

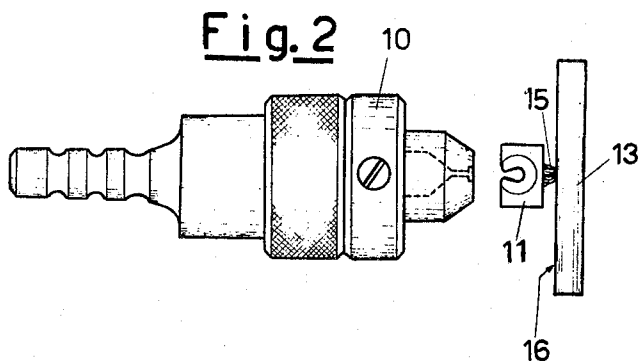
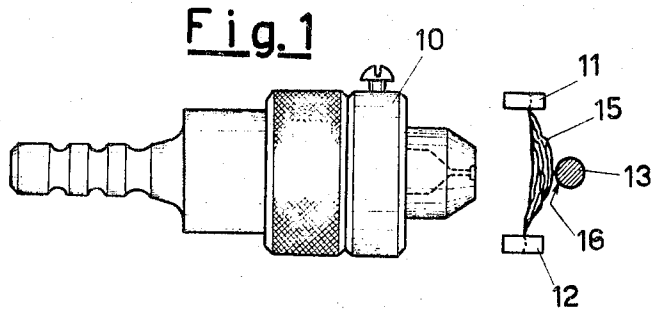
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METHOD AND APPARATUS FOR INTERLACING SYNTHETIC FILAMENTS

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METHOD AND APPARATUS FOR INTERLACING SYNTHETIC FILAMENTS

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It is known that man-made, and synthetic fibers are produced by extruding a viscous mass through a spinneret consisting of a foraminous metal plate. The bundle of monofilaments thus extruded can be collected by winding it on a reel or on a rotating spindle.

In the former case, all the monofilaments are parallel to the axis of the fiber, whereas in the latter case the monofilaments are helically arranged about the axis of the fiber. In order that the processing textile operations may be facilitated, such as the formation of a warp, and the weaving or knitting of said fibers, it is customary to impart a twist to said bundles of monofilaments. The known art provides also other processes for imparting to the monofilament bundles a cohesion which suffices to permit the treatment of said bundles in the weaving operations: for example, it has been suggested subjecting these bundles to the action of gas streams, and more particularly of gas streams endowed with a whirling motion.

The methods adopted heretofore, however, did not prove wholly satisfactory, especially in view of the fact that they produce defective yarns, for example unevennesses in the dyeing of a woven fabric made with these yarns have been frequently reported.

The present invention has for its subject-matter a process for producing from man-made and synthetic filaments having no twist or a very slight twist, yarns having a satisfactory cohesion for subsequent weaving and also for obtaining from said filaments, yarns having a high tinctorial uniformity.

The present invention also contemplates apparatus for performing said process, and the yarns obtained thereby are also encompassed within the scope of this invention.

The "degree of cohesion" is rated as the number of "false knots" per meter. The way in which the measurements are taken will be specified hereinafter. It can be said that this number of "false knots" should be, preferably, from 10 to 50 per meter or more.

For convenience, the term "thread" will connote, in the detailed description to follow, a grouping of continuous filaments substantially parallel which are fed as a unit, either after having assumed the degree of cohesion mentioned above, or before.

The process of the present invention is characterized in that a continuous thread, composed of a plurality of continuous filaments and having no twist or a very low twist, is fed past a fluid stream, preferably a gas stream, so as to deviate this thread from its rectilinear path and have it slide over a convex rest surface, which is preferably embodied in a cylindrical body, such as for example a rod of a sintered ceramic material.

Preferably the flow lines of the gas are such as not to form, in the contact area between the gas and the thread, whirls having their axes parallel to the feed direction of the thread.

Under the influence of the gas stream and in contact with the rod, the individual filaments do not retain their mutual original location parallel to the axis of the thread, but intersect with one another thus forming the aforementioned false knots. This will confer on the filaments

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a very satisfactory mutual cohesion without affecting, in the slightest, the evenness of the tinctorial properties of the thread.

The process of this invention can be put into practice immediately after the manufacturing process of man-made or synthetic yarns and can also be associated with other treatments, thus affording the economical advantage of a continuous processing run.

The process according to this invention can be applied to viscose rayon, acetate rayon, polyamides, polyester and polyurethane filaments and to any other kind of multifilamentary yarns of man-made and synthetic filaments and is adapted to any count of yarn, from 15 deniers to 2,100 deniers, preferably from 30 to 840 deniers and to any tenacity, from 1.5 to 15 deniers per monofilament.

The sliding speed should be varied according to the type of the yarn, but the phenomenon of the formation of the "false knots" takes place at any speed.

The invention will now be described with reference to the attached drawing in which:

FIGS. 1 and 2 are views at right angles to one another illustrating a preferred embodiment of apparatus for forming an essentially non-twisted multifilamentary thread according to the invention.

The apparatus employed is shown in FIGS. 1 and 2 of the accompanying drawings and consists in a nozzle 10, two thread guides 11 and 12 and in a member 13 with whose surface 16—which will be called a "resting surface"—the sliding thread is in tangential contact. The thread guides 11 and 12 have the shape of a ring open towards the nozzle 10 but can also take the form of a two-pronged fork or any other form permitting maintaining the thread in a rectilinear posture and well centered in front of the nozzle. The opening of the thread guide depends on the count of the thread and should be carefully selected in order not to interfere with the advancement of the thread.

The member 13 can have any suitable shape but it is preferred that it has a resting surface 16 with a curvature so smooth as not to jeopardize the thread. It is suggested that the member 13 is a shaped body, and it is preferred that it be convex and cylindrical in shape, with its axis perpendicular to the axis of the thread as well as to the axis of the air stream coming out of the nozzle 10. According to a particularly advantageous embodiment, it is formed by a rod of sintered ceramic material having a diameter in the range from 0.5 to 50 mms. and preferably from 1 to 20 mms.

In any case, the member 13 is placed, away from the nozzle 10, at such a distance from the thread 15 as to come into contact by its surface 16 with the thread at the apex of the deviated path traveled over by the thread when said thread, sliding in the interval between the two thread-guides 11 and 12, is laterally thrust by the air jet. The member 13, however, could also be approached to the nozzle 10, thus exerting a deviating action on the path of the thread, and, if so, this path would be formed by two arcs connected by a curve tangent to the surface 16.

The distance between the nozzle and the thread is dependent on the air jet, the cross-sectional area of the nozzle and the count of the thread and can be varied from 0.5 to 25 mms.; and preferably from 0.6 to 12 mms.

The distance between the two thread-guides seems to have no critical meaning. In practice it is comprised between 1 and 20 cms., preferably between 2 and 6 cms.

The air pressure is varied from 0.5 atmosphere to 12 atmospheres, preferably from 1.05 atm. to 5 atm.

The diameter of the nozzle bore may vary from 0.2 to 2.0 mms. and preferably from 0.5 to 2.0 mms. and the rate of flow of air, which varies according to the cross-sectional area of the nozzle and the pressure upstream thereof, varies from 0.68 cu. meter per hour to 3.0 cu.

meters per hour, preferably from 0.87 cu. meter per hour to 1.3 cu. meters per hour. All the quantitative limitations set forth are not rigorous, since the invention can be practiced also outside the ranges specified above.

The apparatus described above acts in the following manner: the bundle 15 of substantially parallel filaments is moved downwardly for example in FIG. 1 across the two successive thread guides 11 and 12 which define a rectilinear path parallel to a tangent to the convex surface 16 of the fixed piece 13, and at right angles to the direction of the jet ejected from the nozzle 10. The kinetic energy of the gas jet forces the single filaments of the thread 15 to deviate and some of them to come into sliding contact with the convex surface 16.

Since the resting member 13 might not deviate the travel of the thread 15 physically and is not struck by the gas jet before this has struck and gone through the thread, the function of said member 13 cannot be easily explained and no theoretical convincing explanation has been found for the effect produced thereby.

It has been possible to ascertain, however, that, if this member 13 is removed or is displaced so as to lose any contact with the thread, satisfactory yarns are no longer obtained. The following examples describe the process of the invention without limiting it.

Example 1

A viscose thread consisting of 48 monofilaments in the course of coagulation is drawn by a pair of skew rollers and subsequently collected, at different speeds; on foraminous aluminum bobbins. Between the feed roller and the collecting bobbins the thread has been thrust by an air jet produced by a nozzle having a diameter of 1 mm., a length of 6 mms. and fed by compressed air at a pressure of 3 kgs./sq. cm. (relative pressure). The axis of the thread (this slid at a speed at 83 meters per min.) was placed at a distance of 22 mms. from the nozzle opening. At the side of the thread away from the nozzle, there was placed a cylindrical body with its axis perpendicular to the axis of the thread, and this body consisted of a rod of sintered ceramic material, having a diameter of 4 mms.

The thread collected on the bobbins, after neutralization, desulfurization, bleaching and drying had an appearance similar to that of a thread obtained under the same conditions but without treatment with the air jet. By placing threads, obtained without and with the use of the air jet, between two fixed points and introducing a needle between the monofilaments it could be noted that in the untreated thread the needle was able to slide even a meter long without any hindrance, whereas the thread treated with the air jet arrested the needle after a travel not longer than:

- 4-8 cms. when the speed of the collecting bobbin was by 4% lower than that of the skew rollers;
- 2-5 cms. when the speed of the collecting bobbin was by 7% lower than that of the skew rollers, and
- 0.5-3 cms. when the speed of the collecting bobbin was by 10% lower than that of the skew rollers.

Every point at which the needle was stopped was regarded as a "false knot" and, consequently, there is, in the several cases, a degree of cohesion which is inversely proportional to the mean distance between two consecutive "false knots."

Example 2

A 75 denier acetate rayon thread, formed by 23 parallel monofilaments has been passed, at its exit from the spinning cells, between a nozzle as described in the foregoing and a rod spaced from the nozzle so as to be thrust by the air jet coming out of the nozzle at a pressure of 5 kgs./sq. cm. The sliding speed of the thread was the one usually adopted for acetate rayon spinning, that is to say: 600 meters per minute, and the thread was fed and collected practically at the same speed. However, in view

of the particular stage of the process run in which the operation according to the invention is being effected, it can happen that a certain shrinkage of the thread may take place, so that a difference between the feeding speed and the collecting speed may arise. This difference, at any rate, is not due to the requirements of the operation according to the invention. This consideration is fully valid also for the examples which follow and has the value of a general rule.

The distance between the thread and the nozzle bore was 5 mms. but this distance could be varied within a relatively wide range. The rod, in the example in point, was formed by a rod of sintered ceramic material having a diameter of 5 mms. approximately.

The tension of the thread past the nozzle was of about 2-3 grs. The thread, collected on bobbins, showed, when examined as hereinbefore described, a number of "false-knots" varying from a minimum of 15 to a maximum of 22 per meter run. The appearance of the thread was absolutely normal, no appreciable modification being ascertainable by the unaided eye.

With the thread thus treated there have been prepared cloth beams which, on weaving and sizing, proved full satisfactorily, as compared with cloth beams prepared with the normal production thread (100 twists per meter).

The behaviour of the loom of the cloth beams so prepared and the appearance and the "hands" of the fabrics obtained thereby, both of the twill and taffetas fabrics, were quite normal and equivalent to those obtained with twisted thread (100 twists per meter).

Example 3

A 60 denier, 18 filament nylon 6 (or nylon 66) thread was drawn on a conventional drawing and twisting frame at a speed of say 450 meters per minute with a draft ratio of say 3.47, with the known method of winding the thread between a slow roller and a fast roller.

Past the fast roller and before the ball on arrester, an apparatus, quite similar to that described in the Example 1, was installed.

The thread collected on a bobbin rotated at 6,000 r.p.m. or more and with a twist of 10-15 twists per meter, was placed on a torsionmeter. It can be definitely noted that these twists do not constitute a serious obstacle to the advancement of a thread between the filaments until the needle impinges either clamp of the testing machine. If, conversely, the thread has been treated by the process of the invention, the needle is hindered in its travel between the monofilaments every 1.5-5 cms. so that the twists cannot be displaced towards the clamps as occurred with the untreated thread.

Example 4

A 100 denier, 28 filament nylon 6 (or nylon 66) thread is drawn with a conventional drawing and winding machine and the thread is wound on a bobbin with its monofilaments parallel to the axis of the thread.

The draft ratio is the same as in Example 3 but the collecting speed is 600 meters per min.

The treatment of the thread according to the method of Example 3 permits producing a thread which, when checked with the method described, shows a number of false knots ranging between 38 and 45 false knots per meter.

Example 5

A 420 denier, 72 filament nylon 6 (or nylon 66) thread is treated according to the procedure of Example 4.

A thread is obtained, which has from 20 to 52 false-knots per meter.

What we claim is:

1. A process for producing an essentially non-twisted multifilamentary thread consisting of a plurality of single filaments essentially interlaced with one another, comprising conducting a plurality of single filaments across a

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gap in a free space in front of a convex surface, and directing a jet of pressurized gaseous medium at the filaments so that said jet impinges on said filaments at essentially right angles to their path of travel and in a direction intersecting said surface, whereby the filaments are deviated toward said surface and contact and interlace with each other as they progress across said gap, said surface having a length in the direction of travel of the filaments less than the length of said gap and said surface being so disposed that said jet divides and flows around both sides of said surface.

2. The process of claim 1, wherein said jet consists of a stream of air ejected from a nozzle at a pressure between 0.5 and 12 atmospheres and the nozzle is spaced from 0.5 to 25 mms. from the filaments.

3. The process of claim 2, wherein said jet is provided by feeding said nozzle with from 0.62 to 3 cu. m./hour of pressurized air.

4. The process of claim 1, wherein the said jet consists of a stream of air ejected from a nozzle at a pressure between 1.05 and 5 atmospheres and the nozzle is spaced from 0.5 to 25 mms. from the filaments.

5. The process of claim 4, wherein said jet is provided by feeding said nozzle with from 0.87 to 1.3 cu. m./hour of pressurized air.

6. Apparatus for processing multifilamentary material, to provide a coherent multifilamentary thread, comprising two spaced longitudinally-aligned guide members between which the filaments travel across the space, a stationary member having a convex surface supported in spaced relation to and behind the path of travel of the filaments from one guide member to the other, and nozzle means disposed in front of said path and connected to a source of pressurized gaseous medium to blow said gaseous medium against the filaments and toward said convex surface as the filaments travel from one guide member to the other, said nozzle means having a bore the axis of which intersects at essentially right angles both said path and said convex surface, whereby said gaseous medium

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is blown at right angles to said path and to said surface said surface having a length in the direction of said path less than the distance between said guide members and said surface being so disposed relative to said nozzle that the gaseous medium divides and flows around opposite sides of said convex surface.

7. The apparatus of claim 6, wherein said convex surface is a cylindrical surface of a diameter between 0.5 and 50 mms. and the gaseous medium is pressurized to between 1.05 and 5 atmospheres.

8. The apparatus of claim 6, wherein said convex surface is a cylindrical surface of a diameter between 0.5 and 20 mms., and the distance between said thread guides is from 1 to 20 cms.

9. The apparatus of claim 6, wherein said nozzle is provided with a bore of a diameter between 0.2 and 5 mms. and the gas pressure is between 1.05 and 5 atmospheres.

10. The apparatus of claim 6, wherein the said nozzle is provided with a bore of a diameter between 0.5 and 2 mms., the air pressure is between 0.5 and 12 atmospheres, and the air flow is from 0.87 to 1.3 cu. m. per hour.

References Cited by the Examiner

UNITED STATES PATENTS

2,313,630	3/1943	Dockerty	28—72
2,395,136	2/1946	Millhiser	28—72
2,783,609	3/1957	Breen	57—140
2,909,827	10/1959	Waugh	28—72
2,985,995	5/1961	Bunting et al.	57—140
3,110,151	11/1963	Bunting et al.	28—72
3,113,366	12/1963	Taylor	28—1
3,115,691	12/1963	Bunting et al.	28—1
3,125,793	3/1964	Gonsalves	28—72

FOREIGN PATENTS

554,150 3/1958 Canada.

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