Sept. 2, 1941. T. L. SHEPHERD 2,254,712

COMPOSITE RUBBER-TEXTILE THREAD, YARN, FABRIC, AND METHOD OF PRODUCTION

Filed Oct. 12, 1939

Fig. 1.

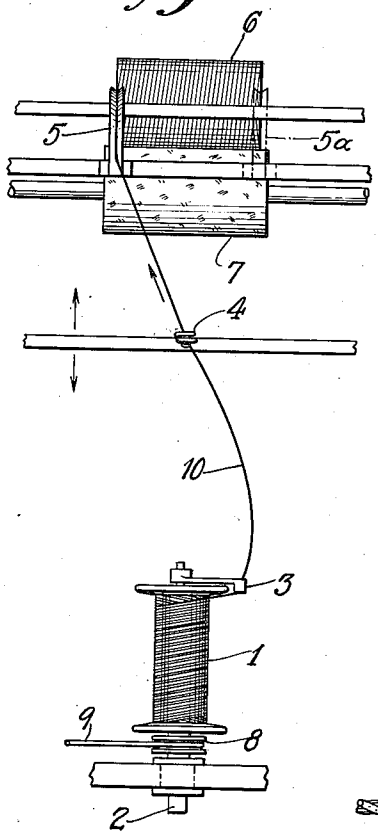


Fig. 4.

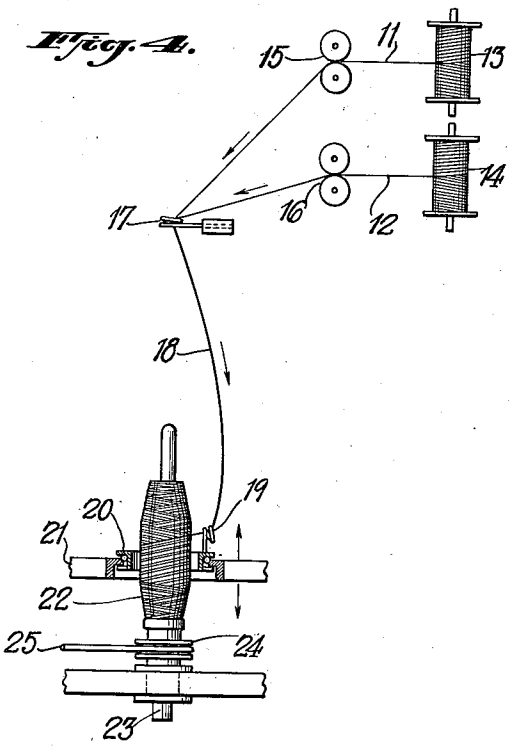


Fig. 2.

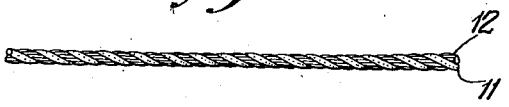


Fig. 3.

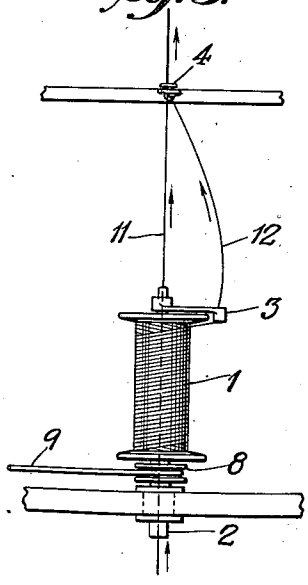


Fig. 5.

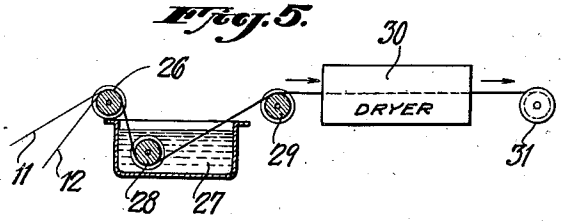
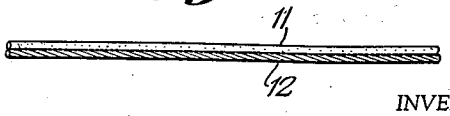


Fig. 6.



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COMPOSITE RUBBER-TEXTILE THREAD, YARN, FABRIC, AND METHOD OF PRODUCTION

Thomas Lewis Shepherd, London, England, assignor to The Clark Thread Company, a corporation of New Jersey

Application October 12, 1939, Serial No. 299,164
In Great Britain October 12, 1938

12 Claims. (Cl. 57—149)

This invention pertains to improvements in elastic or elasticizable threads, yarns and fabrics composed of rubber or other elastic strand and textile thread, and in processes for producing them.

A familiar type of elastic textile is that woven from elastic yarn formed by sheathing or cabling one or more rubber strands or filaments in one or more layers of cotton, silk or other smoothly-lying textile thread, by winding the thread helically about the rubber strands so as to cover the same, whereby the resulting composite yarn may be stretched to a limited extent depending on the initial compactness with which the thread is helically wound.

This type of elastic yarn is expensive owing to the extensive winding operations and the excessive amount of textile thread required to cover the elastic. Moreover, yarn of this character as commonly used is difficult to handle in the looms, since it must be stretched and woven under tension owing to its elasticity. As a consequence, slight variations in tension during weaving produce marked variations in the weave productive of a non-uniform product.

In accordance with a basic concept of the present invention, these and like defects are eliminated by forming the composite yarn of rubber or other elastic strand and creped textile thread, or of textile thread which is susceptible to creping or crinkling by appropriate treatment after being formed into the yarn and after the yarn is woven into a fabric. By the choice of a crepe-twisted textile thread or one which is susceptible to creping, the thread may be combined in substantially parallel, or in sparsely wound relation if desired, with the elastic strand and united thereto in such manner as to form a substantially inelastic and easily handled composite yarn, without impairing the elastic properties of the resulting fabric, while nevertheless providing adequate coverage of the elastic strand. The creping by producing transverse undulations or crinkles causes the textile thread to draw up longitudinally whereby the yarn may be stretched to the extent required to smooth out the crinkles; while in the non-distended condition the creping takes up the slack which would otherwise be present in the thread if combined in substantially parallel or in sparsely wound relation with the elastic strand. On the other hand, the creped textile thread limits the degree to which the rubber or other elastic strand can be stretched so that possibility of damage to the latter by undue stress or strain is thereby greatly reduced. Also the creped thread has the further beneficial effect in correcting within limits any irregularities in the stretch given to the elastic prior to or during the formation of the composite yarn.

In the drawing:

Fig. 1 illustrates diagrammatically the production on a standard type of uptwister of a composite yarn in accordance with a modification of the invention in which the rubber strand and highly twisted textile thread are twisted together;

Fig. 2 shows a piece of composite yarn as produced in accordance with Fig. 1;

Fig. 3 shows a modification of Fig. 1 in which the rubber strand is fed through an axial bore in the twisting spindle;

Fig. 4 illustrates diagrammatically the production on a ring-doubler type of twister, of a composite yarn in accordance with Fig. 2;

Fig. 5 illustrates diagrammatically the production of a composite yarn in accordance with a modification of the invention in which substantially parallel fibers of rubber strand and textile thread are bonded together with an adhesive; and

Fig. 6 shows a piece of composite yarn as produced in accordance with Fig. 5.

A smoothly-lying textile thread which may conveniently be creped or crinkled in the woven fabric, may be prepared by subjecting the thread to a high degree of twist, such as forty to sixty turns per inch, followed by a steaming operation or other suitable treatment, such as sizing, to set the twist and prevent snarling. The thread may be sized before or after twisting, well-known types of oil sizes being suitable, such as those employing a drying oil base, for example linseed oil, appropriately emulsified in accordance with known procedure. For rayon crepe thread, a size commercially available under the trade name "Raycol" has been found satisfactory. Care should be taken in the choice of the size and otherwise not to weld the individual filaments or fibers of the yarn together. The thread then has the property on subsequent "wetting out" or "desizing" of contracting and creping or crinkling to varying degrees depending on the amount of the twist, the material used and the size of the thread, whereby a crepe or pebble effect is produced in the fabric. The wetting out or desizing is accomplished, for example, by soaking and scouring in hot soft water to which a little soap has been added, and

in case of sizes difficult to remove, a little sodium carbonate may also be added except for cellulose acetate yarns.

Based on these principles, a substantially inelastic composite yarn suitable for weaving, but one which may nevertheless be rendered elastic in the woven fabric, may be prepared, in accordance with one modification of the invention, by twisting together, say to the extent of five to twenty turns per inch, one or more elastic strands of rubber or the like of a count say of 30,000 yards to the pound, and one or more strands of textile thread, for example as cotton, silk, rayon, etc., which thread has previously been sized and given a creping twist to the extent of about twenty to forty turns per inch. The whole is then steamed or submitted to other known methods of setting as aforesaid, the result being a composite rubber-textile yarn which is substantially inelastic, and in this respect similar to ordinary textile yarns. Such a yarn may be easily woven or handled on the knitting machines or looms and the like without any trouble, and the fabric or the like woven therefrom may be subsequently wetted out or desized, resulting in contraction of both the textile threads and the rubber strand as a result of which the fabric becomes elastic without rucking or cockling. In this connection, the rubber strand, prior to twisting and combining with the textile thread, is preferably stretched to a suitable degree, compatible with the retraction which is desired and which will eventually be obtained on wetting out or desizing.

A composite yarn having the above characteristics may be produced according to a second modification of the invention, by feeding the rubber strand, preferably under suitable tension as aforesaid, and highly twisted textile thread, in parallel and contiguous relation through a suitable size or bonding agent, so that they become cemented and adhere together without twisting. The textile thread thus employed is preferably twisted to the extent of about forty to sixty turns per inch. The size or bonding agent assists in rendering the yarn inelastic by virtue of the relatively hard coating which it forms, and also assists in preventing retraction of the elastic strand when combined under tension with the textile thread, the action in this respect being similar to that described in my copending application now Patent No. 2,182,996.

Sizes or bonding agents employed for this purpose should be of such nature as not to harm either the rubber strand or the textile thread. They should be such as to give adequate adhesion when present in relatively small proportion, for example 5% to 10% by weight of the yarn. They should dry rapidly to a non-tacky condition, and form a sufficiently flexible coating to permit winding, pirning and weaving without difficulty, and should maintain these properties for long periods without deterioration. Suitable sizes or bonding agents for this purpose are gelatine, glue, casein, dextrine, etc., to which softeners or plasticizers such as Turkey red oil, diglycol laurate, or even small amounts of glycerine may be added. The size may also contain substances capable of aiding penetration, such as soap, pine oil, etc.; also preservatives, such as phenol, beta naphthol, etc; and likewise, if desired, fugitive tints for identification purposes. The size or bonding agent is capable of being removed on wetting out or desizing of the fabric as above in the usual way, whereby the crepe effect is produced and the elastic properties imparted to the fabric.

Sizes or bonding agents of this character may be removed by wetting out or desizing by the same procedure as above described for oil sizes by soaking and scouring in hot, soft water containing a little soap, etc. In this way, both the oil size applied to the textile fibers before twisting, as well as the bonding agent used for making the composite rubber-textile yarn, are simultaneously removed.

In carrying out this modification, the textile thread may have been twisted without prior sizing or setting, as the size or other bonding agent used to cause the textile and rubber strands to adhere together will prevent snarling during weaving. The handling of the textile and rubber threads may be assisted by twisting them together slightly—say two to five turns per inch—prior to bonding or cementing to form a composite yarn consisting of more or less parallel strands of rubber fiber and textile thread.

In the Fig. 1 modification, the rubber strand and textile thread, the latter having preferably been previously twisted to about twenty to forty turns per inch as explained, are prewound side by side in parallel relation on a bobbin 1, the rubber strand being preferably wound under tension. The bobbin is then placed on spindle 2 of the uptwister and the contiguous fibers of rubber strand and textile thread, comprising the composite yarn, are fed through the flyer 3, vertically adjustable guide 4, and over the traversing guide 5, reciprocating between positions 5 and 5a, and onto the take-up roll 6, frictionally driven by the cork covered drive roll 7. Spindle 2 is rotated at high speed by the pulley 8 and drive belt 9, causing the yarn to be thrown off with such force, as indicated at 10, that the flyer 3 is caused to be revolved by the yarn itself, whereby the yarn is twisted as shown in Fig. 2 in which the rubber strand is shown at 11 and the textile at 12. The degree of twist is controlled by the rotative speed of the spindle and the rate of take-up at 6, and preferably is adjusted to impart a further twist of about five to twenty turns per inch.

The modification of Fig. 3 is like that of Fig. 1 except that in this case the spindle 2 contains an axial bore through which the rubber strand 11 is fed, the bobbin 1 containing only the textile thread 12. Rotation of the bobbin 1 and flyer 3 thus imparts a twist only to the textile thread and winds it about the rubber strand passing up through the center of the bobbin, whereby twisting of the rubber strand is eliminated.

In the modification of Fig. 4, the rubber strand 11 and textile thread 12, are fed from separate bobbins 13 and 14, through draw-off rolls 15 and 16, and passed together through a stationary guide 17, to form composite yarn 18, which is fed through guide 19 of a ring traveller 20 freely rotatable in frame 21, the yarn passing thence onto a bobbin 22 fixed to spindle 23. The spindle is rotated at high speed by pulley 24 and drive belt 25, causing the yarn to be wound on the spindle at the rate at which it is supplied by the draw-off rolls 15, 16; and also causing the yarn to be twisted prior to winding by the action of the traveller 20 which moves around with the pull of the yarn on guide 19 and thereby twists the yarn. For supplying the rubber strand under tension, draw-off rolls 15 are rotated at lower speed than rolls 16 supplying the textile thread.

Under these conditions, the degree of twist imparted to yarn is determined by the rotative speed of spindle **23** and the delivery speed of the draw-off rolls **16**, this being greater than that of rolls **15** due to the tension applied to the rubber strand. Fig. 2 is also illustrative of the twisted yarn produced in this way.

In the modification of Fig. 5, the rubber strand **11** and textile thread, may be fed as in Fig. 4, from separate bobbins **13**, **14** through draw-off rolls **15**, **16**, and then fed together over a rotatable guide **26** containing a V-shaped peripheral groove for feeding the rubber strand and textile thread in substantially parallel contiguous relation into a bath **27** of the bonding agent, the yarn passing thence under a similar guide **28** in the bath and thence out over a similar guide **29** and through a dryer **30** onto a bobbin **31**. Fig. 6 is illustrative of the composite yarn formed in this way. Alternatively, the rubber strand and textile thread may be twisted together slightly by the method of Figs. 1, 3 or 4 before passing through the bonding bath **27**, as this facilitates the maintenance of a contiguous relationship between the strand and thread for purposes of bonding.

I claim:

1. A substantially inelastic composite yarn comprising longitudinally contiguous lengths of elastic strand and of highly twisted and sized textile thread, productive of a creped thread on desizing thereby to impart limited elasticity to said yarn.

2. A substantially inelastic composite yarn comprising longitudinally contiguous lengths, twisted together, of elastic strand and of highly twisted and sized textile thread, productive of a creped thread on desizing thereby to impart elasticity to said yarn.

3. A substantially inelastic, composite yarn, comprising longitudinally contiguous lengths of elastic strand and of highly twisted textile thread bonded together with a cementing agent, said thread undergoing pronounced creping on removal of said cementing agent for imparting limited elasticity to said yarn.

4. A textile fabric containing a woven composite yarn comprising lengths of elastic strand and of highly twisted and sized textile thread productive of a creped thread on desizing.

5. Process for making a composite yarn of elastic strand and textile thread suitable for weaving elastic fabrics, which comprises: crepe twisting said thread, feeding said thread and strand in contiguous relation, and cementing the same together.

6. Process for making a composite yarn of rubber strand and textile thread, which comprises: imparting a creping twist to said thread and combining said strand under tension therewith by twisting, and steaming to set the twist.

7. Process for making a composite yarn of elastic strand and textile thread suitable for weaving elastic fabrics, which comprises: imparting a creping twist to said thread, feeding said thread and strand under tension and in contiguous relation, and cementing the same together.

8. Process for making elastic fabric from textile thread and elastic strand, which comprises: crepe-twisting said thread and subjecting to treatment temporarily inhibiting the creping effect, combining said thread with said strand to produce a substantially inelastic yarn, weaving at least a portion of said fabric with said yarn, and subjecting the finished fabric to treatment causing said thread to crepe, whereby limited elasticity is imparted to said fabric.

9. Process for making elastic fabric from textile thread and elastic strand, which comprises: imparting a creping twist to said thread and subjecting to treatment setting the twist temporarily to prevent creping, combining said strand under tension therewith to produce a substantially inelastic composite yarn, weaving at least a portion of said fabric with said yarn, and subjecting said fabric to treatment productive of creping in said thread whereby to impart elasticity to said fabric.

10. Process for making elastic fabric from textile thread and rubber strand, which comprises: sizing said thread and imparting a creping twist thereto, combining said thread and strand into a composite yarn by twisting, subjecting said yarn to a steaming operation temporarily to set the twist and to render the yarn substantially inelastic, weaving at least a portion of said fabric with said yarn, and subjecting said fabric to a desetting treatment to produce creping of said thread thereby to impart elasticity to said fabric.

11. Process for making elastic fabric from textile thread and rubber strand, which comprises: sizing said thread and imparting a craping twist thereto, feeding said thread and strand in linearly contiguous relation under tension and cementing together temporarily to set the twist and to form a substantially inelastic composite yarn, weaving at least a portion of said fabric with said yarn, and subjecting said fabric to treatment to remove said cement and cause creping of said thread thereby to impart elasticity to said fabric.

12. The process which consists in imparting a creping twist to a textile thread, feeding such thread and an elastic strand under tension, in contiguous relation, cementing the same together to bond said strands into a substantially inelastic composite yarn, fabricating cloth of such composite yarn and thereafter subjecting such cloth to treatment for releasing the cement bond and causing creping of the textile thread to take place on the retraction of the elastic strand.

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