired to have the yarn 12 shown on the cover 14 then the yarn tensioning device 40 should be adjusted so that it will exert very little tension on such yarn. On the other hand, if it is desired to conceal this helically wrapped yarn 12 in the cover 14, then the device 40 should be adjusted to exert considerable tension so as to bury this yarn in the cover 14.

The primary purpose of the present invention is to provide a roving covered elastic yarn that is strong and has very good wearing properties; and in order to increase the strength of this elastic yarn as contemplated by the present invention, it is important that the fine strong yarn 12 be a small high tenacity strand formed of one or more continuous filaments such as natural silk; synthetic polyamides of which nylon is an example; synthetic polyesters of which the condensation product of glycol and terephthalic acid in an example; polyacrylics of which polyacrylonitrile is an example; copolymers of acrylics and vinyls of which dynel is an example; and regenerated cellulose of which high tenacity viscose rayon and cellulose regenerated from stretched cellulose-acetate are examples.

For a further understanding of the invention reference is had to the following table which gives the construction of two elastic yarns constructed in accordance with the present inven-

tion, and two yarns of approximately the same weight but not embodying the invention.

	New	Old	New	Old
Core	125's	125's	100's	100's
Percent Core	37.4	42.0	35.2	42.0
Percent Cover	52.2	58.0	56.5	58.0
Percent Nylon	10.4		8.3	
Yards per Lb	10,900	11,500	7,600	8,300
Tensile (at break), lb	.59	.49	.80	.70

The reinforcing nylon strand in this table is one end of 15 denier monofilament nylon. The 125's core is a rubber thread so small that 125 of them laid side by side measure one inch, and the 100's core is of such a size that 100 of them laid side by side measure one inch. The increase in strength of the elastic yarn due to the construction of the present invention is shown by comparing the tensile strength given in the first column with that of the second column; and the tensile strength given in the third column with that of the fourth column. Furthermore it is found that the roving cover is much more firmly secured to the rubber core in the new construction of column one and three than in the old construction of column two and four.

The construction of the present invention is highly desirable where it is desired to increase the strength and wearing properties of fine elastic yarn, such as yarns that run over 5,000 yards to the pound, but it may be used also in heavier yarns.

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

1. A single cover elastic yarn, comprising a twisted rubber core and a cover formed of a thin drafted ribbon of substantially parallel fibers laid helically around the core in a direction reverse to the twist of the core, and firmly held in place by a fine high-tenacity continuous filament yarn disposed in spaced coils about the ribbon cover and substantially buried therein, whereby the fibrous ribbon cover is firmly held in place by a yarn that has only a small fraction of the weight of the ribbon.

2. A single cover elastic yarn, comprising a twisted rubber core and a cover formed of a thin drafted ribbon of substantially parallel fibers laid helically around the core in a direction reverse to the twist of the core, and firmly held in place by a much smaller high-tenacity continuous filament yarn disposed in widely spaced coils about the ribbon cover and adapted to hold the cover firmly in place and to materially strengthen the elastic yarn.

3. A single cover elastic yarn, comprising a twisted rubber core and a cover formed of a drafted ribbon of substantially parallel fibers laid helically around the core in a direction reverse to the twist of the core, and firmly held in place by a much smaller high-tenacity continuous filament nylon yarn disposed in widely spaced coils about the rubber core in contact with the ribbon cover so that it holds the cover firmly in place and materially increases the strength of the elastic yarn.

4. A single cover elastic yarn, comprising a twisted rubber core and a cover formed of a drafted ribbon of substantially parallel fibers laid helically around the core in a direction reverse to the twist of the core, and firmly held in place by a fine, continuous filament yarn of contrasting appearance disposed in spaced coils about the ribbon cover so that it is visible at the surface of the cover and imparts thereto a two-tone appearance. and adapted to help hold the cover in place and to strengthen the elastic yarn.

5. A single cover elastic yarn, comprising a twisted rubber core and a cover formed of a drafted ribbon of substantially parallel fibers laid helically around the core in a direction reverse to the twist of the core, and firmly held in place by a much smaller continuous filament yarn disposed in widely spaced coils about the ribbon cover and adapted to hold the cover firmly in place and to materially strengthen the elastic yarn.

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No references cited.