APPARATUS AND PROCESS FOR THE MANUFACTURE
OF HIGHLY CRIMPED YARNS BY FALSE TWIST
Filed July 22, 1963

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This invention relates to a process for the manufacture of highly cramped yarns, particularly by application of a false twist.  

In the manufacture of highly cramped yarns, particularly in textured thermoplastic textiles, by the application of a false twist wherein twist is set in the yarn prior to untwisting, it is necessary to reconcile different factors.  

In order to obtain a highest possible degree of crimping, it is desirable to apply the strongest possible tension. However, upon application of high tension the resistance of the yarn is weakened, and increasingly more so, with the increase in the torsion for a predetermined count. For this reason it is not possible to exceed a certain torsion limit. In addition to the count, this limit is a function of the number of filaments forming the yarn, the chemical nature of the yarn and the treatment temperature.  

The greater or the lesser the degree of crimping of the yarn the higher or lower the elastic elongation of the yarn in the decrimping. Such property directly effects the "springiness" and "bulkiness" of the yarn.  

The more or less rapid the rate of return of the yarn decrimped by elongation to its untensioned cramped state the greater or the lesser the "springiness."  

This "springiness" and the permanence of the "high-bulk" effect increase with the temperature of the heat treatment, but the heat intensity applied must not, however, exceed the softening point of the textile material.  

If the temperature of the heat treatment is increased, a more "springy" yarn is obtained. Moreover, the crimping is more stable to repeated elongation but unfortunately it less resistant and withstands lower tension.  

A compromise between the temperature and the applied torsion is thus necessary.  

It is now been found that if the twist given by the false twist element is partially prevented from descending into the heat treatment element so that the temporary twist, at least at the outlet of the heat treatment element, does not exceed that which is compatible with the heat treatment temperature, it is possible to give an increased false twist and that the untwisting at the other end of the spindle, which is equal to the total twist, a part of which is checked before the heating arrangement, gives a more highly cramped yarn, which is springier and more stable.  

According to an apparatus feature of the invention, a member which may or may not be adjustable and which checks or impedes the twist is interposed between the false twist spindle and the heating element.  

In accordance with prior art method and apparatus, by way of example, for a 100-denier polyhexamethylene adipamide yarn, the maximum false twist is of the order of 2400 turns per meter for the temperature 225 ° C. It is however possible in accordance with the present invention to give a twist of approximately 3200 turns per meter of which 900 turns are checked by the twist-checking member, and 2400 turns are transmitted to the heating element. Increased bulkiness and springiness is present in the yarn produced in accordance with this invention a-a- viz. of that of the prior art.  

It is quite evident that these figures are given by way of example and do not limit the scope of the invention. The invention can be carried into effect in various ways. It is in particular possible to use an adjustable impeding means or partial obstruction, but this general term covers numerous variants. The invention will be more closely understood by reference to one specific embodiment relating to the above numerical example. The embodiment is illustrated in the accompanying diagrammatic drawing.  

In this drawing, a yarn 10 which is to be twisted is unwound endwise from a package 11 by means of a delivery device 12. The delivery device 12 consists of a belt 15. The yarn 10 is advanced by passage between the outer surface of the belt 15 and the surface of roller 16. An adjustable tensioning device 17 can be positioned between the delivery device 12 and supply package 11. The tensioning device 17 conveniently consists of a pair of loop members 18, 19 through which is passed yarn 10. The yarn 10 is tensioned in the desired degree between these members 18, 19 by passage between a base 20 and a plate 21. The yarn from delivery device 12 enters the heating element 22, which preferably acts by direct contact of the yarn 10 with a heated inner convex surface. The latter may have the form of a curved metal tube of small internal diameter and heated by direct resistance.  

The yarn 10 then travels to the false twist spindle 27 by way of an obstruction 26 comprising three parallel bars, 23, 24, 25 of which 23 and 24 are fixed, while the position of 25 is adjustable in the plane of symmetry of the assembly comprising 23 and 24 midway between their axes.  

Above the bar system 26, the yarn 10 is subjected to a false twist in an appropriate spindle 27 and is immediately untwisted. The yarn 10 is taken up by the second delivery device 32, which delivers the yarn to a spool 33. The second delivery device 32 is similar to delivery device 12, consisting of a pair of rollers 28, 29 over which is passed a continuous belt 30. The yarn 10 is passed between the outer surface of belt 30 and the outer surface of roll 31 to take-up roll 33. Roller 33 is rotated via means of the drive roll 34, the yarn 10 passing from delivery device 32, over a roller 35, thence to the take-up roll 33.  

Up to a certain limit, the further the bar 25 is spaced from the common plane of the axes of 23 and 24, the more efficient it will be in checking the propagation of the twist given by the false twist spindle, and vice versa. Thus movement of the bar 25 outwardly obviously produces greater impedance to the movement of the yarn 10 passing over the bars 23, 24, 25 due to increased friction. Conversely, movement of the bar 26 inwardly toward bars 23, 24 reduces friction and therefore reduces the impeding effect upon the yarn 10.  

The bars or one of said bars of obstruction 26 can be heated and cooled, and/or they can be wetted and/or a lubricant can be applied thereto. It is understood, of course, that the quantum of heat applied in the manner should not be such as to constitute a mere extension of the heat setting step. Instead, the bars would be relatively cool so that the post twisting step is conducted at a lower temperature than that of the heat setting step. Also, while the bars can be lubricated, or wetted, it is understood that friction will be reduced and therefore it will be necessary to compensate therefore by outward movement of bar 25.  

It is apparent that some variation can be made in the present invention without departing its spirit and scope. The novel feature of this invention contemplates a chain of concurrent steps comprising applying a measure of twist to a yarn, and then heat setting this twist into the yarn. This measure of twist is preferably the maximum twist compatible with the existing yarn temperature.
After this step an additional post twist or relatively "cold" twist of similar torque is superimposed thereupon. Following these hot and cold twist steps, a twist of opposite torque is applied which is equal to the sum total of the torque applied in the opposite direction by the aforesaid steps. In this manner a greater bulk and springiness is produced than in a process wherein all of the twist in one direction is heat set within the yarn and then removed by twisting in the opposite direction.

Having described the invention what is claimed is:

1. In a continuous false twist process for the manufacture of crimped yarn by applying a twist, heat setting the twist within said yarn, and then untwisting the twist to impart high elasticity and springiness to the yarn the improvement comprising applying twist to the yarn of amount compatible with the yarn temperature, heat setting the twist within the yarn, applying additional twist in the same direction in a post twisting step, and then removing all of the applied twist by applying an equal and opposite torque in the reverse direction whereby a higher than normal degree of elasticity and springiness is imparted to the yarn.

2. The process of claim 1 wherein maximum twist is imparted to the yarn as is compatible with yarn temperature, wherein this maximum twist is heat set within the yarn, and wherein additional twist in the same direction is applied at a lower temperature than in the heat setting operation.

3. In false twist apparatus for the crimping of a continuous textured thermoplastic textile yarn wherein is included delivery means for advancing the yarn from supply to take-up, and between which delivery means the yarn is tensioned, and also between which yarn delivery means is located twisting means and heat setting means for application of false twist and for heat setting the twist within the yarn, respectively, the improvement comprising yarn impeding means located between the twisting means and heat setting means whereby only a portion of the false twist applied by the twisting means is transmitted to the heat setting means.

4. The apparatus of claim 3 wherein the yarn impeding means comprises a triumvirate of parallel bars upon which the yarn moves from supply to take-up.

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