July 4, 1961 C. B. KINGSBURY 2,990,670

YARN CRIMPING AND TEXTURING APPARATUS

Filed March 7, 1957 2 Sheets-Sheet 1

Fig. 4.

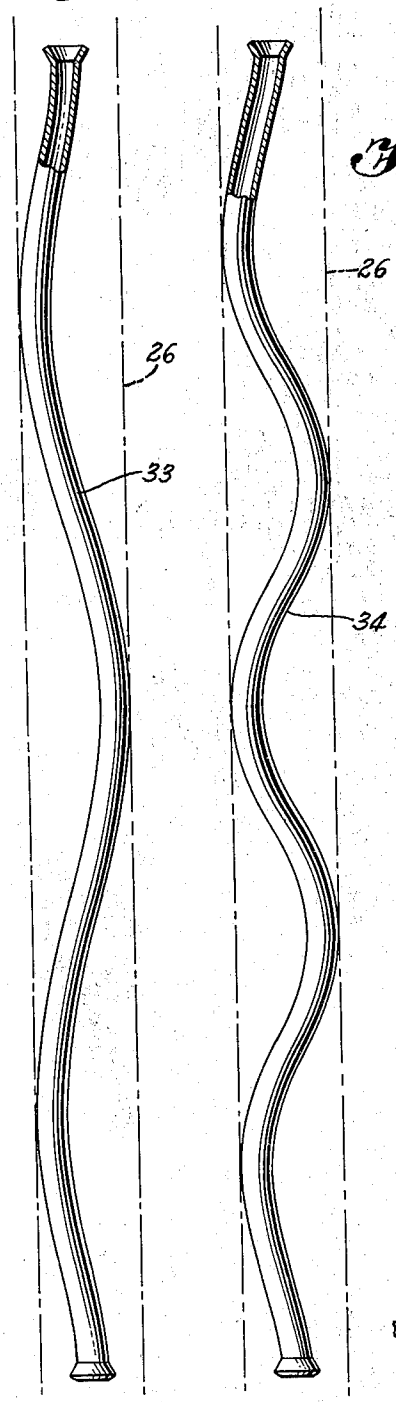


Fig. 5.

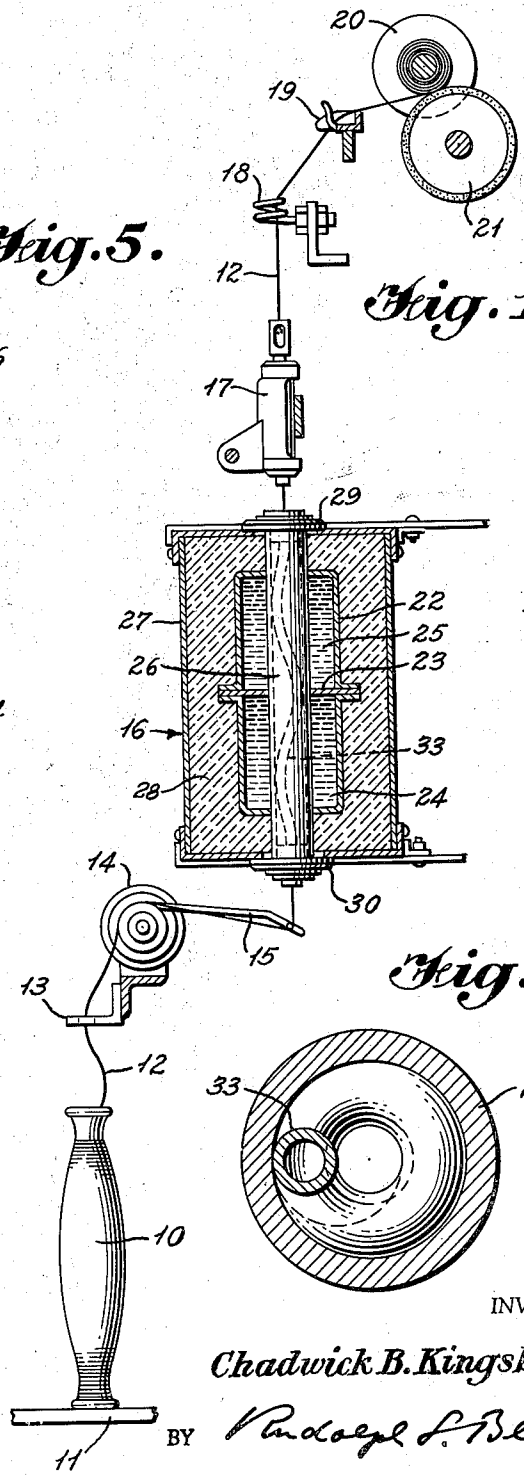


Fig. 1.

Fig. 3.

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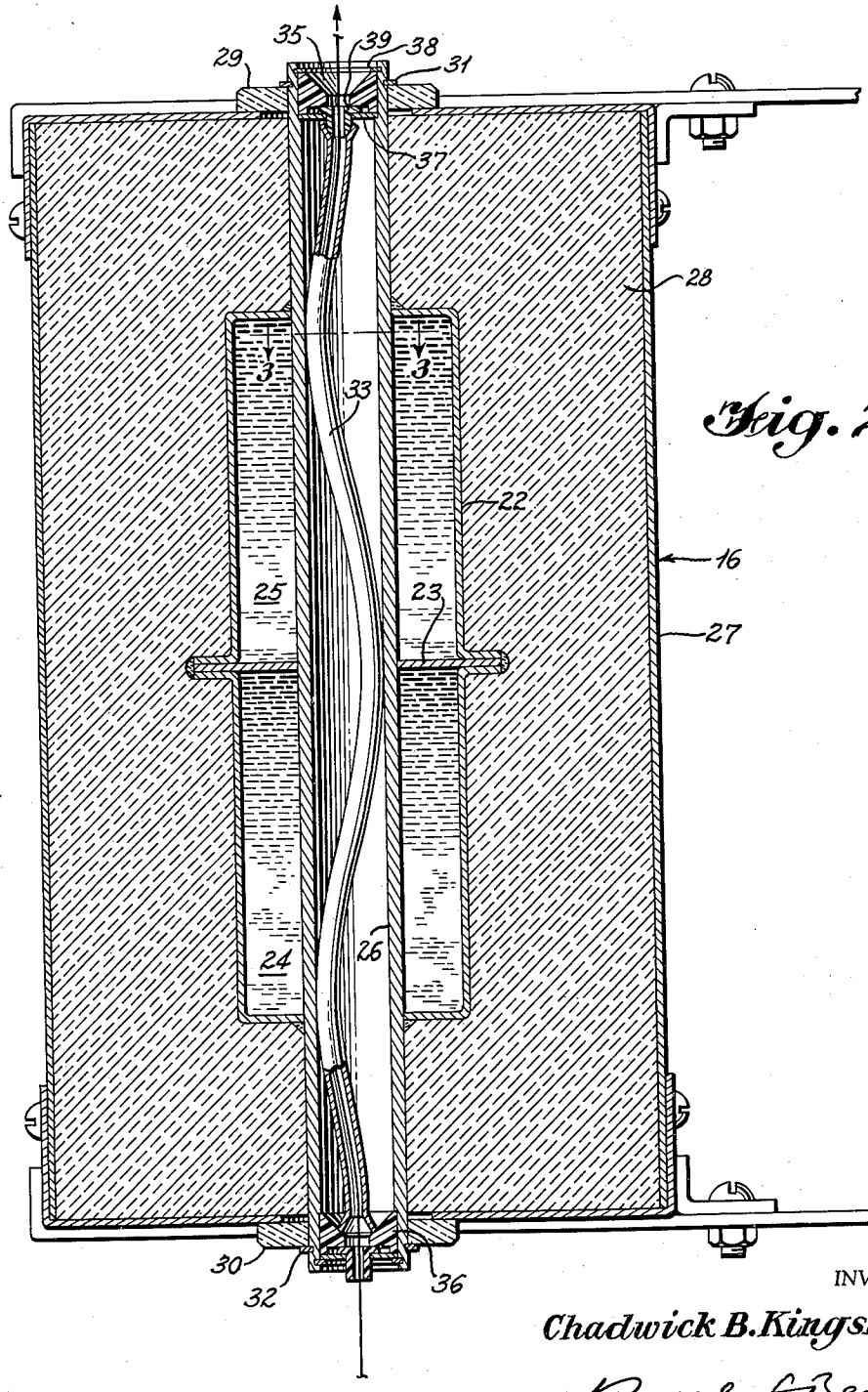


Fig. 2.

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YARN CRIMPING AND TEXTURING APPARATUS

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4 Claims. (Cl. 57—34)

This invention relates to the production of crimped thermoplastic yarn or as it is better known, stretch-yarn or stretch-nylon. More particularly, the invention relates to a heating device for setting a crimp in thermoplastic yarn which is inserted by twisting the yarn by the false twist method.

It is now well-known in the art that garments, for example sox and underclothing, having a great ability for being stretched and yet which, when relaxed, will return to substantially their original dimensions, can be produced from a synthetic thermoplastic yarn in which a crimp has been set by the false twist method. It is also known that the amount of stretch of the yarn and consequently of garments made of the yarn is determined primarily by the amount of crimp or degree of false twist which is "set" in the yarn; it being generally true that the greater the amount of crimp, the greater the stretch.

In general, the false twist method of crimping yarn comprises drawing the thermoplastic yarn through a rotating false twist spindle which inserts a twist in the yarn behind the spindle and heating the yarn in the zone in which it is twisted so that after the yarn passes beyond the spindle the twist remains "set" in the yarn because of the fact that the yarn had been in a somewhat softened or plastic state at the time it was subjected to the twist. While it is required for the yarn to have a high degree of stretch (approximately one hundred percent being commercially acceptable), for certain purposes it is desirable for the garment to have a mossy or pebbly texture and for other purposes a silky texture is desired, or it may be desired to have a texture anywhere in between mossy and silky. Heretofore it has been possible to vary the texture of the yarn and the garments made of the yarn by varying the amount of permanent crimp but this has resulted in changing the degree of stretch. It has also been possible to vary the texture of the yarns without varying the degree of stretch but so far as is known prior methods have involved costly after-treatments. The present invention provides a simple and inexpensive means of varying the texture of the yarns without varying the degree of stretch and without costly after-treatments.

It is the primary object of the present invention to provide a heating device for use in the false twist process which may be so arranged as to control the texture of the yarn without altering the actual amount of crimp and consequently without affecting the degree of stretch of the yarn.

It is the further object of the invention to provide a heating device for use in the false twist method which may be so arranged as to produce a yarn having a texture anywhere in between mossy and silky.

It is another object of the invention to control the texture of the yarn without any sacrifice in the degree of stretch and without introducing after-treatments.

Other and further objects, features and advantages of the invention will become apparent as the description of a preferred embodiment thereof proceeds.

Referring now to the drawings:

FIG. 1 is a diagrammatic view of a false twist apparatus showing the manner of use of the improved heating device of this invention,

FIG. 2 is a view partially in section and partially in elevation of the improved heating device,

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2,

FIG. 4 is a side elevational view, partially in section, showing one embodiment of one of the elements of the heating device and

FIG. 5 is a view similar to FIG. 4 but showing a variation.

The yarn crimping apparatus of which the present invention constitutes a variation is fully described in the pending application of R. H. Carter, C. B. Kingsbury and D. J. Lamb, Serial No. 543,361, filed October 28, 1955, now U.S. Patent No. 2,900,783, and therefore will not be described in detail in this specification. However, the arrangement is shown diagrammatically in FIG. 1 and in general comprises a pirn or other supply package **10** mounted upon a rail **11**. The yarn or strand **12** is drawn from the pirn through a guide **13** and thence through a compensating tension device **14** and through an eye in the end of a tension sensing and regulating arm **15** of the tension device. After leaving the eye in the arm **15**, the yarn passes upward through a heating chamber generally designated **16** and which will presently be described in detail. Located directly above the heating chamber **16** is a false twist spindle **17** which may be of any suitable construction, for example, as shown in the above mentioned application but the present invention is not concerned with the details of construction of the false twist spindle. It will be understood that each rotation of the false twist spindle inserts one turn of twist into the yarn and that the twist runs back along the strand through the heating chamber wherein the twist or crimp is "set." After leaving the spindle **17**, the yarn passes through a pigtail guide **18** and a traversing guide **19** and onto a spool **20**, said spool being driven to take up the yarn by a cork covered roller **21** which bears against the yarn in order to pull the yarn at a constant speed.

As described in the above mentioned application, the heating chamber **16** comprises an inner casing **22** divided by a horizontal partition **23** into a lower section or chamber **24** and an upper section or chambers **25**. Extending vertically through the chambers **24** and **25** is a hollow cylindrical member **26** which as shown in FIG. 2 is welded to the casing **22**.

An outer casing **27** surrounds the inner casing **22** and suitable insulating material **28** is provided between the two casings. As described in the above mentioned application, in practice there are a plurality of cylindrical members **26** extending through the casing **22** and there are also a plurality of casings **22** mounted in series. In order to uniformly heat the various cylinders **26** and the yarn passing therethrough, hot oil is circulated through the bottom chambers **24** of the various casings **22** and returned to its starting point through the series of upper chambers **25**, such circulation of oil assuring that each tube **26** will be at the same temperature, as is described in said above mentioned application.

Referring particularly to FIG. 2; for purposes of locating the casing **22** within the casing **27**, collars **29** and **30** of porcelain or other relatively low heat conducting material are provided around the ends of cylindrical member **26** and are held tightly against the casing **27** by means of snap rings **31** and **32** which snap into grooves provided therefor in the cylindrical member.

It is pointed out in the above referred to application Serial No. 543,361 that a very satisfactory crimped yarn can be produced by running the yarn in an unconfined manner through the cylindrical member **26** and by allowing the twist inserted by the false twist spindle to run

back through the cylinder **26** where the crimp is set due to the heat within the cylinder. It has now been found however that while such an arrangement produces a yarn that is highly satisfactory for many purposes, such yarn produces a fabric which is known in the trade as "mossy" or pebbly. For many purposes it is desirable to be able to produce a stretch yarn fabric which has a silky texture or some texture other than mossy and the present invention provides a means for controlling the texture of the yarn and consequently the texture of the fabric.

It has been found that the texture of the yarn can be controlled by causing the yarn to contact to a greater or lesser degree a non-yielding hot surface in the heating zone. In order to accomplish this, the present invention contemplates requiring the yarn to follow a circuitous path through the heating zone and to contact a non-yielding hot surface either continuously while the twist is being inserted or intermittently, depending upon the texture desired.

Thus, mounted with a friction fit within the cylindrical member **26** is a closed conduit or tube **33** having a serpentine configuration such that the yarn cannot pass therethrough without contacting at least at spaced intervals the inner surface thereof. The tube **33** is of considerably smaller diameter than the cylindrical member **22** and may be in the form of a helix as indicated in FIG. 3 so that said tube winds around the inner surface of the cylindrical member and is in continuous contact therewith, or said tube may take a zigzag path which only contacts the cylindrical member at intervals or again the tube **33** may have an irregular shape. Instead of the relatively large pitch shown for the tube **33** in FIG. 4 a tube having a smaller pitch, such as the tube **34** shown in FIG. 5 may be provided.

The tube **33** and likewise the tube **34**, if extending in the form of a helix around the inside of the cylindrical member **26**, has its ends bent away from the inner surface of the cylinder and said ends, which may be flared as shown in the drawings, are located on the longitudinal axis of said cylindrical member.

In order to confine the heat within the cylindrical member the ends of said member are closed by means of caps **35** and **36**. The lower end of the upper cap **35** rests upon a washer **37** which is seated against a shoulder provided within the cylindrical member and a snap ring **38** holds said cap in place. The cap **35** is funnel shaped and has a centrally located opening communicating with the upper end of tube **33**, eyelet **39** being provided between the cap and the tube if desired. The funnel shape of the cap **35** facilitates the introduction of a thread-up wire into the tube **33**. As will readily be understood, in order to thread-up or get the operation started a wire is inserted into the tube **33** from the top and pushed through said tube so that the yarn may be attached to the wire and pulled through said tube. The cap **36** is mounted similarly to the cap **35** but, since the thread-up wire is not inserted from the bottom, the funnel shaped portion of said cap may be faced toward the inside of the tube. The

greater the frictional contact of the yarn with the heated tube the more silky will be texture of the yarn. Of course there is a limit to the amount of frictional contact which can be tolerated without damaging the yarn but it is believed that by having the yarn in contact with the tube while it is being heated and twisted the convolutions of the twist are confined to an even, smooth pattern which produces the silky texture.

Having thus described a prepared embodiment of the invention, what is claimed is:

1. Apparatus for crimping thermoplastic yarn comprising a heating chamber having a casing divided into a lower section and an upper section, a plurality of first tubular members extending through the lower and the upper sections of said chamber, means for feeding heating fluid through one of said sections, means for returning the heating fluid to said feeding means through the other of said sections, a second tubular member of serpentine configuration extending through each of said first tubular members, and means for inserting false twist in thermoplastic yarn passing through said second members.

2. Apparatus for crimping thermoplastic yarn comprising a heating chamber having a casing divided into a lower and an upper section, a plurality of first tubular members extending through the lower and the upper sections of said chamber, means for feeding heating fluid through one of said sections, means for returning the heating fluid to said feeding means through the other of said sections, a second tubular member of helical configuration extending through each of said first tubular members, and means for inserting false twist in thermoplastic yarn passing through said second members.

3. Apparatus for crimping thermoplastic yarn according to claim 1 wherein the ends of said second members are located substantially on the longitudinal axes of said first tubular members out of contact with the inner surfaces thereof, and caps closing the ends of said first tubular members, said caps having funnel-shaped openings communicating with said second members.

4. Apparatus for crimping thermoplastic yarn according to claim 2 wherein the ends of said second members are located substantially on the longitudinal axes of said first tubular members out of contact with the inner surfaces thereof, and caps closing the ends of said first tubular members, said caps having funnel-shaped openings communicating with said second members.

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