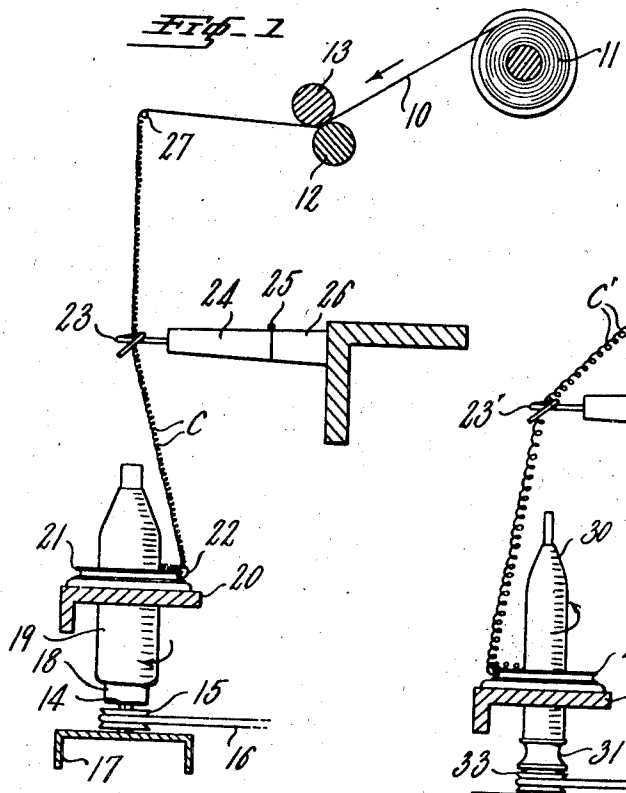
Oct. 19, 1948. R. J. CLARKSON 2,451,919

METHOD OF MAKING STRETCHABLE YARN

Filed Nov. 25, 1947

Fig. 1



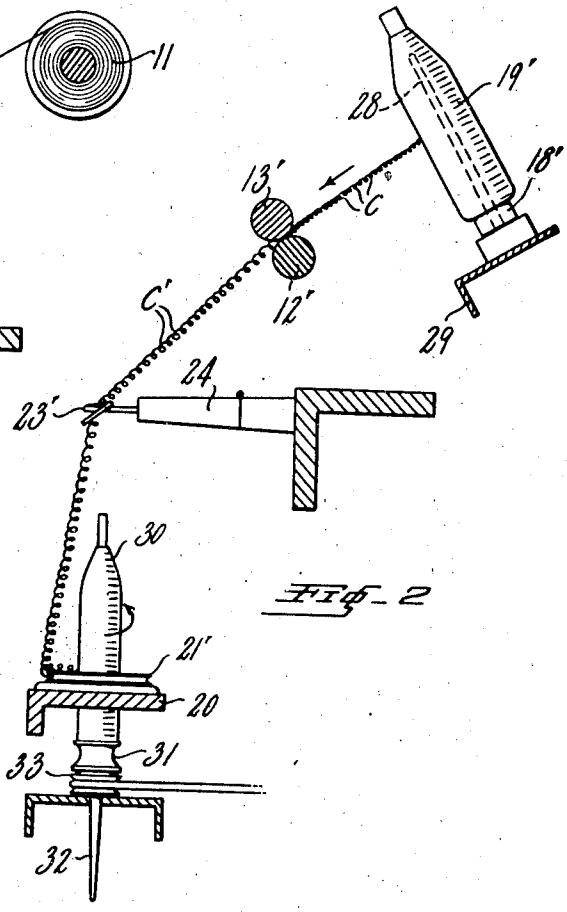


Fig. 2

Fig. 3

Fig. 4

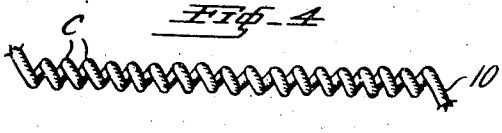
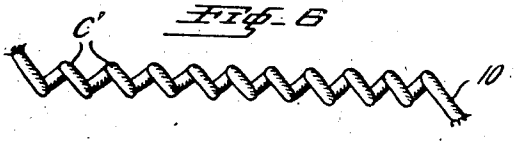


Fig. 5

Fig. 6



INVENTOR.
ROBERT J. CLARKSON
BY
Charles B. Wilson
ATTORNEY

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METHOD OF MAKING STRETCHABLE YARN

Robert J. Clarkson, Winnsboro, S. C., assignor to United States Rubber Company, New York, N. Y., a corporation of New Jersey

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3 Claims. (Cl. 57—156)

1

This invention relates to a novel method of making stretchable yarn of the general type of yarn described and claimed in the Foster Patent 2,387,320.

The Foster patent teaches how to make an all-textile yarn having high stretch characteristics, and by following the teachings of such patent the range of stretch and contractive action of the yarn can be controlled throughout a wide range. The yarn of such patent is well adapted for use in the manufacture of stretchable surgical bandages, slip covers for upholstered furniture and for other purposes, and as a result there is a growing demand for this type of yarn.

The primary purpose of the present invention is to provide an inexpensive method of producing stretchable yarn of the general type contemplated by said Foster patent, and to provide a method whereby such yarn can be produced on well known textile machinery such as is commonly found in textile mills.

I have found that in order to produce a stretchable yarn of the general type contemplated by the Foster patent it is not necessary to wind the yarn around a central core or central supporting spindle as described in said patent, but that a highly twisted and coiled yarn can be produced at a lower cost on the ordinary ring and traveller type of spinning machine with some changes in its operation.

The spinning machine is employed to overtwist a highly twisted yarn so that the added twist imparted to the yarn will cause it to form helical coils, but in order to control the formation of these coils it is important to draw the yarn about a fixed support, as it approaches the spinning spindle, to cause the yarn to bend sharply at the support and thereby prevent the coils being formed from travelling away from the spinning spindle past this support.

The spinning apparatus used will serve to provide the highly twisted yarn with a series of helical coils, but these coils will be closed or substantially closed, in that the central opening of each coil will be extremely small. A yarn that is highly twisted and is also provided with these closed helical coils will have high stretch characteristics and is well adapted for use as warp in a woven stretchable fabric, but it is found difficult to weave this yarn in a fabric as weft or filling because of its tendency to kink and snarl as it leaves the package in the shuttle.

Having in mind the foregoing the present invention contemplates a simple, practical and inexpensive method for producing a highly twisted

2

yarn formed with closed helical coils and having high stretch characteristics so that it is well adapted for use as warp in a stretchable fabric; and the present invention also contemplates a novel method whereby such yarn may be relaxed to increase the diameter of the helical coils and reduce the number of coils per inch, to thereby produce a yarn which is less likely to kink and snarl and will operate satisfactorily in a loom shuttle.

The above and other features of the present invention will be further understood from the following description when read in connection with accompanying drawing showing one good practical form of apparatus for carrying out the present method.

In the drawing:

Fig. 1 is a vertical sectional view of ring spinning mechanism employed to impart tight helical coils to a high twist yarn.

Fig. 2 is a vertical sectional view of somewhat similar equipment employed to open up and reduce the number of helical coils imparted to the yarn by the apparatus of Fig. 1.

Fig. 3 is an enlarged transverse sectional view, and Fig. 4 is an enlarged side elevation of the helically coiled yarn produced by the apparatus of Fig. 1; and

Fig. 5 is a transverse sectional view, and Fig. 6 is a side elevation of the relaxed helically coiled yarn produced by the apparatus of Fig. 2.

The method of the present invention may be employed to treat various types of yarn such as cotton, wool, rayon, silk, nylon and the like, but the yarn employed should have a relatively high twist such as is frequently referred to as a crepe twist. The highly twisted or crepe twisted yarn which is designated upon the drawing by 10 may be a single or ply yarn as desired, and is shown in the drawing as a single yarn. The yarn 10 may be supplied to the spinning equipment shown in Fig. 1 from any suitable source of supply, such as a spool or package 11 which is supported in fixed bearings so that the package may rotate as the yarn 10 is unwound therefrom. During the spinning operation the yarn 10 is drawn forward from the package 11 at a controlled speed by the cooperating rolls 12 and 13. The lower roll 12 should be driven at a speed which bears a definite relation to the speed of the spinning spindle 14. The roll 13 may be free running and positioned to rest by gravity upon the yarn 10 to prevent slippage between this yarn and the power driven roll 12.

The spinning spindle 14 may be of usual or pre-

ferred construction and is rotated by the whirl 15 having the driving belt 16. This spindle is rotatably supported by the rail 17. The spindle may have mounted thereupon any desired type of bobbin 18 upon which is wound the yarn package 19. The usual traversing rail designated by 20 has an opening to receive the package 19, and upon the upper face of this rail is mounted the usual spinning ring 21 upon which slides the traveler 22. Some distance above the upper end of the spindle 14 is provided the usual pigtail guide 23 secured to the supporting block 24 which is connected by a hinge 25 to a support 26, the arrangement being such that the block 24 may be swung upwardly out of the way when a bobbin is to be removed from the spindle.

All of the apparatus described so far by reference numerals is or may be of well known construction and constitutes one of a number of spinning units with which the spinning frame is provided. In order to impart the desired helical coils to the yarn 10 it is important to provide some form of support between the feed rolls and spindle about which the yarn 10 will bend sharply as it advances towards the spinning spindle. It is desirable to position this support some distance above and in line with the axis of the rotating spindle 14, so that as the spindle rotates the twists it imparts to the yarn 10 will cause the yarn to coil as shown in Fig. 1, and these coils will travel upwardly through the pigtail 23 but not beyond a point defined by the position of the support just mentioned.

In practice it is found that a small tightly stretched wire 27 about which the advancing yarn 10 is bent forms a simple but practical means for arresting the travel of these coils away from the spinning spindle. Such a wire may be stretched lengthwise of the spinning machine frame parallel to the ring rail 20 so that it lies directly above the spinning spindle 14 and some distance from the feed rolls 12 and 13. It is found desirable to make this wire 27 as small as can be used without cutting or unduly chafing the running yarn 10. It is also found desirable to so position this wire that the yarn 10 will be bent sharply about the same at an acute angle, so that the angle formed between the vertical portion of the yarn having the coil C and the uncoiled portion of this yarn advancing to the wire from the feed rolls will be slightly less than 90°. Under these conditions very few coils will travel past the wire 27 towards the feed rolls 12 and 13, and by controlling the speed of the rolls 12 and 13 relative to the spindle speed the number of helical coils formed per inch of yarn 10 can be controlled fairly accurately.

In carrying out the present invention it is important, as above stated, that the yarn 10 have a relatively high twist, and it is also important that the spindle 14 be rotated in a direction to increase the twist of the yarn to thereby cause the yarn to coil rather than twist still further. If the yarn 10 has what is known as a Z twist, then the package 19 should be rotated in the direction indicated by the arrow in Fig. 1 to further twist this yarn and produce the helical coils C shown in Fig. 1, and then wind this twisted and coiled yarn upon the package 19, as is usual with the ring and traveler type of spinning machine.

The operation of the apparatus shown in Fig. 1 in the manner just described will produce the helically coiled yarn that is shown much enlarged in Figs. 3 and 4, and it will be noted in Fig. 3

that the coil C has no central opening or practically no central opening. This is due to the fact that the method of forming the helical coils herein described tends to form the closed coil C shown in Fig. 3 rather than the open coil C' shown in Fig. 5. When it is desired to form the open coil C' of Fig. 5 the apparatus shown in Fig. 2 may be employed and operated in the manner which will now be described. This apparatus of Fig. 2 may for the most part be similar to that shown and described in Fig. 1.

After the package 19 of Fig. 1 has been wound to the desired size it is removed from the spindle 14 and transferred to Fig. 2 where it is designated as 19' and supported on a non-rotating pin or spindle 28 projecting upwardly from a rail 29.

The yarn supplied by the package 19' of Fig. 2 and having the coils C is drawn forward from this package by the feed rolls 12' and 13' of Fig. 2, and then passes from these feed rolls in an inclined direction to the pigtail 23' and then downwardly to a traveler upon the ring 21', and is wound in a package 30 upon a cop 31 carried by the spindle 32 which is rotated by the whirl 33.

Since the purpose of the apparatus shown in Fig. 2 is to relax the coiled yarn produced by the apparatus of Fig. 1, by reducing the number and increasing the size of the individual coils as indicated by C', it is important that the package 30 be rotated in the opposite direction from that of the package 19, as illustrated by the arrows shown in Fig. 1 and Fig. 2.

The operation of the apparatus of Fig. 2 is such that the yarn having the tight coils C is drawn forward by the feed rolls 12' and 13' which are driven at a definite speed with respect to that of the spindle 32, so that this coiled yarn is not relaxed until it passes the nip of the feed rolls 12' and 13', but as this yarn passes from the feed rolls to the bobbin 30 the coils become larger in size and fewer in number, due to the rotation of the spindle 32 in the direction to remove a substantial percentage of such coils. This direction of rotation serves also to open up the coils to increase their outside diameter and the size of the central opening as shown in Fig. 5.

It is desired to point out that the present method which utilizes an over twisting of the yarn 10 to impart thereto the helical coils C will not form helical coils that are highly uniform, and that usually the stretchable yarn produced in accordance with the present method will be less uniform in appearance than that shown in Figs. 4 and 6 of the drawing which show a better than average run. It is found in practice that the relaxed yarn of Figs. 5 and 6 is much easier to handle without kinking and snarling than is the tightly coiled yarn of Figs. 3 and 4.

The tightly coiled yarn of Figs. 3 and 4 can be used as warp yarn in a fabric without serious difficulties due to snarling, since warp yarns can be maintained under sufficient tension during the weaving operation to hold them straight. This however is not the case with weft or filling, as it is practically impossible to maintain uniform tension upon a weft yarn as it is carried back and forth across the looms in a shuttle. It is found that the relaxed yarn of Figs. 5 and 6 works well in a shuttle without kinking or snarling unduly. In view of what has just been said the highly coiled yarn of Fig. 4 may be regarded as an elastic warp yarn and the less highly coiled yarn of Fig. 6 may be regarded as an elastic weft

yarn. The relaxed yarn of Fig. 6 will have a softer feel than that of Fig. 4.

The ability of the yarn of Fig. 6 to contract in a fabric to impart elastic properties to the same will be considerably less than that of the yarn of Fig. 4, but this difference in contractive force can be taken care of by using a higher number of the yarns of Fig. 6 than of the yarns of Fig. 4. For example in weaving a two-way stretch fabric in which elastic properties are imparted to the fabric by the yarn herein disclosed, it may be desirable to use one elastic yarn such as shown in Fig. 4 for each two ordinary yarns in the warp of the fabric, whereas the weft of the fabric may be formed entirely of the yarn shown in Fig. 6.

In order that a further understanding of the yarn herein shown and described may be had the following table is given of a single cotton yarn, the readings shown being the averages of a number of readings:

Properties of yarn before coiling: Count, 9.2's-Z; T. P. I., 20.6; diameter, .0099".

After coiling

Manufacturing turns per inch, 18.56-Z.
Coils per inch after shrinking (12 gram contact load), 40[1].
Outside diameter of coils, .0188".
Percentage elongation at break, 86.9%.
Stress to break yarn, between 300–400 grams.

(Yarn did not straighten out completely before breaking).

After relaxing

Manufacturing turns per inch, 10.21-S.
Coils per inch after shrinking (12 gram contact load), 17.2[1].
Outside diameter of coils, .0271".
Percentage elongation when straightened, 35.4%.
Stress to straighten out yarn, 300 grams.
Percentage elongation at break, 42%.
Stress to break yarn, between 400–600 grams.

If a fabric embodying the elastic yarn herein described is woven with these yarns under considerable tension the fabric will have very little elasticity as it comes off the looms, but the desired elastic properties can be imparted to the fabric by wetting the fabric and then drying it free of tension.

[1] The inclined front bar of the helical coils has a Z slope.

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

1. The method of producing an all textile stretchable yarn having controlled stretch properties, which includes the steps of drawing a crepe twist yarn about a support so that it bends sharply about the support and then advancing it to a revolving spindle that further twists the yarn and forms successive coils between this spindle and support, then advancing this twisted and coiled yarn a second time and twisting it in the opposite direction to increase the diameter and decrease the number of the coils to make the yarn easier to stretch.

2. The method of producing an all textile stretchable yarn having controlled stretch properties, which includes the steps of drawing a crepe twist yarn about a support so that it bends sharply at an acute angle about the support and then advancing it to a revolving spindle that further twists the yarn and forms numerous coils between the support and spindle, then advancing this twisted and coiled yarn a second time and twisting it in the opposite direction to thereby increase the diameter of the coils and decrease their number.

3. The method of producing an all textile stretchable yarn having controlled stretch properties, which includes the steps of drawing a crepe twist yarn about a stretched wire so that it bends sharply around such wire and then advances to a revolving spindle that further twists the yarn and forms successive coils extending from the spindle to the wire, then advancing this twisted and coiled yarn a second time and twisting it in the opposite direction to decrease the number of coils and increase their diameter to make the yarn less likely to kink.

ROBERT J. CLARKSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,888,554	Holt	Nov. 22, 1932