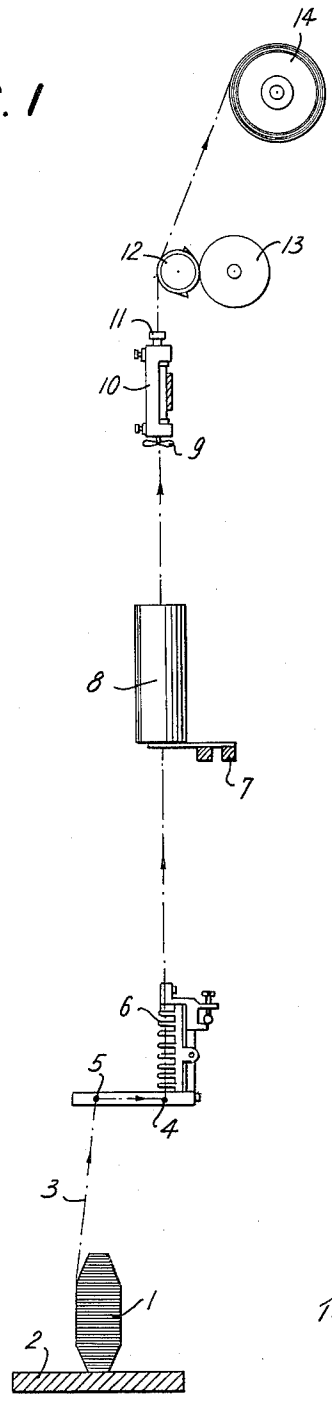
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TEXTILE PROCESSES

Filed June 10, 1959 2 Sheets-Sheet 1

FIG. 1



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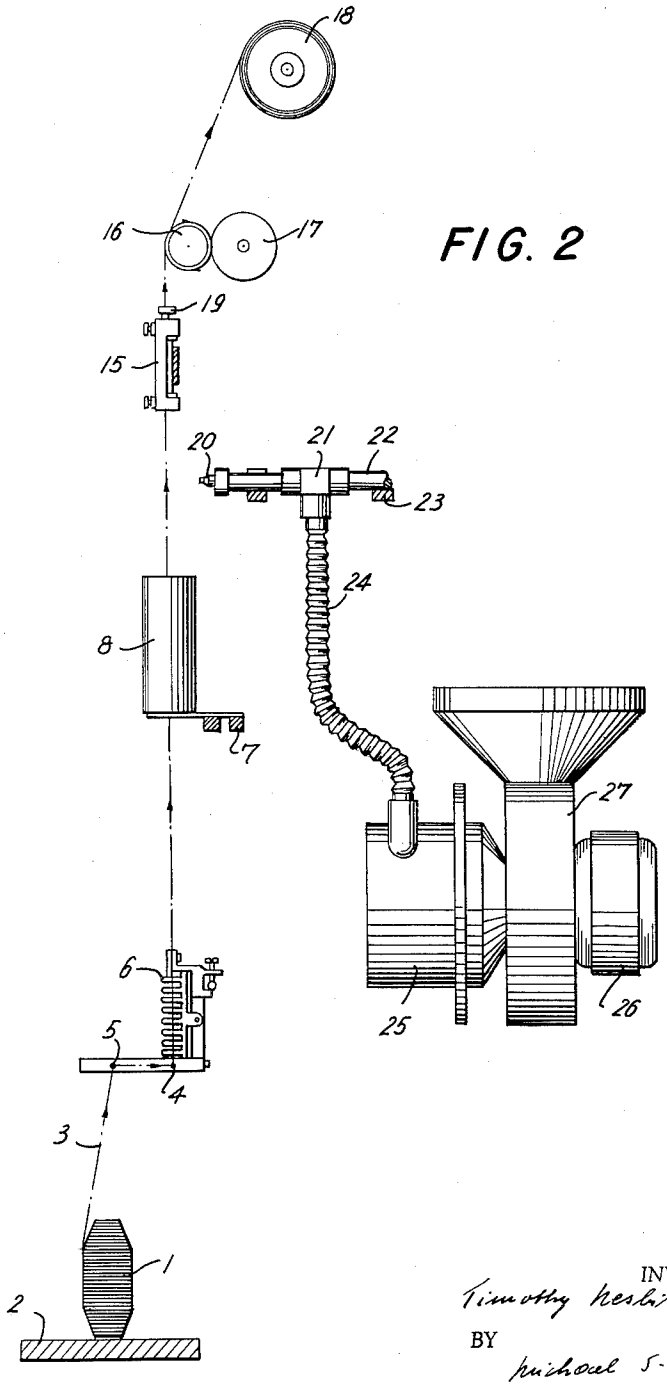


FIG. 2

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TEXTILE PROCESSES

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Our invention relates to a process and apparatus for the crimping of filaments or fibres of yarns. It is particularly concerned with the crimping of yarns made from artificial filaments.

Yarn, and particularly yarn containing continuous filaments, may have a high twist imparted to it, which twist is set in the yarn by a suitable setting medium after which the yarn is untwisted by a false twist device. The crimp imparted by the twisting operation is however retained in the yarn as a result of which it has a handle which is woolly and springly to an extent greater than that existing before the operation. Such crimping must of course be inserted by a medium which so acts on the material of which the yarn is made that subsequent processes such as dyeing do not remove it to any appreciable extent.

The apparatus used may comprise a container or bobbin for the yarn to be processed, means for setting a twist in the yarn, a false twist device, and a further bobbin onto which the crimped yarn is finally wound. Yarn tensioning or feeding devices may also be provided.

It is obvious that the setting process involves the possibility of re-arrangement of the molecular structure of the filaments of which the yarn is composed. Thus, where steam is employed as a setting medium, the combination of heat and moisture applied to the said filaments is such as to enable the long chain molecules of which the filaments are composed to orient themselves in such a manner as to provide a yarn in which each filament tends to take up a helical form. The twist is applied to the yarn by a false twist device which follows the application of the setting medium. If however the yarn remained in its settable condition the whole of the way through the false twist device up to and beyond the point of exit from the said device, it is again obvious that any molecular rearrangement which took place at the point of application of the steam would be wholly or mainly removed at the point of exit of the yarn from the false twisting device. Since in practice this is found not to be the case, and since most of the twist applied to the yarn by the false twist device appears as crimp in the finished yarn, it follows that the effect of molecular rearrangement produced by the setting device or medium must wholly or mainly disappear before the yarn reaches the point of the false twisting device at which the said twist is applied.

Assuming again that steam is applied, elimination of the steam can take place by evaporation, and the temperature of the yarn can be lowered by conduction and radiation, in the space between the steam-applying device and the false twister, since in practice this distance may be anything up to 12". Again, if thermoplastic yarns are being crimped and the setting medium is a hot dry gas or a hot plate over which the yarn passes, the temperature of the yarn falls rapidly in the space between the last point of application of the heat and the point of application of the twist. It therefore follows that the twist is fed backwards from the false twister through what is referred to hereafter as a fixing region, to a point coinciding with or slightly subsequent to the point of application of the setting medium.

This explanation we find to be borne out in practice.

Thus if the point of application of the setting medium is located close to the false twister the crimp finally fixed in the yarn may be of a lesser degree than if the said point of application is more remote from the twister. It follows that the rate at which the yarn can be crimped is subject to certain limitations. The first is the rate at which the filaments of the yarn are acted upon by the setting medium. Where heat alone is employed, this rate is high and does not necessarily constitute any serious barrier to high speed, though if steam or a setting solution containing for example a softening agent is applied, this time may be appreciable. The second limitation is the time involved in removing or reducing the effect of the setting medium on the yarn, since this must take place, i.e., twist must be fixed in the yarn in the fixing region, before the yarn reaches the false twister. Again, in the case of a setting medium involving only heat, the rate of heat loss by the yarn is fairly high, though if yarn material solvent or softener is employed, the elimination time tends to be higher than that in which plain heat alone is used. The final limitation is the rate at which false twist can be applied to the yarn by the twister. In practice, this is not found to be a serious limitation as this rate of application of false twist can be made very high indeed—up to and beyond 50,000 revolutions per minute.

Since the setting medium elimination or reduction takes place in the said arrangement by passage through the air beween the point of application of the setting medium and the twister, it follows that either an increase in the length of the said air-space or an increase in airflow in the said space relative to the yarn, necessarily permits an increase in the rate of yarn transfer through the device as a whole, and according to our present invention, air currents are induced in the said region by means of a blower or fan, the effect of such currents being, as stated above, a more rapid elimination of the setting medium from the filaments of which the yarn is composed and therefore the production of a higher output from the device than would previously have been possible, all other circumstances remaining unchanged.

In an embodiment of our invention the yarn to be crimped, for example a thermoplastic such as nylon, is wound on a bobbin which is located at the bottom of the apparatus. From the bobbin the yarn passes through either a pair of feed rollers or a suitable brake or tension regulating device. From this device the yarn proceeds upwards through a heating zone preferably incorporating a heated plate having a slightly curved and channelled surface, in which zone the yarn is heated to a temperature determined in practice as being suitable for setting twist. The said plate may be heated either from an inset electrical heater or resistance element, or alternatively from a circulating current of hot oil, and the temperature of the heating surface may be automatically regulated so as to compensate for changes in the ambient temperature, mains voltage or yarn throughput, or all of the said variants.

The yarn now passes upwards through an air space in which the relative speed of the yarn and surrounding air is artificially increased as by means of an air jet directed at the yarn, or alternatively the false twist device through which the yarn subsequently runs may be provided with small fan blades on one end which cause an air circulating or aspirating effect. After passage through the air space and through the subsequently located false twister, the yarn is drawn by a pair of take-up rollers at a rate found to be most suitably adapted to the retention of the crimp imparted to the yarn by the preceding portions of the apparatus, whereafter it is wound on a receiving bobbin.

The arrangement above described is not only suitable for use in connection with thermoplastic yarns and a setting medium involving heat only; it may also be employed on yarns requiring moist heat, such as steam, for setting, or for yarns in which swelling or softening by means of a chemical agent is necessary, provided that the swelling or softening agent is removable, or its effect on the filaments can be reduced, by means of circulating air currents.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a schematic illustration of one possible embodiment of a structure according to the present invention; and

FIG. 2 is a schematic illustration of a second embodiment of a structure according to the present invention.

Referring now to FIG. 1, it will be seen that in an apparatus according to our invention, a yarn package 1 is supported from a base 2. Yarn from the package travels along the path 3 to direction-changing pins 4, 5 and thence to a tension device 6. From this device the yarn passes through a heater 8 in which an elevated temperature is maintained substantially constant by passage through an electrical winding fed with current derived from the busbars 7. The voltage of the busbars may be controlled by a thermostat or other suitable means so that the heater temperature remains within permissible limits about a predetermined temperature.

From the heater the yarn travels upwards to a false twist tube 11 carried in a framework 10, the twist applied by the tube to the yarn running backwards along the yarn into the heater 8 where the said twist is set in the yarn which while passing through the heater is partially softened. From the twist tube 11 the yarn passes round driven rollers 12, 13 and thence to a take-up package 14 under slight tension.

If the yarn were to remain in its softened condition during its passage through the twist tube, the twist set in the yarn by the heater 8 would of course be substantially removed as soon as the yarn left the twist tube since the latter imparts exactly the same amount of forward twist as it does reverse twist to the yarn during the latter"s passage through the tube. It is therefore necessary to ensure that the yarn hardens after leaving the heater 8 and before entering the twist tube 11. Under previously known conditions this hardening had taken place automatically by passage of the yarn through an air space. This air space of a few inches long was sufficient to ensure that yarns of low or moderate denier, progressing at speeds of up to 100 feet per minute were sufficiently cooled or dried before entering the twist tube. Recent demands for larger denier yarns has however rendered the cooling or drying effect of a few inches of air insufficient. We therefore provide in the present embodiment a small fan 9 which may be carried by the lower end of the twist tube 11. This fan directs a quantity of air along the path followed by the filament between the heater 8 and the twist tube 11, this increased flow of air serving to produce an accelerated cooling or drying effect.

If instead of the heater 8 a yarn treating bath or tube containing a solvent liquid or vapour had been used, then the effect of the fan would be to cause an increased rate of evaporation of solvent, so that the design is effective whether the yarn is softened by solvents, water, steam or heat.

FIG. 2 shows an arrangement which is similar to that of FIG. 1 except that the fan 9 is replaced by a jet of air.

The yarn bobbin 1 is located on a base 2 from which the yarn travels at path 3, 4, 5, 6 as previously described and then runs through a heater 8, supported on busbars 7. Thereafter the yarn traverses an air space, a twist tube 19 carried in a support 15, rollers 16 and 17, and is finally wound on a package 18. In order to increase the rate of setting of the twist in the air space, an air jet 20 is located in this space and is directed so as to blow a jet of air across or along the yarn's path. The jet may be fitted into a common pipe 21 supported by an extension 22 of a part of the framework of the machine 23. The pipe 21 is supplied with air under pressure by a pipe 24 connected to a blower 25. The blower is driven by a motor 26 and the air intake may be filtered at point 27.

Although the construction shown in FIG. 2 employs pressurised air in order to cool the yarn, it should be understood that an evacuation system can be employed if required, the jet 20 being then caused to suck air across the yarn path instead of blowing it. Again, several points of application or extraction of air from near the yarn path may be employed, instead of a single point as shown.

What I claim is:

1. In an apparatus for crimping a thermoplastic yarn, in combination, means for advancing the yarn which is to be crimped along a predetermined path; false twist means cooperating with the yarn as it moves along said path to false twist the same, said false twist means providing a twist of the yarn through a predetermined portion of said path in advance of said false twist means where the yarn moves toward the latter; softening means located along said path in advance of said false twist means at a part of said predetermined portion of said path for rendering the yarn partially plastic so that the twist is applied to the partially plastic yarn, the yarn moving through a free, open space from said softening means to said false twist means; and blower means driven by said false twist means for creating a stream of air which is directed from said false twist means toward said softening means and which engages the yarn in said free space to set the yarn before it reaches said false twist means.

2. In an apparatus for crimping a thermoplastic yarn, in combination, means for advancing the yarn which is to be crimped along a predetermined path; false twist means cooperating with the yarn as it moves along said path to false twist the same, said false twist means providing a twist in the yarn through a predetermined portion of said path in advance of said false twist means where the yarn moves toward the latter, said false twist means including a rotary spindle having one end directed toward said predetermined portion of said path; means located along said path in advance of said false twist means at a part of said predetermined portion of said path for rendering the yarn partially plastic so that the twist is applied to the partially plastic yarn, the yarn moving through a free, open space from said means for rendering the yarn plastic to said false twist means; and a fan fixed to said end of said spindle of said false twist means for rotating with said spindle and creating a stream of air which moves along the yarn in said space for setting the yarn before it reaches said false twist means.

3. In an apparatus as recited in claim 1, said blower means being located at the exterior of said false twist means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,863,280	Ubbelohde	Dec. 9, 1958
2,928,229	Haas	Mar. 15, 1960

FOREIGN PATENTS

775,075	Great Britain	May 22, 1957
1,106,447	France	July 20, 1955