

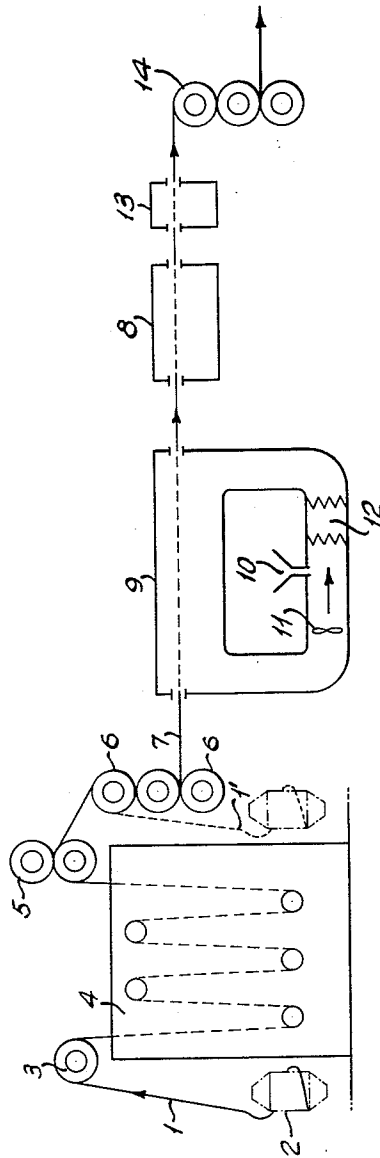
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METHOD FOR CRIMPING SWELLABLE FILAMENTARY MATERIALS

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1

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METHOD FOR CRIMPING SWELLABLE FILAMENTARY MATERIALS

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The invention relates to a novel method for crimping swellable filamentary materials and is a continuation-in-part of my copending applications, Serial No. 349,285, filed April 16, 1953, now Patent No. 2,863,280 and Serial No. 418,443, filed March 24, 1954.

The method disclosed and claimed in said applications comprises the steps of first passing the filamentary material in the form of a continuous bundle into a softening zone where said material is softened, then passing said softened material into a setting zone wherein twist subsequently imparted to said material is set, thereafter imparting false twist to the material so that the false twist runs back along said material through the setting zone and is received by the material in the softening zone, removing the false twist from the bundle and collecting the latter, preferably under tension.

If said method is applied to swellable filamentary material, for instance to continuous bundles of viscose, cuprammonium, or cellulose ester filaments, fibers and yarns, the material is softened in the softening zone by any of the well-known swelling agents, which agent is removed or neutralized in the solidifying zone.

The success of said method is believed to be due essentially to the characteristic sequence of operations, i.e. softening, setting, and false twisting with the twist going back through a considerable length of solidified material into the softening zone. In this way, a crimped product is obtained which is substantially different from that previously obtained with other procedures involving softening, twisting, and setting steps.

In order to obtain the desired high degree of false twist in a very short period of time, the apparatus described in my recited copending applications for carrying out the twisting method comprises a pair of spaced belt runs or the like, which are moved at equal speeds in opposite directions and between which the filamentary bundles are drawn in a direction normal to the movement of the belts. The latter are so spaced that when they are in motion they effect a rolling or twisting action on the bundle by frictional contact therewith or with a twist tube of minimum diameter, through which the bundle is drawn. In this way, the distance between the belt surfaces and the axis of the bundle is kept to a minimum with the result that a maximum amount of twist is obtained in as short a time as possible.

Said twisting tubes need not be supported and can be extremely thin-walled and of very small diameter, i.e., of the order of 2 to 3 mms. Hence, even relatively slow belt speeds give a very high number of tube revolutions, e.g. 140,000 to 200,000 r.p.m. and higher, thus insuring rapid and otherwise satisfactory twisting of the bundle.

It is a principal object of the present invention to provide novel improvements which eliminate certain difficulties encountered in crimping swellable yarns and other filamentary materials according to the method generally described in my said copending applications, Ser. Nos. 349,285 and 418,443.

2

Other objects and advantages will be apparent from a consideration of the specification and claims.

My continuous crimping method, when applied to fibers swellable in water, requires the following sequential steps:

- 5 (a) Softening the fibers by swelling;
- (b) Removal of excess swelling agent;
- (c) Passing the still soft bundle through a zone where it receives the false twist;
- (d) Setting the twist by complete removal of the swelling agent;
- 10 (e) Imparting the twist after the fibers have been completely solidified;
- (f) Removal of the false twist.

I have found that the crimp of such swellable filamentary material can be considerably improved by passing the bundle through the twist-receiving zone (c) under high tension and by combining the twisting and tensioning effects in said zone so as to expel mechanically a major part of the swelling agent adhered to the swollen filamentary material before it enters the setting zone (d).

The invention will be more fully understood by reference to the accompanying drawing showing a diagrammatic view for carrying out the method of the invention.

Referring now to the drawing, a rayon filament bundle 1 is passed from spindle 2 over a guide roll 3 first through a swelling bath 4, which preferably consists of mere water but may contain any of the well known swelling agents. The swelling bath solutions may be cold or warm, dependent on the filaments and swelling agents used, and may contain, in addition, wrinkle proofing agents.

The bundles of swollen filaments pass then over the rollers 5 and 6 and receive immediately afterwards along the stretch 7 the twist imparted to the bundle in the twisting device 13. As pointed out hereinabove, said twist runs backwarily against the direction of travel from the twisting device 13 through the zones 8 and 9 to the rollers 6.

Instead of the bundles 1, bundles may be employed, the filaments of which have been swollen in any other manner, for instance bundles of rayon filaments which have been completely processed but not yet dried and which are introduced directly in the apparatus through the rollers 6, as indicated by the broken line 1'.

During the twisting operation, not only the water adhered to the filaments but also the water diffused into the filaments have to be removed. This might be accomplished by mere heating; such procedure, however, would be too expensive and time-consuming and would reduce the output to an objectionable extent.

According to the invention, the traveling filamentary bundle 1 is placed under tension, for instance by rotating the rollers 14 at a higher speed than rollers 6, whereby the simultaneously imparted stretch and twist press the turns of the swollen filaments strongly against each other. In addition, strong centrifugal effects are generated by the very high number of tube revolutions referred to hereinabove. The combined action of compression and centrifugal force expels the major part of the liquid still adhered to the filamentary bundle already within the length of travel 7; the removal of the liquid may be assisted by a current of air.

The filamentary bundles are then passed through a duct or channel 9 (corresponding to the softening or plasticizing zone 8 of the application Serial No. 418,443), wherein they are dried by means of hot air or superheated steam. The steam is preferably recycled whereby water is dropped in at 10 and the steam is heated by electrically heated wires 12 and circulated through the duct 9 by means of a fan 11.

The dried heated filamentary bundle passes then through the cooling or solidification zone 8, the twist imparting zone 13 and the rollers 14, whereby the false twist of the bundle is removed on its travel from 13 to 14. The

solidified individual filaments retain a corkscrew structure and are collected after leaving the rollers 14 in form of a highly elastic voluminous yarn.

Rayon and other water sensitive or swellable filaments are characterized by the property of retaining satisfactory crimp only as long as they remain dry; they lose the crimp completely or in part when they are placed under tension and stretched in the wet state, which is unavoidable for instance on washing. According to the invention, the loss of crimp is avoided by imparting the false twist to bundles which contain in addition to the water sensitive filaments water resistant thermoplastic filaments, for instance nylon and the like filaments, and by joining the two types of filaments so thoroughly that the thermoplastic filaments maintain the crimp and take up the stretch when the bundle is stretched in the wet state. A suitable method to accomplish this result will now be described.

A thermoplastic filament which is insensitive to water, or preferably a bundle of such filaments, for instance nylon, is passed through the whole apparatus shown in the drawing in closest relationship to the bundle of rayon filaments; it is also possible to introduce the nylon bundle close to the rayon bundle only from the rollers 6, as indicated by the dotted line 1'. In either case, immediately after the rollers 6, the swollen rayon bundle and the not swollen nylon bundle are twisted together to a single bundle. If the twisting device 13 is arranged to impart to the bundle a right-hand twist, it is preferred to introduce untwisted bundles or bundles having a slight left-hand twist; conversely, bundles with a light right-hand twist may be introduced when a left-hand twist is applied. In this way, the two bundles enter into particularly close engagement at the moment where they become temporarily untwisted due to the opposite twist originating from the twisting device 13.

Subsequently, the water insensitive component of the filamentary bundle, for instance nylon, is softened and plasticized in the heating zone 9 by the steam which is super-heated to a temperature of 180 to 220° C., preferably 200–210° C., or more. In this plasticized state, it combines intimately with the drying rayon during completion of the twisting operation. Said water insensitive filaments are then solidified in the following cooling or solidifying zone 8. Both components, rayon and nylon, enter then cooled and intimately twisted into the twisting device proper 13.

As twisting device 13, I preferably use a device of the type described in my copending applications, Serial Nos. 349,285, now Patent No. 2,863,280, and 418,443. Particularly suitable is the device shown in Fig. 6a of said

patent, where a large number of twisting tubes is placed between the two runs of an endless belt, the inner run of which is driven over a roll.

Though, in the foregoing, reference has been had to rayon and nylon only, it will be understood that other combinations of swellable and non-swellable filaments may be used in the same manner, for instance alginate, casein, Orlon filaments and the like.

I claim:

1. A method of producing a crimped blended filamentary material which comprises passing a bundle of continuous swellable cellulosic filaments in the water-containing swollen state in closely spaced relationship with at least one water-resistant thermoplastic filament through a heating zone to dry said swollen filament and to render said thermoplastic filament plastic, cooling said filaments so as to remove the plasticity imparted to said thermoplastic filament in the preceding step and to solidify said filament, applying a false twist to said filaments in a twist inserting zone, which false twist twists said swollen cellulosic and unswollen thermoplastic filaments to a single bundle and runs backwardly along said filaments against the direction of their travel from said twist inserting zone into said heating zone, where it is received by said thermoplastic filaments while they are in the plastic state, and continuing the travel of the filaments after said twist-inserting zone for a length sufficient to allow untwisting of said inserted false twist, said thermoplastic filament maintaining the crimp of the swellable filament intertwined therewith when the filaments thus treated are subjected to stretch in the wet state.

2. The method claimed in claim 1 where a bundle of continuous swellable filaments and a bundle of thermoplastic filaments is used.

3. The method as defined in claim 1, wherein the bundles enter said heating zone with a slight twist of opposite direction to the twist to be imparted in said twist-inserting zone.

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