Dec. 27, 1949 V. A. AGRESTI ET AL 2,492,778

YARN TWISTING APPARATUS AND METHOD

Filed Oct. 6, 1948

FIG. 1.

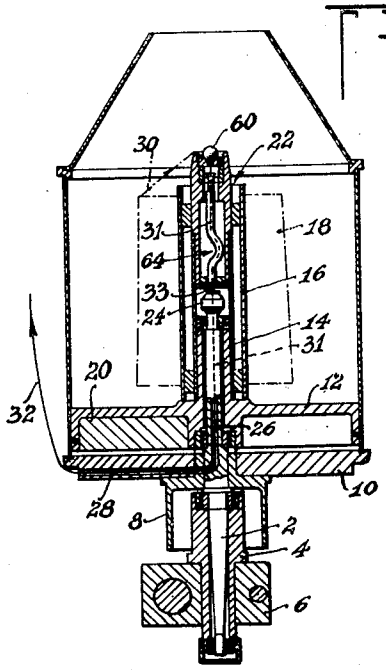


FIG. 2.

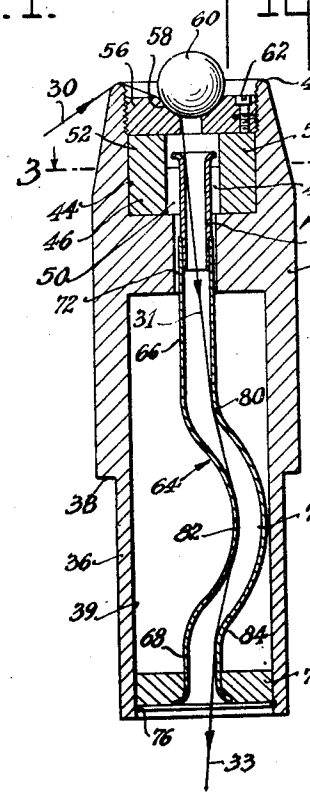


FIG. 3.

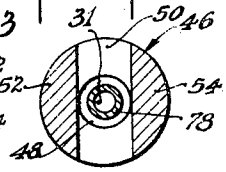


FIG. 5.

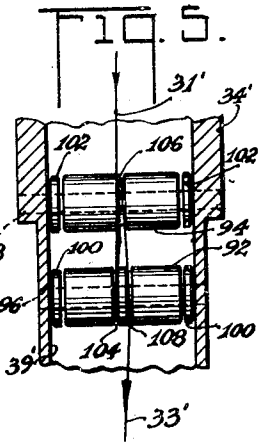


FIG. 4.

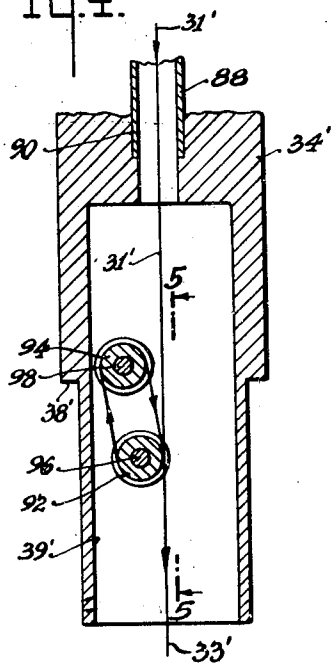
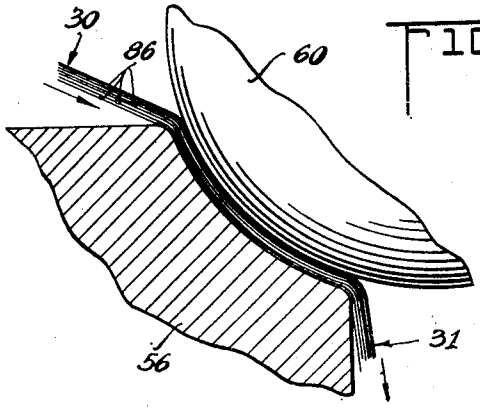


FIG. 6.



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Patented Dec. 27, 1949 2,492,778

UNITED STATES PATENT OFFICE

2,492,778

YARN TWISTING APPARATUS AND METHOD

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Application October 6, 1948, Serial No. 52,994

15 Claims. (Cl. 57—58)

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This invention relates to an apparatus for twisting flexible elongated materials composed at least largely of a plurality of continuous filaments, such as yarn, and to a method of twisting such materials.

The invention has among its objects the provision of apparatus for twisting yarns and the like elongated flexible materials, particularly those composed at least largely of a plurality of fine continuous, substantially parallel, filaments, by which breakage of the filaments as a consequence of their passage through a tension imposing device and subsequently into a twisting means is substantially eliminated.

A further object of the invention resides in the provision of apparatus combining a tension imposing means and a twisting device subsequently operating upon the elongated flexible material with means interposed between the tension and twisting devices to prevent travel of the twist backwardly to the tension device.

The invention has as a still further object the provision of a method of twisting elongated flexible materials composed at least largely of a plurality of fine, continuous, substantially parallel, filaments wherein the material is subjected to retarding tension and is then twisted, the material being so manipulated between such operations that the twist is prevented from extending back to the location of imposition of the tension, whereby the filaments may realign themselves before being twisted together.

These and further objects of the invention will be more readily understood in the following description of preferred embodiments of the apparatus and method in accordance therewith.

It is to be understood that the invention may be used to advantage in various types of apparatus for twisting elongated flexible materials such as yarns, and that it is not necessarily employed in a twisting spindle, or in a twisting spindle of the 2-for-1 type with which the invention is illustrated and described. It is also to be understood that, whereas the elongated flexible material with which the apparatus and method are described as being employed as rayon yarn, the materials with which it is useful may be composed wholly or at least largely of a plurality of elongated, substantially continuous, parallel fibers of whatever origin, such terminology including yarns composed wholly of synthetic fibers such as rayon, nylon, and the like, combinations of such fibers, as well as yarns composed of fine wires.

Prior to the present invention, in the spinning of yarns of the type described, of which rayon is typical, difficulty has been experienced because the twisted threads were undesirably fuzzy. Microscopic examination of the threads showed that the fuzz was composed of the ends of broken filaments. Further research into the problem revealed that the tension imposing and twisting apparatus employed subjected the yarn entering the tension device to such forces that loops were formed in some of the filaments of the yarn prior to its entry into the tensioning device. Such loops travelled through the tension device and were immediately caught in the twisted filaments, since twisting of the yarn began immediately at the exit end of the tension device. Typical loops of the type under discussion, enlarged somewhat in size for ease of illustration, are shown at **86** in Fig. 6 in some of the filaments composing the yarn **30** entering between the elements **56** and **60** of the tension device to be described.

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The apparatus of the invention overcomes such difficulty and produces a thread substantially free from fuzz, that is, broken filaments, by interposing between the tension means and the twisting device, and substantially spaced from the former, a twist barrier, that is, means engaging the yarn as it issues from the tension device and preventing the twist from extending back to the tension device. There is thus provided a path of travel of the yarn, subsequent to the tension device, of substantial extent in which the yarn is subjected to purely tensile forces. Within such path the filaments, subjected to tension by mechanism operating upon the yarn in its forward portion, may realign themselves so that the filaments lie substantially parallel and so that whatever loops in the filaments which have passed through the tension device will be pulled out without breakage of such filaments. The twist is then imposed upon the filaments when they are free from loops and lie substantially parallel to each other; in such condition of the yarn there is no tendency to impose a greater tension on one filament than another, so that practically no breakage of filaments occurs upon twisting.

The invention will be more readily understood by reference to the accompanying drawing, in which

Fig. 1 is a view in axial section through a 2-for-1 twisting spindle embodying the apparatus of the invention;

Fig. 2 is an enlarged view in axial section through the tension imposing and twist barrier device shown in Fig. 1;

Fig. 3 is a view in cross section through the

magnet of the tension device, the section being taken along the line 3—3 in Fig. 2;

Fig. 4 is a fragmentary view in axial section through the lower portion of a tension device incorporating another embodiment of twist barrier;

Fig. 5 is a fragmentary view in cross section through the apparatus of Fig. 4, the section being taken along the line 5—5 in Fig. 4; and

Fig. 6 is a somewhat schematic enlarged fragmentary view in section showing the yarn as it passes into and through the tension device.

The apparatus of the invention, by way of illustration, is shown incorporated in a 2-for-1 twisting spindle of the type illustrated and described in the patent application of Henry C. Uhlig, Serial No. 46,108 filed August 25, 1948, entitled "Flexible elongated member tensioning device." The tension imposing device here shown and described is generally similar to that disclosed and claimed in such Uhlig application. It is to be understood, however, that within the scope of the invention the apparatus and method may be employed in conjunction with any known twisting apparatus employing a tension imposing device and a subsequent, adjacently positioned, yarn twisting device.

The twisting spindle shown in Fig. 1 is provided with a shaft 2 supported for rotation in the sleeve 4 as shown, such sleeve in turn being supported in the member 6 which forms a portion of the frame of a cord twisting machine (not shown). Shaft 2 is driven by the pulley 8 which is designed to be engaged by a driving belt, not shown. Keyed to shaft 2 above the pulley for rotation therewith is the twisting disc 10. Above such disc and floatingly mounted on the upper end of shaft 2 is a bobbin support having a lower flanged portion 12 and an upstanding central tube portion 14 telescoping the upper end of the shaft 2. The bobbin or wound package 18 of yarn to be twisted is provided with a core 16 which is mounted upon tube 14 and held centrally thereof against rotation with respect thereto by top and bottom annular spacers, as shown. In this instance the yarn 30 of which package 18 is composed is a "flat yarn," that is, it is generally of rectangular cross section and is made up of a pluraity of fine, continuous, flexible filaments or fibers lying substantially parallel to each other. The bobbin or package support, and consequently the package, are mounted to float substantially in one angular position by means of eccentrically mounted weight 20 on the flange 12, the shaft 2 being mounted at a small angle to the vertical, as for instance, 12°.

Mounted on top of the bobbin support is the tension device generally designated 22, such device being, as stated, generally of the type disclosed and claimed in the prior Uhlig application. Below the tension device and mounted on the top of the shaft 2 so as to rotate therewith is the twisting guide 24 which engages the yarn as it passes downwardly from the tension device. The yarn is thus given a first twist in that portion of its travel between the tension device and the twisting guide 24. Below such twisting guide the yarn travels through the axial passage 26 in shaft 2 and then through the radial passage 28 in the twisting disc 6, such two passages being connected as shown. The yarn then passes outwardly into the balloon 32, by which the yarn is subjected to tension throughout its length backward to the tension device 22, and upwardly to a guiding eye (not shown) positioned above and coaxial with shaft 2 so that the yarn is given a second twist in its passage through the balloon 32.

In the embodiment of the invention shown in Figs. 1 and 2 the twist barrier interposed between the tension device and the twisting guide takes the form of a bent yarn conducting tube 64, the bend in such tube being sufficient markedly to divert the yarn from the straight path which it otherwise would take between the tension device and the twisting guide, such diversion being sufficient to stop travel of the twist from the twisting guide at the bent portion of the tube. The structure of this embodiment of twist barrier and its relationship to the tension device will be more clearly apparent from a consideration of Fig. 2.

As shown, the tension device and the twist barrier are, for convenience, incorporated in a single supporting member 34. Member 34, which is generally in the form of a right circular cylinder, has its lower end 36 of reduced outer diameter, portion 36 joining the upper part of the body at the shoulder 38. Portion 36, as is evident in Fig. 1, is held non-rotatively with respect to tube 14 by being telescoped within the upper end of the tube 14 of the bobbin support, the shoulder 38 resting on top of such tube. The upper end of body 34 is in the form of an upwardly tapering frustum of a cone, the top edge 42 being rounded to guide the incoming yarn 30 smoothly into the tension device. The upper end of body 34 is provided with an axial counterbore 44 in which is snugly received the integral permanent magnet 46. Such magnet, which performs the same general function as the magnet in the tension device disclosed in the prior Uhlig application, and may be made of the same alloys as those disclosed in connection with such magnet in the said Uhlig application, is generally of right circular cylindrical form, as evident in Fig. 3. A transverse slot through the upper portion of the magnet makes it generally of U cross-section, as shown in Fig. 2, the two upstanding legs being designated 52 and 54 and the bottom connecting portion being designated 50. An axial bore 48 is provided through portion 50 of the magnet to allow reception of the upper, non-magnetic, yarn guiding tube 78. In this embodiment the magnet is magnetized so that one of the upstanding portions, such as 52, is the north pole and the other portion, such as 54, is the south pole.

Positioned in counterbore 44 above magnet 46 is the non-magnetic seat-providing member 56 having the centrally located seat 58, in the form of a portion of a sphere, provided on its upper surface. Such seat communicates with a central axial yarn receiving bore in member 56, as shown. A ball 60, made of magnetic material, and preferably being of the same diameter as the sphere on which seat 58 lies, is retained in the seat through attraction exerted thereon by magnet 46. Yarn 30 passes between the seat 58 and the ball 60, as shown, and is subjected to a retarding tension as a result thereof. Such tension may be varied by varying the attraction between the magnet and ball. In the device shown, this is accomplished by providing a threaded mounting for member 56 in the counterbore 44 so that member 56 may be raised or lowered with respect to the magnet. Member 56 is retained in a desired predetermined adjusted position by means of the locking means 62 which selectively deforms one threaded portion of seat member 56 with respect to the other.

The bent tube 64 has an upper straight axially extending portion 66, a lower straight axially ex-

tending portion 68, and an intermediate bent portion 70 in the form of a shallow U. The bent tube is mounted in body 34 by means of the annular retainer 74 connected to the lower end 68 of the tube and telescoped within the lower end of the large counterbore 39 in the lower portion of body 34. Member 74 is retained in place by means of the spring ring 76 which is snapped into a recess in the wall of counterbore 39 below member 74. Tube 64 is held in coaxial relationship with body 34 by having its upper end snugly received in axial bore 72 in body 34. The upper cord guiding tube 78 is mounted by having its lower end telescoped within the upper end of portion 66 of the bent tube, as shown.

A consideration of the embodiment of the apparatus shown in Figs. 1 and 2 will reveal that the bent portion 70 of tube 64 is of such configuration that, no matter how yarn 31 emerging from the tension device 22 is presented to such tube 64, such yarn engages the inner wall of the tube at at least three points, the upper, first bend 80, the intermediate bend 82, and the lower, last, bend 84. Such engagement of the yarn with the wall of the tube, in conjunction with the tension to which the yarn is subjected, prevents passage at least above the upper bend in the tube 64 of the twist imparted to the yarn in the portion 33 of its travel above the twisting guide. The yarn issuing from the tension device in that portion of its travel designated 31, between such device and at least its first point of engagement with the wall of tube 64, is subjected to a purely tensile force, so that the filaments in the yarn may realign themselves and any loops formed in the filaments will be pulled out before the yarn is subjected to twist in its portion 33.

Although the embodiment of twist barrier shown in Figs. 1 and 2 is to be preferred because of its simplicity, economy, and ease of threading, various other types of twist barriers may be employed within the scope of the invention. One such other twist barrier is shown in Figs. 4 and 5 in which it is incorporated in the lower end of a tension device supporting body similar to member 34 in Fig. 2. Such body and its parts which correspond to those shown in Fig. 2 are designated by the same reference characters primed. In this embodiment of the device, since no bent tube is employed, the upper yarn guiding tube 88 corresponds in function to the tube 78 previously described, is mounted directly on body 34' at 90.

The twist barrier in this instance is composed of rollers engaging the yarn to divert it markedly from the straight line path which it would take between the tension device and the twist guide in the absence of the twist barrier. Two such rollers are employed, the bottom roller being designated 92 and the upper one 94. Such rollers are mounted within the counterbore 39' on axles 96 and 98, respectively, the axles and rollers being retained in place by conventional split spring rings engaging in grooves in the axles, such rings on axle 96 being designated 100 and those on axle 98 being designated 102.

Yarn in the portion 31' of its travel, after having issued from the tension device, not shown in Figs. 4 and 5, is passed first around the groove 104 in roller 92, thence upwardly and around the groove 106 in roller 94, and finally downwardly into the engagement of short angular extent with groove 108 in roller 92, from which it emerges into the path shown at 33'. From path 33' the yarn enters a twisting guide, not shown in Figs.

4 and 5, such as guide 24 shown in Fig. 1. The diversion of the yarn about the guide rollers, in conjunction with the tension imposed on the yarn, is sufficient for such rollers to constitute a twist barrier, substantially no twist reaching the yarn above its engagement with groove 104 in roller 92.

Although we have described and illustrated preferred embodiments of the apparatus for, and a method of, twisting elongated flexible materials such as yarns, it is to be understood that such embodiments are illustrative only since the invention may be varied considerably as to details. The invention is therefore defined within the scope of the appended claims.

We claim as new the following:

1. A tensioning device for yarn or the like travelling in the direction of its length under tension imposed upon it in its forward portion, which comprises means for engaging the yarn in its travel and for imposing a substantial retarding force thereon, and means immediately forward of the yarn engaging means but spaced a substantial distance therefrom for substantially diverting the yarn issuing from the yarn engaging means from a straight line path of travel, the last named means comprising a member having a smoothly curved yarn receiving and conducting surface of such curvature that it substantially prevents travel of twist in the yarn, imparted to the yarn at a location immediately forward of the yarn diverting means, into the span of the yarn between the yarn engaging means and the yarn diverting means.

2. A tensioning device for yarn or the like travelling in the direction of its length under tension imposed upon it in its forward portion, which comprises a first means for engaging the yarn in its travel and for imposing a substantial retarding force thereon, and a second means immediately forward of the first yarn engaging means but spaced a substantial distance therefrom for engaging the yarn issuing from the first yarn engaging means, the second yarn engaging means comprising a member having a curved yarn receiving and conducting passage therethrough of such curvature that the yarn passing through it is substantially diverted from a straight path of travel and so that travel of twist in the yarn, imparted to the yarn at a location forward of the curved passage, into the span of the yarn between the first and second yarn engaging means, is substantially prevented.

3. A tensioning device for yarn or the like travelling in the direction of its length under tension imposed upon it in its forward portion, which comprises a first means for engaging the yarn in its travel and for imposing a substantial retarding force thereon, and a second means immediately forward of the first yarn engaging means but spaced a substantial distance therefrom for engaging the yarn issuing from the first yarn engaging means, the second yarn engaging means comprising a member having a smoothly curved yarn receiving and conducting passage therethrough of such curvature that the yarn passing through the passage is substantially diverted from a straight path of travel, so that travel of twist in the yarn, imparted to the yarn at a location forward of the curved passage, into the span of the yarn between the first and second yarn engaging means, is substantially prevented.

4. A tensioning device for yarn or the like travelling in the direction of its length under tension imposed upon it in its forward portion, which comprises a first means for engaging and com-

pressing the yarn in its travel and thus imposing a subtantial retarding force thereon, and a second means immediately forward of the first yarn engaging means but spaced a substantial d'stance therefrom for engaging the yarn issuing from the first yarn engaging means, the second yarn engaging means comprising a member having a smoothly curved yarn receiving and conducting passage therethrough, an intermediate portion of which is of shallow U-shaped curvature, the curvature of the passage being such that the yarn passing through the passage is subjected to but a small retarding force as a result thereof but is substantially diverted from a straight path of travel so that travel of twist in the yarn, imparted to the yarn at a location forward of the curved passage, into the span of the yarn between the first and second yarn engaging means, is substantially prevented.

5. A tensioning device for yarn or the like travelling in the direction of its length under tension imposed upon it in its forward portion, which comprises a first means for engaging the yarn in its travel and for imposing a substantial retarding force thereon, such first means comprising a first member, said first member having an aperture therethrough, at least a portion of the wall of the aperture being in the shape of a portion of a sphere and constituting a seat and a yarn engaging surface past which the yarn travels, a second member in the form of a sphere supported in the seat, the sphere being movable into and away from the seat in the first member, the yarn being compressed between the seat and the sphere, and means to press the sphere into the seat, and a scond means immediately forward of the first yarn engaging means but spaced a substantial distance therefrom for engaging the yarn issuing from the first yarn engaging means, the second yarn engaging means comprising a member having a smoothly curved yarn receiving and conducting passage therethrough, an intermediate portion of which is of shallow U-shaped curvature, the curvature of the passage being such that the yarn passing through the passage is substantially diverted from a straight path of travel so that travel of twist in the yarn, imparted to the yarn at a location forward of the curved passage, into the span of the yarn between the first and second yarn engaging means, is substantially prevented.

6. Apparatus for twisting elongated flexible material such as yarn which comprises means engaging the forward portion of the yarn to impel the yarn under tension in the direction of its length through the twisting aparatus, a tension means engaging the yarn in its travel and imposing a substantial retarding force thereon, a yarn twisting guide forward of the tension means and receiving yarn therefrom, means to rotate the twisting guide relative to the tension means, and yarn engaging means positioned intermediate the tension means and the twisting guide and immediately forward of the tension means, but spaced substantial distances from both the tension means and the twisting guide, for substantially diverting the yarn issuing from the tension means from a straight line path of travel between the tension means and the twisting guide, said last named yarn engaging means being so constructed and arranged as substantially to prevent travel of the twist in the yarn, imparted thereto by the twisting guide, into the span of the yarn between the tension means and such last named means.

7. Apparatus for twisting elongated flexible material such as yarn which comprises driven means engaging the forward portion of the yarn to impel the yarn under tension in the direction of its length through the twisting apparatus, a tension means engaging the yarn in its travel and imposing a substantial retarding force thereon, a yarn twisting guide forward of the tension means and receiving yarn therefrom, means to rotate the twisting guide relative to the tension means, and yarn engaging means positioned intermediate the tension means and the twisting guide and immediately forward of the tension means, but spaced substantial distances from both the tension means and the twisting guide, for substantially diverting the yarn issuing from the tension means from a straight line path of travel between the tension means and the twisting guide, whereby substantially to prevent travel of the twist in the yarn, imparted thereto by the twisting guide, into the span of the yarn between the tension means and such last named means, the last named means comprising a member having a smoothly curved yarn receiving and conducting passage therethrough, an intermediate portion of which is of shallow U-shaped curvature.

8. Apparatus for twisting elongated flexible material such as yarn which comprises driven means engaging the forward portion of the yarn to impel the yarn in the direction of its length through the twisting apparatus under tension, a tension means engaging the yarn in its travel and imposing a substantial retarding force thereon, said tension means comprising a first member, said first member having an aperture therethrough, at least a portion of the wall of the aperture being in the shape of a portion of a sphere and constituting a seat and a yarn engaging surface past which the yarn travels, a second member in the form of a sphere supported in the seat, the sphere being movable into and away from the seat in the first member, the yarn being compressed between the seat and the sphere, and means to press the sphere into the seat, a yarn twisting guide forward of the tension means and receiving yarn therefrom, means to rotate the twisting guide relative to the tension means, and yarn engaging means positioned intermediate the tension means and the twisting guide and immediately forward of the tension means but spaced substantial distances from both the tension means and the twisting guide for substantially diverting the yarn issuing from the tension means from a straight line path of travel between the tension means and the twisting guide, whereby substantially to prevent travel of the twist in the yarn, imparted thereto by the twisting guide, into the span of the yarn between the tension means and such last named means, the last named means comprising a member having a smoothly curved yarn receiving and conducting passage therethrough, an intermediate portion of which is of shallow U-shaped curvature.

9. The method of twisting elongated flexible material such as yarn or the like consisting at least largely of a plurality of individual continuous filaments lying generally parallel to each other in the direction of the length of the yarn, which comprises feeding such yarn in the direction of its length in a zone of substantial length, within such zone performing on the yarn the following steps: impelling the yarn forwardly at the forward end of such zone, applying a retarding force to the yarn at the rear end of such zone

whereby the yarn is maintained under tension, feeding the yarn, from the location of application of the retarding force, in a straight line for an appreciable distance, at the end of such straight-line path diverting the yarn markedly from a straight line by engagement of the yarn by a diverting member, restoring the yarn in its travel, at a location forward of such diversion, to a path generally parallel to that between the points of application of the retarding force and of the diversion, and twisting the yarn at a location forward of its restoration to a straight line path of travel by rotating its forward portion about its longitudinal axis relative to its portion rearwardly of the point of diversion, the tension in the yarn and its path of travel during such diversion being such that travel of the twist in the yarn into the span of the yarn between the points of application of the retarding force and of the diversion is substantially prevented, whereby the filaments may realign themselves under tension into substantially parallel relationship after being subjected to the retarding force and before being twisted together.

10. The method of twisting elongated flexible material such as yarn or the like consisting at least largely of a plurality of individual continuous filaments lying generally parallel to each other in the direction of the length of the yarn, which comprises feeding such yarn in the direction of its length in a zone of substantial length, within such zone performing on the yarn the following steps: impelling the yarn forwardly at the forward end of such zone, applying a retarding force to the yarn at the rear end of such zone by compressing the yarn between yarn engaging members whereby the yarn is maintained under tension, feeding the yarn from the location of application of the retarding force in a straight line for an appreciable distance, at the end of such straight-line path diverting the yarn markedly from a straight line by engagement of the yarn by a smoothly curved diverting member, restoring the yarn in its travel, at a location forward of such diversion, to a path generally parallel to that between the points of application of the retarding force and of the diversion, and twisting the yarn at a location forward of its restoration to a straight line path of travel by rotating its forward portion about its longitudinal axis relative to its portion rearwardly of the point of diversion, the tension in the yarn at the location of its diversion and its path of travel during such diversion being such that travel of the twist in the yarn into the span of the yarn between the points of application of the retarding force and of the diversion is substantially prevented, the engagement between the yarn and the smoothly curved diverting member being such as to impose a primarily circumferential force on the yarn while not adding materially to the tension in the yarn, whereby the filaments may realign themselves under tension into substantially parallel relationship after being subjected to the retarding force and before being twisted together.

11. The method of twisting elongated flexible material such as yarn or the like consisting at least largely of a plurality of individual continuous filaments lying generally parallel to each other in the direction of the length of the yarn, which comprises feeding such yarn in the direction of its length in a zone of substantial length, within such zone performing on the yarn the following steps: impelling the yarn forwardly at the forward end of such zone, applying a retarding force to the yarn at the rear end of such zone by compressing the yarn between yarn engaging members whereby the yarn is maintained under tension, feeding the yarn from the location of application of the retarding force in a straight line for an appreciable distance, at the end of such straight-line path diverting the yarn markedly from a straight line by engagement of the yarn with a member having a yarn receiving and conducting passage in the shape of a U curve restoring the yarn in its travel, at a location forward of such diversion, to a path generally parallel to that between the points of application of the retarding force and of the diversion, and twisting the yarn at a location forward of its restoration to a straight line path of travel by rotating its forward portion about its longitudinal axis relative to its portion rearwardly of the point of diversion, the depth of the U-shaped curve of diversion and the tension in the yarn at the location of its diversion being such that travel of the twist in the yarn into the span of the yarn between the points of application of the retarding force and of the diversion is substantially prevented, whereby the filaments may realign themselves under tension into substantially parallel relationship after being subjected to the retarding force and before being twisted together.

12. Apparatus for twisting elongated flexible material such as yarn which comprises driven means engaging the forward portion of the yarn to impel the yarn under tension in the direction of its length through the twisting apparatus, a tension means engaging the yarn in its travel and imposing a substantial retarding force thereon, a yarn twisting guide forward of the tension means and receiving yarn therefrom, means to rotate the twisting guide relative to the tension means, and yarn engaging means positioned intermediate the tension means and the twisting guide and immediately forward of the tension means, but spaced substantial distances from both the tension means and the twisting guide, for substantially diverting the yarn issuing from the tension means from a straight line path of travel between the tension means and the twisting guide, whereby substantially to prevent travel of the twist in the yarn, imparted thereto by the twisting guide, into the span of the yarn between the tension means and such last named means, the last named means comprising a member having a smoothly curved yarn receiving and conducting surface.

13. A tensioning device for yarn or the like travelling in the direction of its length under tension imposed upon it in its forward portion, which comprises means for engaging the yarn in its travel and for imposing a substantial retarding force thereon, and means immediately forward of the yarn engaging means but spaced a substantial distance therefrom for substantially diverting the yarn issuing from the yarn engaging means from a straight line path of travel, the last named means comprising a yarn guiding roller journalled on an axis substantially at right angles to the path of travel of the yarn from the yarn engaging means, yarn issuing from the yarn engaging means being guided around the roller in contact with a substantial angular extent of the roller, such roller substantially preventing travel of twist in the yarn, imparted to the yarn at a location immediately forward of the yarn diverting means, into the span of the yarn be-

tween the yarn engaging means and the yarn diverting means.

14. Apparatus for twisting elongated flexible material such as yarn which comprises means engaging the forward portion of the yarn to impel the yarn under tension in the direction of its length through the twisting apparatus, a tension means engaging the yarn in its travel and imposing a substantial retarding force thereon, a yarn twisting guide forward of the tension means and receiving yarn therefrom, means to rotate the twisting guide relative to the tension means, and yarn engaging means positioned intermediate the tension means and the twisting guide and immediately forward of the tension means, but spaced substantial distances from both the tension means and the twisting guide, for substantially diverting the yarn issuing from the tension means from a straight line path of travel between the tension means and the twisting guide, said last named yarn engaging means comprising a yarn guiding roller journalled on an axis substantially at right angles to the path of travel of the yarn from the yarn engaging means, yarn issuing from the yarn engaging means being guided around the roller in contact with a substantial angular extent of the roller, such roller substantially preventing travel of the twist in the yarn, imparted thereto by the twisting guide, into the span of the yarn between the tension means and such last named means.

15. Apparatus for twisting elongated flexible material such as yarn which comprises driven means engaging the forward portion of the yarn to impel the yarn under tension in the direction of its length through the twisting apparatus, a tension means engaging the yarn in its travel and imposing a substantial retarding force thereon,

a yarn twisting guide forward of the tension means and receiving yarn therefrom, means to rotate the twisting guide relative to the tension means, and yarn engaging means positioned intermediate the tension means and the twisting guide and immediately forward of the tension means, but spaced substantial distances from both the tension means and the twisting guide, for substantially diverting the yarn issuing from the tension means from a straight line path of travel between the tension means and the twisting guide, whereby substantially to prevent travel of the twist in the yarn, imparted thereto by the twisting guide, into the span of the yarn between the tension means and such last named means, the last named means comprising a yarn guiding roller journalled on an axis substantially at right angles to the path of travel of the yarn from the yarn engaging means, yarn issuing from the yarn engaging means being guided around the roller in contact with a substantial angular extent of the roller.

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