Aug. 7, 1962 E. H. PITTMAN ET AL 3,047,932

APPARATUS FOR INTERMITTENTLY EDGE-CRIMPING YARN

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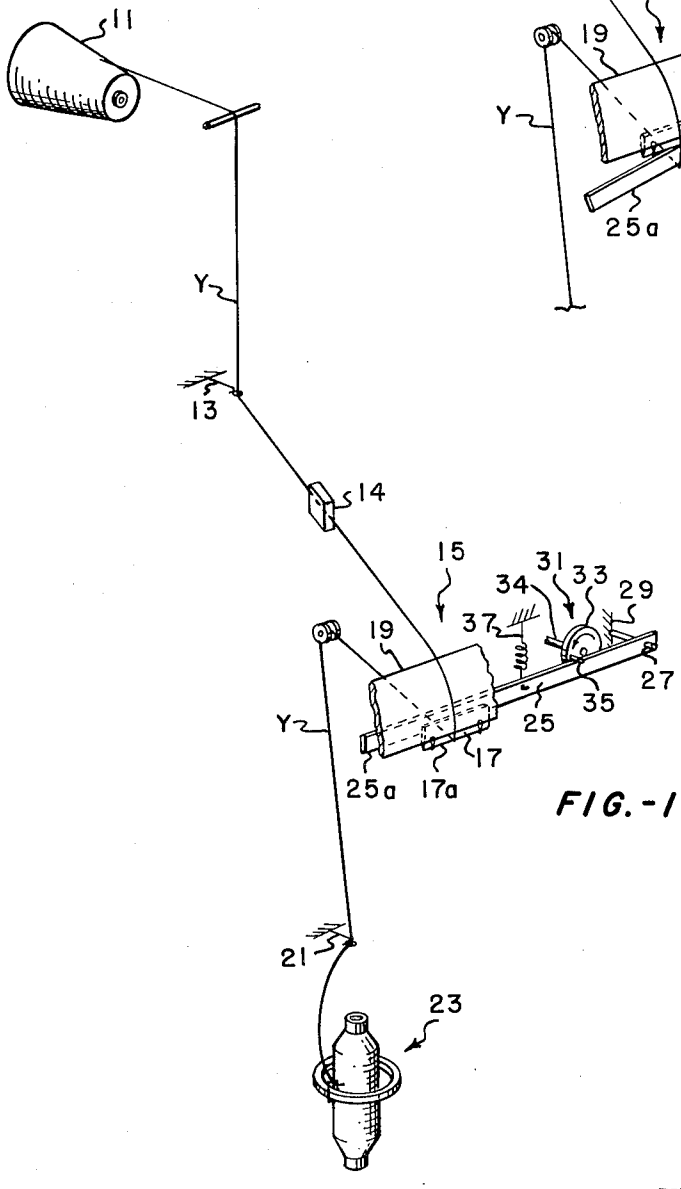

FIG.-1-

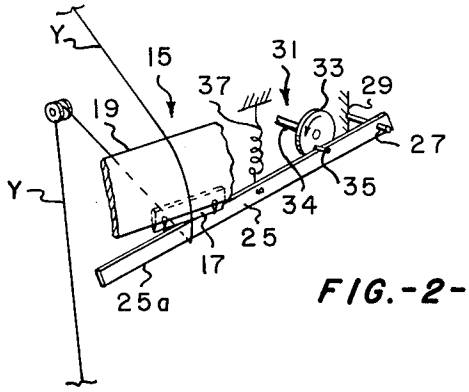

FIG.-2-

INVENTOR.
E. HENRY PITTMAN
E. DARE BOLINGER
BY Reginald J. Pippin Jr.
ATTORNEY

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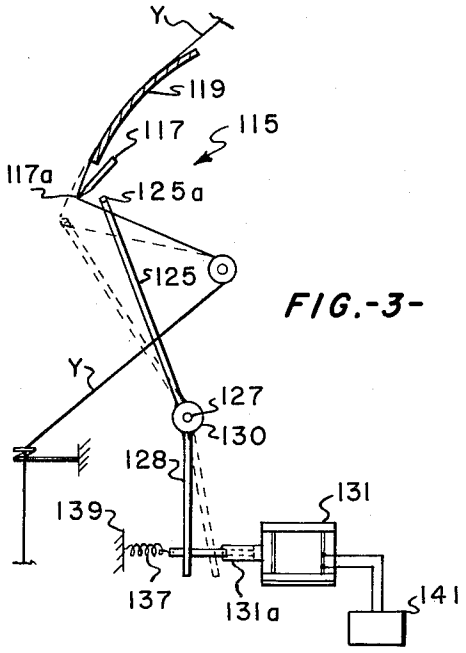

FIG.-3-

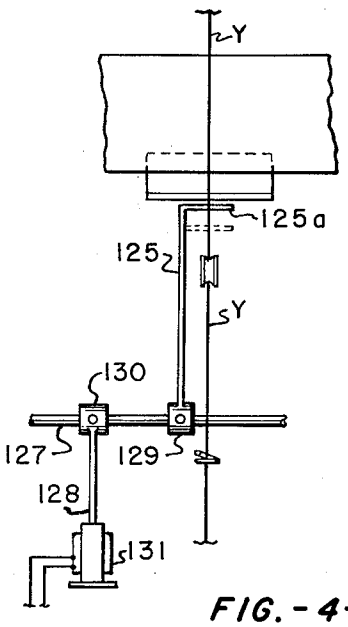

FIG.-4-

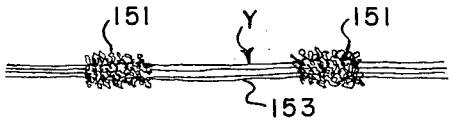

FIG.-5-

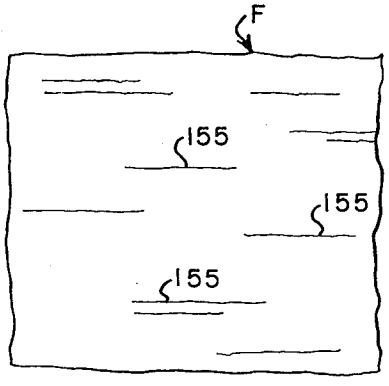

FIG.-6-

INVENTOR.
E. HENRY PITTMAN
E. DARE BOLINGER
BY Reginald A. Biggins Jr.
ATTORNEY

United States Patent Office

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APPARATUS FOR INTERMITTENTLY EDGE-CRIMPING YARN

Edgar Henry Pittman and Edgar Dare Bolinger, Spartanburg, S.C., assignors to Deering Milliken Research Corporation, Spartanburg, S.C., a corporation of Delaware

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This invention relates to novel intermittently elasticized yarn products and to methods and apparatus for producing such yarns, and more particularly to novel intermittently elasticized and bulked edge crimped thermoplastic yarns and fabric made from such yarns and to novel methods and apparatus for producing such yarns.

In order to produce various styling effects in fabrics, it is highly desirable to employ a yarn having alternate elasticized or bulked incremental lengths or segments and substantially unelasticized incremental lengths or segments. We have found that such a yarn may be produced from originally unelasticized continuous filament thermoplastic yarn in a continuous process by intermittently elasticizing the yarn during linear advance of the yarn past an elasticizing medium.

Briefly the invention as it relates to the apparatus for producing the novel intermittently elasticized and bulked yarn includes a yarn crimping device preferably in the form of a sharp edged blade over which the yarn is advanced through a relatively sharp angle, and a yarn removal member which is intermittently moved to remove the yarn from contact with the treating edge of the yarn crimping device. The yarn removal member may preferably take the form of an oscillating or reciprocating arm having a yarn contact surface of substantially larger radius of curvature than the radius of curvature of the sharp edge of the edge crimping device, so as to effect substantially little or no elasticization of the yarn as it passes thereby while the yarn removal member has the yarn removed from the edge crimping device. While the invention may in some instances be employed without the heating of the thermoplastic yarn, it is most desirable in order to provide permanent crimp in the yarn in the elasticized segments that the yarn be in a heated state while passing over the edge crimping surface. Therefore, in the preferred embodiment the apparatus includes a preheater in the form of a yarn contact heater element over which the yarn passes prior to passing over the sharp edge of the edge-crimping blade in order to heat the yarn up to a temperature between the second order and first order transition points for the particular yarn. The blade of the edge crimping device is preferably considerably colder than the heated yarn passing thereover.

Various features and attendant advantages will become apparent to one skilled in the art from a reading of the following detailed description of the invention wherein,

FIGURE 1 is a schematic view in perspective of an apparatus according to the present invention, the apparatus being shown in elasticizing position.

FIGURE 2 is a schematic illustration of a portion of the apparatus of FIGURE 1 showing the apparatus in nonelasticizing position.

FIGURES 3 and 4 are schematic illustrations in side and front elevation respectively of a modified embodiment according to the invention, the device being shown in full line in the elasticizing position and in broken lines in the nonelasticizing position.

FIGURE 5 is a schematic illustration of a length of fully developed yarn according to the invention.

FIGURE 6 is a schematic plan or face view illustration of a section of a fabric constructed of yarn according to the invention.

Referring now in detail to the figures of the drawings, in FIGURE 1 a yarn Y of continuous filament thermoplastic material or a blend including thermoplastic filaments, having any desired number of filaments, is fed from a suitable supply indicated at 11 through suitable guide means illustrated schematically at 13 and a tension regulating device generally indicated at 14 to an intermittent elasticizing arrangement, generally indicated at 15. In the presently illustrated embodiment the elasticizing arrangement takes the form of a sharp edged razor blade 17, the sharp yarn treating edge 17*a* of which has a radius of curvature of approximately .0002–.003" (dependent upon the denier of the yarn), and preferably has any surface roughness removed therefrom. The yarn is preheated through the medium of a suitable heater device which in the presently illustrated embodiment takes the form of an electrically heated strip 19 of metal over which the yarn runs substantially immediately prior to engagement with the sharp edge 17*a* of the edge-crimping blade. The blade 17, heater strip 19, and the guides 13 and 21 for guiding the yarn to and from the heater strip and blade are arranged with respect to each other so as to form a sharp angular bend in the yarn as it proceeds over the edge of the blade, the yarn thus having both a small patent crimp and a relatively large permanent latent crimp formed therein by this passage over and from the blade or such other sharp-edged equivalent element. After passage through the edge-crimping device the thus texturized yarn is fed along a desired path to a suitable takeup arrangement generally indicated at 23.

The latent crimp may be subsequently developed in any suitable manner either prior to or after formation of a fabric therefrom, as by hot moisture, hot air, or contact heater treatment, or by long standing exposure in a more or less relaxed state at normal room temperature or the like.

As the yarn proceeds through the elasticizing device, it is periodically moved into and out of elasticizing position. To this end the yarn is moved away from and into contact with the sharp edge 17*a* of the blade through the medium of an arm 25 loosely pivotally mounted on a pivot pin or shaft 27 which is suitably supported in any desired manner on a suitable support member 29 at one side of the edge crimping blade 17. While any suitable means may be employed for intermittently oscillating the yarn removal yarn from its quiescent position as in FIGURE 1 to its active position as shown in FIGURE 2, the illustrated embodiment includes a rotatable eccentric 31 in the form of a collar 33 secured on the drive shaft 34 of a motor (not shown) and having a short rod or pin 35 suitably secured thereto as by welding in an eccentric position. Rotation of the motor shaft 34 causes the eccentric pin 35 to move the yarn removal arm 25 against the action of a return spring 37 to thereby remove the yarn from and replace the yarn onto the edge crimping blade edge 17*a* once for each rotation of the motor shaft. For a constant speed motor it will thus be apparent that the yarn produced according to this embodiment will have periodic non-random elasticized and unelasticized yarn segments, the relative lengths of the alternate segments being adjustable as by adjustably varying the position of the pivot axis of the shaft 27 and/or the eccentric 31 to alter the ratio of yarn time on and off the blade edge 17*a*. In many instances it will be desirable to have randomly spaced and random lengths of elasticized and unelasticized yarn segments. In such case other suitable means may be employed for moving the yarn removal member in a random fashion.

The yarn engaging edge 25*a* of the yarn removal arm 25 has a much larger radius of curvature (e.g. .030–.120" or more) than that of the sharp edge 17*a* of the crimping blade 17, in order that this yarn engaging edge

surface 25*a* will effect considerably less and preferably substantially little or no edge crimping of the yarn.

In the modified embodiment as illustrated in FIGURE 3 the yarn is fed from a suitable supply source through an intermittent elasticizing arrangement 115 to a yarn takeup arrangement in a manner generally similar to the embodiment of FIGURE 1. In this embodiment the yarn proceeds over the heater strip 119 and edge crimping blade 117 and is removed from the blade edge 117*a* intermittently through the intermittent oscillation of a wire arm 125 having a transversely bent portion 125*a* of relatively large cross sectional radius of curvature (e.g. 1/16") for intermittently removing the yarn Y from the sharp edge crimping edge 117*a* of the blade 117. This yarn removal arm 125 may be oscillated back and forth in any suitable manner, the present embodiment illustrating the employment of a solenoid and return spring arrangement. The armature 131*a* of the solenoid 131 is mechanically interconnected to a lever arm 128 secured on a pivot shaft 127 to which the yarn removal arm 125 is also secured, thus forming in effect a bell crank lever arrangement. In order to provide for adjustment of the stroke of the yarn removal arm the lever arm 128 and the yarn removal arm 125 are preferably adjustably secured to the pivot shaft 127 through the medium of set screw collars 129, 130 to which the respective arms are secured as by welding. A return spring 137 is also connected in opposition to the solenoid, as between the lever arm 128 and a suitable fixed support 139. If desired a suitable stop or stops may be provided for limiting the movement of the lever arm, the active movement of the lever arm in the present embodiment being limited by the engagement of the armature with the ends of the solenoid casing.

The solenoid 131 may be intermittently actuated by any desired intermittent signal generator 141 yielding signals of a desired frequency and duration. While any desired signal generator may be employed for effecting electrical impulses to actuate the solenoid, we prefer in most cases that the signal generator 141 give a more or less random signal output, although in some instances a particular pattern output may be highly desirable in order to give a specific fabric pattern effect.

A length of fully developed yarn produced according to the invention is schematically illustrated in FIGURE 5, and in FIGURE 6 there is shown a schematic plan or face view of a section of a fabric constructed of yarn according to the invention. As generally schematically illustrated in FIGURE 5 it will be noted that the fully developed yarn Y according to the invention has alternate incremental segments which are respectively elasticized and comparatively bulky or voluminous as indicated at 151 and comparatively much less bulky or voluminous as indicated by the substantially straight filament sections designated by the numeral 153. The voluminous incremental segments are representative of the sections of the yarn which have been subjected to elasticizing and bulking by engagement with the sharp crimping edge surface 17*a* or 117*a* of the illustrative embodiments, whereas the comparatively straight less voluminous sections 153 represent the segments of yarn which have been held off the surface of the sharp edge crimping edge 17*a* or 117*a* by the action of the yarn removal member 25 or 125 in the present embodiments. While for illustrative purposes these alternate segments have been shown as substantially equal in length in FIGURE 5, it will be apparent from the teachings herein that one may readily vary the ratio of lengths of the elasticized and bulked incremental segments to the lengths of the substantially unelasticized and unbulked incremental segments. Thus, in some instances it may be desirable to employ relatively long elasticized and bulked segments with very short unelasticized and unbulked segments therebetween, this giving a particular fabric effect with the unelasticized and unbulked segments normally being

predominant to the eye, whereas on the other hand it may be desirable to form a yarn with the substantial unelasticized and unbulked segments much longer than the elasticized and bulked segments, in which case the relatively shorter segments will again have the effect of standing out visually in a fabric formed therefrom. Or it may be desirable in some instances to employ an intermittent single generator or other device which will vary the spacing of the respective incremental lengths of elasticized and unelasticized portions of the yarn during the course of processing the yarn in order to give a different novel effect in a finished fabric.

The small section of fabric F generally illustrated in FIGURE 6 is shown merely for the purpose of illustrating schematically the overall effect to the eye of the surface of a fabric formed of a yarn according to the present invention. The fabric section is illustrated as formed, for example, of loosely woven yarn having yarn according to the present invention in the filling thereof, the yarn being developed either before or after formation of the fabric. It will be apparent that various different surface effects will be obtained either before or after formation in the fabric, the development of the yarn after formation of the fabric having a tendency to draw-up or pucker the fabric surface as a result of effective shrinkage of the overall length of the yarn, particularly in the areas of the elasticized and bulked segments as they lie in the fabric. However, if desired this crinkling effect may be minimized or substantially obviated by making a loosely woven or formed fabric, if such is desired. In the schematically illustrated segment of fabric F the wavy intermittent lines 155 are intended to designate the segments of the yarn which are predominant to the eye from a viewing of the fabric surface, and thus may indicate either the substantially elasticized and bulked segments or unelasticized or unbulked segments, depending upon the ratio of length of the elasticized and bulked segments to the substantially unelasticized and unbulked segments. It will be seen that the wavy lines thus designate a raised appearance when these portions are formed by elasticized and bulked segments, whereas when such is formed by substantially unelasticized and unbulked segments they will be seen by the eye as relatively depressed and comparatively thin. Obviously many pattern variations and formations may be made within the scope of the invention as set forth herein, and it will be readily apparent that this schematic illustration of a fabric is for illustrative purposes only.

Many other modifications and improvements will become apparent to one skilled in the art from a reading of the foregoing description of these illustrative embodiments without departing from the scope and spirit of the invention. It is, therefore, to be understood that the invention is not to be limited to the particular illustrative embodiments, but only by the scope of the appended claims.

That which we claim is:

1. Intermittent yarn-crimping means and means for advancing yarns through said intermittent yarn-crimping means, said intermittent yarn-crimping means comprising an edge-crimping element having a crimping edge engageable by yarn passing thereby and means for intermittently rendering said element ineffective on yarn passing thereby including a member other than said edge-crimping element and movably engageable with yarn passing by said edge-crimping element, said member being movable along a path intersecting transversely the path of yarn passing by said element.

2. Apparatus according to claim 1 wherein said member is an arm pivotally mounted for angular movement, and including means for intermittently moving said arm.

3. Intermittent yarn-crimping means and means for advancing yarn through said yarn-crimping means, said intermittent yarn-crimping means comprising an edge-crimping element having a crimping edge engageable by

yarn passing thereby and means for intermittently rendering said element ineffective on yarn passing thereby, including an arm mounted for angular movement, and means for intermittently moving said arm, said means for intermittently moving said arm being an electro-responsive device.

4. Apparatus according to claim 3 wherein said electro-responsive device is a solenoid, said solenoid being operatively connected in controlling connection to said movable member.

5. Apparatus according to claim 3 further comprising intermittent electrical signal generating means operatively connected in controlling relation to said electro-responsive device.

6. Apparatus according to claim 5 wherein said signal generating means is a random signal generator.

7. Apparatus according to claim 5 wherein said signal generator is a fixed-pattern signal generator.

8. Apparatus according to claim 1 wherein said movable yarn engaging member has a yarn engaging surface thereon, said edge-crimping element having a yarn-engaging-and-crimping surface, said surface on said movable member having a radius of curvature larger than the radius of curvature of said yarn-engaging-and-crimping surface of said edge-crimping element and imparting less crimp to yarn passing thereover than said yarn-engaging-and-crimping surface of said edge-crimping element.

9. Apparatus according to claim 8 wherein said yarn-engaging surface of said movable member imparts substantially no crimp to yarn when engaging therewith.

10. Intermittent yarn-crimping means, means for advancing yarn through said intermittent yarn-crimping means, and heat-applying means for applying heat to said yarn as it passes through said intermittent-yarn-crimping means, said intermittent-yarn-crimping means including a non-rotatable yarn-bending element cooler than the thus heated yarn passing therethrough to thereby effect cooling and crystallization of the heated yarn in a crimp-stressed condition.

11. Apparatus for elasticizing thermoplastic yarn comprising a first yarn contacting member and a second yarn contacting member, means for selectively engaging either of said members with a yarn passing thereby, and guide means for guiding yarn in a sharp angular path over an edge surface of the instant selected one of said members.

12. Apparatus according to claim 11 wherein said edge surface of one of said members is an edge-crimping surface and said edge surface of the other of said members is substantially ineffective to produce an effective crimp in said yarn.

13. Apparatus according to claim 11 wherein said edge-surface of one of said members has a substantially smaller radius of curvature than said edge surface of said other member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,668,564	Laros	Feb. 9, 1954
2,669,001	Keen	Feb. 16, 1954
2,757,436	Nicholl	Aug. 7, 1956
2,854,728	Rainard et al.	Oct. 7, 1958
2,875,502	Matthews et al.	Mar. 3, 1959
2,921,358	Cox et al.	Jan. 19, 1960
2,943,378	Harkenrider et al.	July 5, 1960

FOREIGN PATENTS

203,619	Austria	May 25, 1959
558,297	Great Britain	Dec. 30, 1943