Sept. 23, 1969 F. E. JACKSON 3,468,114

METHOD OF AND APPARATUS FOR MAKING AN INTERLACED YARN

Filed June 18, 1968

FIG. 1.

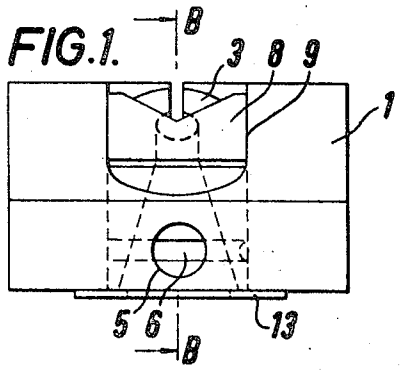


FIG. 2.

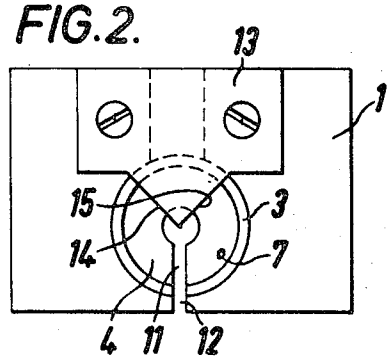


FIG. 3.

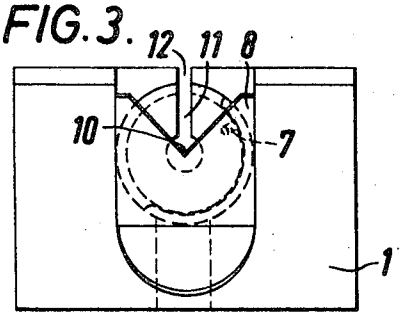


FIG. 4.

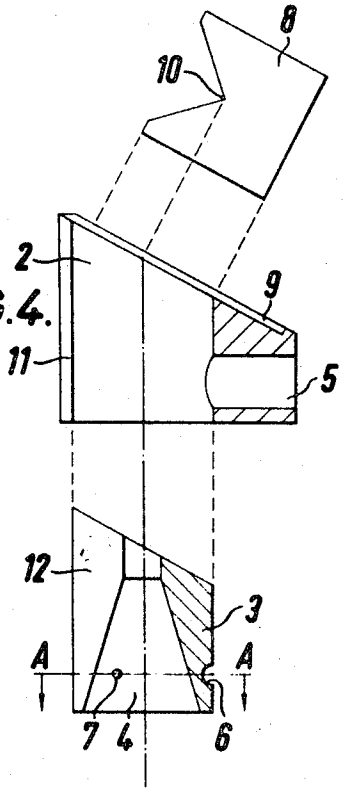
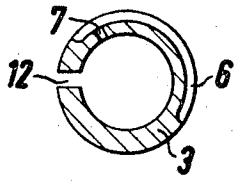


FIG. 5.



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METHOD OF AND APPARATUS FOR MAKING AN INTERLACED YARN

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U.S. Cl. 57—34 7 Claims

ABSTRACT OF THE DISCLOSURE

A method of making a yarn by interlacing a running multifilament bundle comprising moving the bundle laterally into and out of contact with a lateral jet of fluid adapted to interlace the filaments, the frequency and duration of the contact of the bundle and the jet being selected to cause continuous interlacing of the yarn and the bundle being under a tension sufficient to prevent crunodal loops forming in the individual filaments. The bundle may be subjected to a sudden intermittent relaxation of tension synchronised with the bundle coming into contact with the jet.

This invention is concerned with a method of and an apparatus for making an interlaced yarn from a multifilament bundle which is either free from twist or has no more than produced twist.

It has been proposed, for example in British patent specification No. 924,089 to make yarns of interlaced filaments from such bundles to compete with the ubiquitous, but more expensive, yarns of twisted filaments. The interlaced yarns have a unitary structure suiting them for use in such textile processes as weaving and knitting. Such interlaced yarns may be prepared using fluid vortices as described in specification No. 924,089 or by passing a high velocity jet of fluid through a running bundle of filaments into a resonance chamber as described in Canadian patent specification No. 554,150.

The known methods of interlacing produce yarns of comprehensively interlaced filaments, but with little or no control over the relative dispositions of the filaments along the length of the yarn, and in fact, there frequently occurs an irregular periodic structural change in which short lengths of densely interlaced filaments, referred to hereafter as "nodes," separate longer lengths of more open interlacing. The existence and irregular occurrence of nodes may be demonstrated by floating a yarn made by an already known interlacing process, on a clean surface of water when the component filaments will be seen to separate somewhat along the more open interlaced lengths, whilst remaining in close contact at the nodes.

Fabrics made from yarns containing nodes have a flocked appearance which in many applications puts them at a disadvantage compared with the plain fabrics made from the more uniform, twisted yarns.

We have now devised a novel interlacing process and apparatus for carrying it into effect, which diminishes the frequency of nodes in the yarn, without, however, substantially impairing the unitary structure of the yarn.

According to the present invention, a method of making a yarn by interlacing a running multifilament bundle comprises moving the bundle laterally into and out of contact with a lateral jet of fluid adapted to interlace the filaments, the frequency and duration of the contact of the bundle and the jet being selected to cause continuous interlacing of the yarn and the bundle being under a tension sufficient to prevent crunodal loops forming in the individual filaments.

Whilst the bundle is under continuous tension, it is preferred that there should be a sudden intermittent relaxation of tension synchronised with the bundle coming into contact with the jet.

A convenient method of applying the invention is an adaptation of the conventional ring-spinning or cap-spinning processes in which a running bundle of continuous filaments passing through a balloon guide located on the axis of a yarn-collecting bobbin, to a ring-traveller or lower edge of a cap, generates a curvilinear surface or balloon as it spins around the bobbin with the traveller or on the cap edge, whilst being wound onto the rotating bobbin. Such a process is converted to the production of interlaced yarns, when the yarn generating the balloon is caused to pass through the jet of fluid, the jet being adjacent to and stationary with respect to the balloon guide. The preferred interruption in the tension of the bundle may then be brought about by deflecting the ballooning bundle, once in each balloon cycle, inwards of the balloon and releasing the bundle from the deflection so that it is free to return to the conventional balloon path when the bundle is in contact with the jet.

According to a further aspect of the invention, apparatus for making a continuously interlaced yarn from a multifilament bundle comprises means to deliver a jet of fluid adapted to interlace the bundle from a source of fluid under presure, yarn take-up means to move the bundle longitudinally past the jet delivery means under tension and means to move the bundle laterally into and out of the path of the jet.

One embodiment of apparatus in accordance with the invention, in the form of a coverted ring-spinning or cap-spinning machine, comprises a tube for delivering the jet of fluid at the balloon, set adjacent to the balloon guide and directed at a segment of the locus of the balloon. The balloon guide and tube may be integral. The apparatus may also incorporate a deflector adapted to deflect the ballooning bundle inwards of the balloon, once in each balloon cycle, and to release the bundle when it is in the path of the jet of fluid.

The fluid is preferably air, but may be any other innocuous gas or liquid or mixture of gases or liquids, for example, nitrogen, carbon dioxide or water. Heated gases or vapours of volatile liquids, for example steam, may be employed when it is required to combine the interlacing process with a heat treatment of the yarn.

The duration of the contact of the bundle and the jet may be controlled by the width of the tube delivering the jet of fluid, at right angles to the direction of the filaments, and the lateral velocity of the filaments through the jet. The frequency of the contact is a function of the width of the tube, the lateral velocity of the filaments and the frequency of the balloon cycle. In operating a converted ring-spinning machine with a bundle running at 500 metres per minute and a balloon cycle frequency of 6,000 per minute, we have successfully employed circular tubes having diameters of from 1.40 mms. to 1.78 mms. delivering air at a pressure of from 0.25 to 1 atmosphere (gauge). In these circumstances the successive centres of contact of the bundle and the air jet are separated by 8.4 cms. of the length of the bundle.

It would appear that the hitherto known processes of interlacing are prone to produce nodes in yarns owing to the continuous application of fluid vortices to the multifilament bundle. The plurality of vortices generate the violent relative movement of filaments passing through and divided among the vortices and there frequently results a node. The filaments following a node are constrained into close contact by their connection with the node and are not, therefore, so well distributed among the vortices when they are drawn through the turbulent zone, and there results a length of yarn in which the

interlacing is more open. The cycle is completed by the lengths of filaments following the open interlacing which can better distribute themselves among the vortices and the conditions are appropriate once again for the formation of a node.

The intermittent interaction of the jet and the bundle, characteristic of the present invention, is sufficient to ensure a continuous interlacing of the filaments and the violence of the interaction may well be of the kind which, if continuous, could generate nodes. However, the intermittent periods of contact cause only adequate interlacing without the substantial generation of nodes and, before the interlacing can be rendered more dense by continued interaction, the contact of the jet and the yarn is lost and before it is re-established the already interlaced length is withdrawn from the influence of the jet.

An embodiment of apparatus for performing the method according to the invention, in the form of a combined balloon guide and jet assembly, is illustrated in the accompanying drawing, in which:

FIGURE 1 is an elevation,

FIGURE 2 is a plan from below,

FIGURE 3 is a plan from above,

FIGURE 4 is an exploded section on the line B—B of FIGURE 3 but without the deflecting plate, and

FIGURE 5 is a section on the line A—A of FIGURE 4.

Referring to the drawing, a block **1** has a cylindrical cavity **2** in which a cylinder **3**, having a conoidal bore **4** with a cylindrical extension, is a press fit. A passage **5** passes through the block **1** to the cylindrical cavity **2** and there communicates with a channel **6** in the outer surface of the cylinder **3**, and a jet orifice **7** connects the channel **6** and the conoidal bore **4**.

A balloon guide plate **8** having an indented side is located in a channel **9** on the upper sloping surface of the block **1** so that the crotch **10** of the indented side is located on the axis of the cylinder **3**.

The block **1** and the cylinder **3** have contiguous vertical narrow gaps **11** and **12** respectively, to allow a bundle of filaments to be threaded up, that is to be moved laterally into the bore **4** of the cylinder **3** and into contact with the crotch **10** of the guide plate **8**.

With particular reference to FIGURE 2, on the base of the block **1** is fixed a plate **13** carrying a deflecting extension having shoulders **14** and **15** extending towards the axis of the cylinder **3** and partially closing the base of the conoidal bore **4**. The location of the plate **13** is determined by the direction of rotation of the bundle of yarn generating the balloon, the leading shoulder **14** being well in advance of the jet orifice **7**, and the trailing shoulder **15** being located at, or only marginally in advance of, the jet orifice **7**.

When the assembly is installed in a ring-spinning machine in place of the usual balloon guide a bundle of filaments may be threaded up to lie within the conoidal bore **4** and the bundle is engaged with a rapidly rotating bobbin, thereby causing the bundle to rotate about the bobbin generating a balloon, the apex of which is sited at the crotch **10** and the immediately adjacent part within the conoidal bore **4**.

The running speed of the yarn is 500 metres per minute and the frequency of the balloon cycle 6,000 per minute. Air at a pressure of 1 atmosphere (gauge) is introduced through the passage **5**, to issue from the jet **7**, the jet having a diameter of 1.78 mms.

In passing around its balloon path the bundle comes

in contact with the leading shoulder **14** of the plate **13** and is thereby deflected towards the axis of the balloon to be released from this deflection as the bundle passes over the edge formed by the junction of the two shoulders **14** and **15**. At the instant of its release the bundle comes into contact with the jet of air issuing from the orifice **7**. It is then subjected to the interlacing action of the jet. These steps are repeated once in every balloon cycle corresponding to a repetition at every 8.4 cms. of bundle length. It will be appreciated that the interlacing action of the jet and the deflecting extension of the plate **13** extend both backwards and forwards from their points of contact with the bundle so that, although the contacts are intermittent, they produce a continuous interlacing of the filaments of the bundle.

What is claimed is:

1. A method of making a yarn by interlacing a running multifilament bundle comprising moving the bundle laterally into and out of contact with a lateral jet of fluid adapted to interlace the filaments, the frequency and duration of the contact of the bundle and the jet being selected to cause continuous interlacing of the yarn and the bundle being under a tension sufficient to prevent crunodal loops forming in the individual filaments.

2. A method as claimed in claim **1** in which the bundle is subjected to a sudden intermittent relaxation of tension synchronised with the bundle coming into contact with the jet.

3. A method as claimed in claim **1** comprising a ring- or cap-spinning process in which the running bundle generates a balloon about a bobbin and in each balloon cycle passes through a jet of fluid.

4. A method as claimed in claim **3** comprising deflecting the bundle generating the balloon, inwards of the balloon in each balloon cycle, and releasing the bundle from the deflection when the bundle is in contact with the jet.

5. Apparatus for making a continuously interlaced yarn from a multifilament bundle comprising means to deliver a jet of fluid adapted to interlace the bundle from a source of fluid under pressure, yarn take-up means to move the bundle longitudinally past the jet delivery means under tension and means to move the bundle laterally into and out of the path of the jet.

6. Apparatus as claimed in claim **5** comprising a ring- or cap-spinning machine embodying a balloon guide and modified by the addition of a jet delivery means set adjacent the balloon guide and directed at a segment of the locus of the balloon.

7. Apparatus as claimed in claim **6** comprising a deflector adapted to deflect the bundle generating the balloon, inwards of the balloon in each balloon cycle and to release the bundle from the deflection when the bundle is in the path of the jet.

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U.S. Cl. X.R.

28—1; 57—157