

June 10, 1958

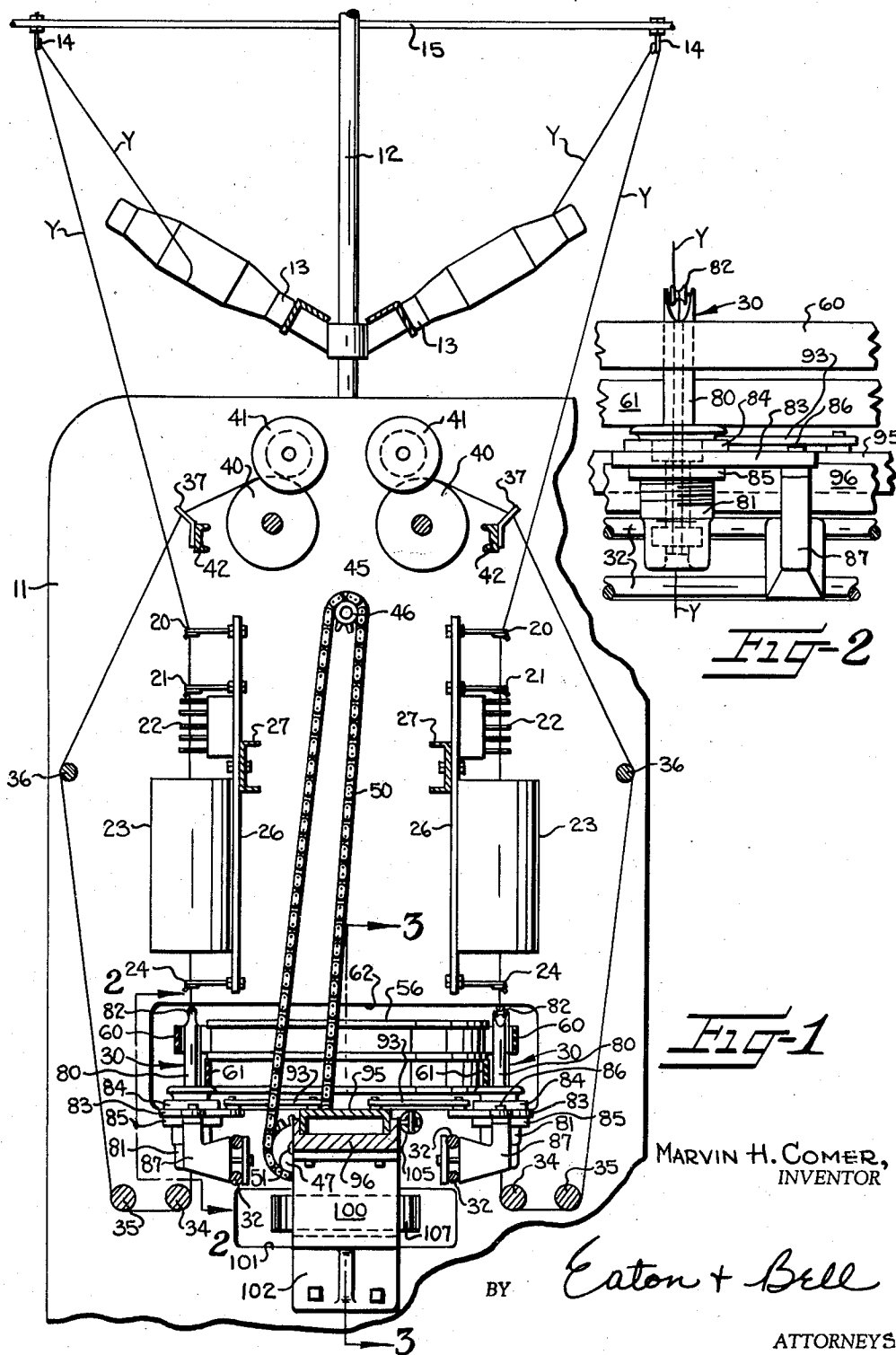
M. H. COMER

2,837,889

PRODUCTION OF LIVELY YARNS

Filed Oct. 17, 1955

3 Sheets-Sheet 1



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3 Sheets-Sheet 3

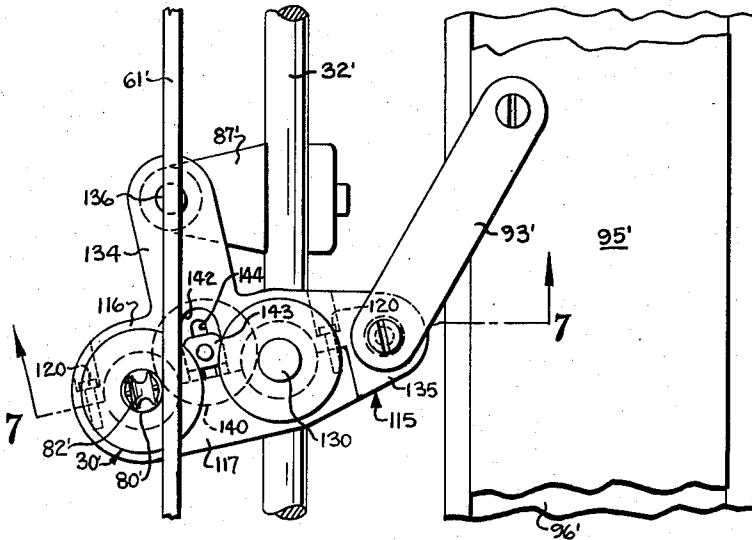


Fig-5

Fig-6

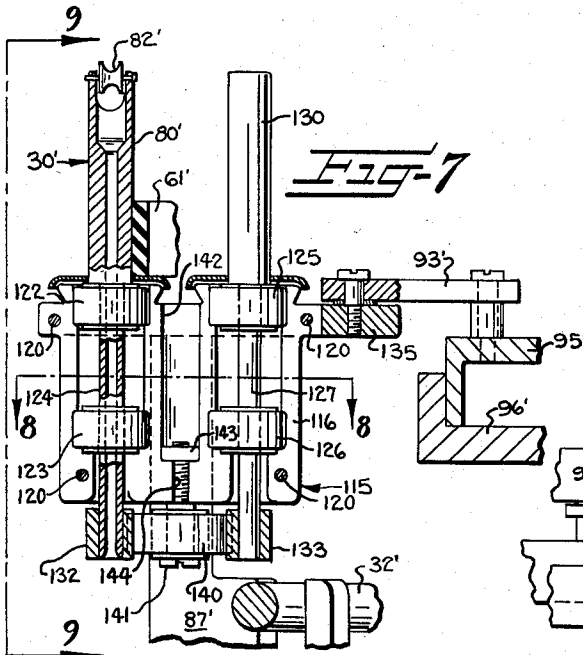


Fig-7

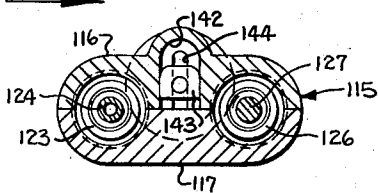
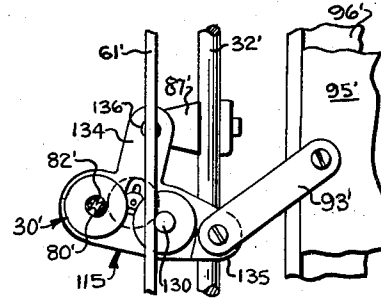


Fig-8

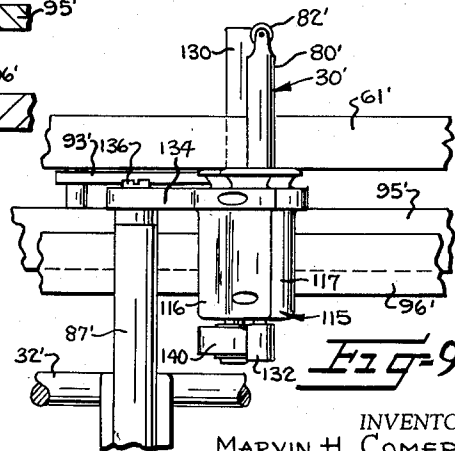


Fig-9

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ATTORNEYS

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2,837,889

PRODUCTION OF LIVELY YARNS

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Application October 17, 1955, Serial No. 541,010

9 Claims. (Cl. 57—104)

This invention relates to the production of lively synthetic yarns such as nylon and the like and, more especially, to improvements in apparatus for and the method of imparting twist to the yarn.

In the knitting of stretchable hosiery and other stretchable fabrics made from synthetic yarn it is customary to knit spaced portions or courses from a yarn which has been twisted in one direction and to knit intervening portions or courses from a yarn which has been twisted in the opposite direction in order that the torque influenced in the fabric by the yarns is equalized in opposite directions and to thereby prevent the resultant product from curling or twisting, i. e., so the resultant product will lie flat. The use of two oppositely twisted yarns has many disadvantages including the requirement for two yarn feeds in knitting operations, excessive time and expense, etc.

It is obvious that it would be highly desirable to produce a single end of yarn which is lively throughout its length, but which has a balanced torque, so as to obtain stretchability in the resulting product without the necessity of using oppositely twisted yarns. Present equipment cannot be used to produce a satisfactory yarn which is lively throughout its length and which has portions thereof twisted in opposite directions due to the fact that the twist is imparted by means of a rotating spindle or other twister element and no means, heretofore, have been devised for providing a substantially instantaneous change in direction of rotation of said spindle. Unless the direction of rotation of the spindle or other twister element can be changed substantially instantaneously, a lag or untwisted area will result between each adjacent pair of portions of twisted or lively yarn. This results in a yarn which is not lively throughout its length so that the resulting fabric is not uniform as to its stretchability and is blemished with streaks or shadow lines caused by the untwisted or lag areas in the yarn. Such lag areas, in addition to reducing stretchability of the resulting product, make the yarn difficult to control due to variations in tension throughout the length of the yarn, which is particularly critical in the knitting operation.

It is therefore an object of this invention to provide an improved method of and means for producing twisted lively synthetic yarn which includes twisting individual ends of monofilament yarn in one direction for a predetermined interval while heating the yarn sufficiently to set the twist therein and at the terminus of the first twisting operation, immediately reverse twisting the yarn in the opposite direction also while subjecting the yarn to sufficient heat to set the twist therein and repeating this process throughout the length of the yarn to thereby produce a lively yarn in which those portions which are twisted in one direction are immediately contiguous to portions thereof which are twisted in the opposite direction.

In order to impart twist to the yarn in accordance with the above process, yarn passes from a yarn source,

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through a tensioning device or devices and then through a heating unit, then through a hollow twister spindle having a roller or the like at its upper end about which the yarn passes prior to passing through the hollow twister spindle, and from the lower end of the twister spindle, the yarn is suitably guided to a driven take-up roll or spool. The twist is imparted to the yarn by imparting rotation to the spindle first in one direction and then the other. It is essential that the change from one twist direction to another takes place substantially simultaneously. Attempts to use a reversible motor driving a belt which engaged the spindles have failed due to the fact that it is necessary to stop the motor momentarily each time a change in direction of movement of the belt is made.

In order to eliminate any momentary dwell of the spindles between each change in direction of rotation, method and means are provided for changing the direction of spindle rotation without any lag. One embodiment of the invention comprises a pair of continuously driven endless belts, both of which are driven in the same direction and which are provided with corresponding pairs of spaced parallel runs which move past opposite sides of the spindles. Means are provided for alternately shifting the spindles into engagement with the adjacent belt runs so that, when the spindles are in engagement with one of said belt runs, they are rotated in one direction and when the spindles are shifted into engagement with the other of the belt runs, instantaneous rotation is imparted to the spindles in the opposite direction thus insuring that there is no lag between changes in the direction of rotation of the spindles and thereby providing a yarn which has adjacent portions thereof twisted in opposite directions with the oppositely twisted adjacent portions being disposed in contiguous relationship, i. e., without intervening untwisted portions between adjacent oppositely twisted portions.

Another embodiment of the present invention resides in a dummy spindle or shaft spaced from and extending parallel to each twister spindle with a transmission roller engaging the dummy spindle and the twister spindle. A single belt run extends between the dummy spindle and the twister spindle so that shifting of the two spindles relative to the belt run causes them to alternately engage the belt run to alternately impart rotation to the twister spindle in opposite directions.

The yarn and resulting fabric produced by means of this invention are believed to be novel and are claimed in separate applications.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which—

Figure 1 is a somewhat schematic transverse vertical sectional view through a twisting machine showing a preferred embodiment of means for carrying out the steps of the improved method of reverse twisting synthetic yarns;

Figure 2 is an enlarged fragmentary view taken substantially along line 2—2 in Figure 1 showing the twister spindle, the improved mounting therefor and the arrangement of portions of the spindle driving belts;

Figure 3 is a somewhat schematic longitudinal vertical sectional view taken substantially along line 3—3 in Figure 1 and showing parts of the machine disposed to the left of the line 3—3 of Figure 1 for purposes of clarity;

Figure 4 is a somewhat schematic sectional plan view of the structure shown in Figure 3;

Figure 5 is a fragmentary top plan view of a modified form of means for alternately driving twister spindles in opposite directions;

Figure 6 is a view similar to Figure 5, on a reduced scale, showing the spindle assembly in a different position;

Figure 7 is a vertical sectional view taken substantially along line 7—7 in Figure 5;

Figure 8 is a fragmentary sectional plan view taken substantially along line 8—8 in Figure 7;

Figure 9 is an elevation of the modified form of spindle driving means, on a reduced scale, taken looking substantially along the line 9—9 in Figure 7.

Referring more specifically to the drawings, the preferred form of the invention is shown in Figures 1 through 4 wherein portions of a conventional twisting machine are illustrated to which improved apparatus for carrying out the steps of the improved method of twisting yarn is applied. The twisting machine comprises longitudinally spaced head end and foot end frame members 10, 11 which support a suitable creel 12. The creel 12 carries a plurality of upwardly and outwardly angularly disposed pirns or yarn packages 13 from each of which a strand of yarn Y passes upwardly and outwardly through a yarn guide 14, the yarn guide 14 preferably being of the pigtail type and being supported on suitable cross bars 15 of the creel 12. A suitable disk-type yarn tension device may be substituted for the yarn guide 14, if desired.

The yarn at each side of the machine extends downwardly and inwardly from its yarn guide 14 and then downwardly successively through another pair of vertically spaced yarn guides 20, 21, a conventional gate tensioning device 22, a tubular heating unit 23 and a yarn guide 24. The yarn guides 20, 21, 24, gate tensioning device 22 and heating unit 23 may be supported on a common upright bar 26. A plurality of such upright bars 26 are preferably provided, one for each of the strands of yarn Y and the upright bars 26 at each side of the machine are suitably secured to longitudinally extending frame members 27 suitably secured at opposite ends thereof to the frame members 10, 11.

The lowermost yarn guide 24, in each instance, is spaced closely above the upper end of a twister head or twister spindle assembly broadly designated at 30 and which may be of any desired or conventional construction. The twister heads or spindle assemblies 30 are supported in a novel manner at each side of the machine, on twister rails or bars 32. The spindle assemblies 30 are each of tubular construction and the yarn passes downwardly therethrough, is twisted thereby and then passes partially around inner and outer lower guide bars 34, 35 and then upwardly against the outer surface of an intermediate guide bar 36 and, thence, through a traversing thread guide 37. Each yarn Y then passes upwardly and inwardly from its corresponding traversing thread guide 37, over a take-up roll 40 upon which a conventional bobbin or spool rests and about which the twisted yarn is wound.

The rods 34, 35, 36 are suitably supported by the end frame members 10, 11 and the traversing thread guides 37 on each side of the machine are supported on conventionally driven traverse bars 42. The take-up rolls 40 are driven through conventional gearing, not shown, connected with a shaft 45 on which a sprocket wheel 46 is mounted, said sprocket wheel 46 being connected with a sprocket wheel 47 by means of a sprocket chain 50. The sprocket wheel 47 is fixed on a shaft 51 (Figure 1) which extends through the foot end frame member 11, is journaled in a housing 52 fixed to the foot end frame member 11, and has a worm 53 fixed thereon which meshes with a worm gear 54 fixed on a vertical shaft 55 which is also journaled in the housing 52.

Instead of the usual single groove pulley being mounted on the shaft 55, an improved double-grooved pulley 56 is fixed on the upper end of shaft 55 and is engaged by upper and lower endless belts 60, 61. Opposed runs of

the upper and lower belts 60, 61 extend lengthwise of the twister machine and through suitable openings 62, 63 provided in the foot end member 11 and the head end member 10, respectively. The end of the twister machine opposite from the pulley 56 is provided with a multi-grooved pulley or double-grooved pulley 65 fixed on a driven shaft 66, which shaft in this instance, is shown as being the shaft of an electric motor 67. The pulleys 56, 65 and belts 60, 61 are important elements of the present invention as will be more clearly described hereinafter.

The electric motor 67 may be supported by any desired or conventional means and, in this instance, the motor 67 is supported in a bracket 70 having spaced pairs of rollers 71, 72 thereon which are guided in track members 73, 74. The inner ends of the track members 73, 74 are suitably secured to the head end member 10 and the outer ends thereof are supported on a suitable out-board frame member 75. A suitable take-up means may be provided for the pulley 65 and, to this end, an internally threaded bracket 76 is fixed to the outer surface of the head end frame member 10 and has a screw 77 threaded therein which extends outwardly therefrom and engages the inner surface of the motor support bracket 70.

Each spindle assembly 30 comprises a hollow or tubular spindle or body 80 which extends downwardly into and is journaled in a bolster 81 and whose bifurcated or slotted upper end has a roller 82 journaled therein. The bolster 81 loosely penetrates a swing arm 83 and has a flange 84 on its upper portion which engages the upper surface of the swing arm 83. A nut 85 is threaded onto the lower portion of the bolster 81 and serves to removably secure the bolster 81 in the swing arm 83. It will be observed in Figures 2 and 4 that the swing arm is pivotally supported, as at 86, on a spindle swing arm bracket 87 suitably secured to the corresponding pair of rods or rails 32. It will be noted that each twister head or spindle assembly 30 is mounted for individual swinging movement and the body or spindle 80 thereof extends upwardly between complementary runs of the upper and lower endless belts 60, 61, said runs being closely spaced so the spindles 80 engage the corresponding runs of only one of the belts at a time.

In order to space complementary runs of the belts 60, 61, it is preferable that the runs of one of the belts, say the belt 61, extends in a straight line between the peripheries of the grooved pulleys 56, 65 and that the runs of the other of the belts, such as 60, extend outwardly and engage guide rollers 90, 91 each of which is journaled on a vertical shaft 92, whose upper end is fixed in a block 93 suitably secured to the corresponding frame member 10 or 11, as the case may be.

Now, the pulleys 56, 65 and endless belts 60, 61 are driven constantly and in the same direction and, in order to cause instantaneous changes in the direction of rotation of the spindles 80 and to correspondingly cause an instantaneous change in the direction in which twist is imparted to the yarn by each twister head 30, it will be observed in Figures 1, 2, 3 and 4 that each of the swing arms 83 has one end of a lever 93 pivotally connected thereto and extending inwardly therefrom at an angle relative to the longitudinal axis of the machine. The inner ends of the levers 93 are all pivotally connected to a reciprocable bar or slide 95 which is guided for longitudinal sliding movement, relative to the axis of the machine, in a channel-shaped guide or frame member 96.

The right-hand end of frame member 96 (Figure 3) is connected, by means of a bracket 97, to the head end frame member 10 and the left-hand end thereof is fixed to the upper end of one leg of a substantially L-shaped bracket 100. It will be noted that the horizontal leg of bracket 100 is substantially longer than the vertical leg thereof and this horizontal leg extends through an opening 101 formed in the foot end frame member 11 and

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has a downwardly projecting flange 102 thereon which is suitably secured to the inner surface of the frame member 11.

The left-hand end or foot end of the slide 95 has a downwardly projecting cam follower 103 thereon which is urged into engagement with the periphery of a cam wheel 104 by means of a tension spring 105, one end of which is connected to the slide 95 and the other end of which is connected to the foot end frame member 11 (Figures 1, 3 and 4).

The cam wheel 104 may be of any desired shape, according to the desired pattern of the reversely twisted portions of the yarn, and is shown in Figure 4 as having equally divided high and low surfaces thereon. The cam wheel 104 is fixed on the upper end of a shaft 106 which extends downwardly and is journaled on the horizontal portion of bracket 100. A gear 107 is fixed on the lower portion of shaft 106 and meshes with an intermediate or change gear 108 which, in turn, meshes with a pinion or gear 109. The gear 109 is fixed on the lower portion of shaft 55 and the shaft 55 may also be journaled in the horizontal portion of bracket 100. The gear 108 may also be suitably journaled on the bracket 100.

As is usual, the yarn Y passes downwardly from the heating unit 23, through the yarn guide 24 and then encircles the roller 82 of the corresponding twister head 30 and then passes downwardly through the spindle 80 in the manner heretofore described. When the low surface of cam 104 (Figure 4) is in engagement with the cam follower 103, the spring 105 then urges the spindles 80 outwardly into engagement with the corresponding runs of the endless belt 60. Assuming that the driven shaft 66 is then imparting rotation to the pulleys 65, 56 and belts 60, 61 in a counter-clockwise direction in Figure 4, the outer runs of the belt 60 impart counter-clockwise rotation to all of the spindles 80 simultaneously. After a predetermined amount of twist has been imparted to the yarn with rotation of the spindles 80 in a counter-clockwise direction, the high surface of the cam wheel 104 engages the roller 103 to move the slide 95 from left to right in Figure 4 and to thus impart a short, quick inward movement to each of the swing arms 83 and the corresponding spindle assemblies or twister heads 30. Thus, the spindles 80, while still rotating in a counter-clockwise direction, are suddenly moved into contact with the inner runs of the belt 61 which, after applying a slight braking action to the spindles 80, immediately impart reverse rotation thereto; i. e., in a clockwise direction in Figure 4. This movement of the spindles 80 in a clockwise direction obviously continues until the low surface of the cam wheel 104 again moves into engagement with the cam follower 103.

It is apparent that the length of the intervals during which rotation is imparted to the spindles 80 in either direction may be determined by changes in the ratios of gears 107, 108, 109 and may also be varied by varying the configuration and size of the cam wheel 104.

Modified form of spindle drive

Referring to Figures 5 through 9, a modified form of spindle assembly and drive is shown wherein the twister spindle itself is of generally conventional construction but wherein only one of the belts shown in Figures 1, 2, 3 and 4 need be used. Those parts shown in Figures 5 through 9 which are substantially the same as parts shown in Figures 1 through 4 will bear the same reference characters with the prime notation added to avoid repetitive description and to also minimize the number of drawings required for a clear illustration thereof.

The spindle assembly or twister head unit in Figures 5 through 9 is broadly designated at 30' and also includes the body portion or twister spindle 80' and the roller 82' in the bifurcated upper end thereof. In this instance, the swing arm is in the form of a housing broadly designated at 115 and which is formed in two sections or halves 116, 117 suitably secured together as by screws 120. Instead

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of using a bolster such as that indicated at 81 in Figure 2, the swing arm 115 of the modified form of the invention serves as the bolster and a pair of upper and lower bearings 122, 123 are provided in the housing 115 in which the reduced lower portion 124 of the twister spindle 80' is journaled. Spaced inwardly of the bearings 122, 123 is a pair of upper and lower bearings 125, 126 in which a reduced lower portion 127 of a dummy spindle or vertical shaft 130 is journaled, the bearings 125, 126 also being fixed in the housing or swing arm 115.

The housing 115 is made in two parts 116, 117 in order to facilitate the positioning of the bearings 122, 123, 125, 126 therein as best shown in Figures 5, 7 and 8.

It will be noted that the dummy spindle or vertical shaft 130 is of substantially the same diameter as the spindle 80' and is spaced inwardly therefrom. The reduced lower portions 124, 127 of the twister spindle 80' and the dummy spindle 130, respectively, extend downwardly below the housing 115 and have respective enlarged portions or rollers 132, 133 fixed thereon or integral therewith which are also preferably of the same external diameter as that of the twister spindle 80' and the dummy spindle 130.

It will be noted that the upper portion of the swing arm or housing 115 has a pair of outwardly projecting portions 134, 135 thereon, the portion 134 being pivotally connected, as at 136, to the upper end of the corresponding swing arm support bracket 87' and the projection 135 being pivotally connected to the corresponding link 93'.

Now, the slide 95' may be reciprocated by any suitable means, such as that shown in the left-hand portions of Figures 3 and 4, to move the same between the positions shown in Figures 5 and 6 and to, in turn, alternately move the twister spindle 80' and the dummy spindle 130 into and out of engagement with the belt 61' extending between the spindles 80', 130. It is apparent that the belt 61' functions in the usual manner to rotate the twister spindle 80' by direct contact therewith. Now, when the swing arm or housing 115 is moved from the position shown in Figure 5 to that shown in Figure 6, rotation is imparted to the dummy spindle 130 in the opposite direction from which rotation is imparted to the twister head spindle 80' when the swing arm 115 occupies the position shown in Figure 5.

In order to transmit like rotation from the dummy spindle 130 to the twister spindle 80', it will be noted that the enlarged portions or rollers 132, 133 on the lower ends of the reduced portions 124, 127 of the respective spindles 80', 130' engage a common intermediate roller or transmission roller 140 which is preferably in the form of an anti-friction bearing covered with a suitable friction material such as neoprene, rubber, leather or the like. The roller 140 is journaled on a stud 141 which is shown in the form of a shoulder screw and whose threaded upper end penetrates the lower central portion of the housing or swing arm 115 as best shown in Figures 5, 7 and 8.

The section 116 of the housing 115 has a vertically extending slot 142 therein in which a nut 143 is loosely positioned, the walls of the slot 142 preventing rotation of the nut 143. The lower portion of the housing or swing arm 115 has an adjustment slot 144 therein of less width than the slot 142 and this slot 144 is loosely penetrated by the threaded upper end of the shoulder screw 141, and the threaded upper end of the shoulder screw 141 is threaded into and through the nut 143. Thus, the transmission roller 140 may be adjusted toward and away from the rollers 132, 133 on the lower end of the reduced portions 124, 127 of the respective spindles 80', 130 in order to insure that the transmission roller 140 is in frictional contact with the rollers 132, 133.

It will thus be observed that, when rotation is transmitted to either of the spindles 80' or 130, the corresponding roller 132, 133 imparts rotation to the other of the

spindles by means of the intervening transmission roller 140. Although only a single twister head unit is shown in Figures 5 through 9, it is apparent that the twister machine, such as that shown in Figures 1, 3 and 4, would have a plurality of such units thereon and, of course, the belt 61' may be mounted and driven in substantially the same manner as the belt 61 in Figure 4.

It is thus seen that, as each strand of yarn Y passes through the corresponding heating unit 23, it is twisted by the corresponding twister head 30 or 30' so the yarn is actually twisted while it is within the heating unit and while it is subjected to the setting temperature and, after a predetermined number of turns of twist have been imparted to a predetermined length of the yarn, rotation is imparted to the corresponding spindle or twister head in the opposite direction without any delay between the interval of rotation in one direction and the interval of rotation in the other direction to thereby insure that the yarn is twisted throughout its length.

In practice, it has been found that adjacent oppositely twisted portions of the yarn may be from six inches to one-hundred inches long, regardless of the denier of the yarn, although it is preferable that the recurring lengths or portions of the yarn twisted in each direction are approximately fifty inches long, since in knitting the usual stocking, each course requires approximately twelve and one-half inches of yarn and a fifty inch length of yarn is, thus, equivalent to approximately four knit courses. In other words, in knitting a stocking in which each oppositely twisted portion of the yarn is fifty inches long, spaced groups of four courses, with four intervening courses therebetween, would be twisted in one direction and the four intervening course, in each instance, would be twisted in the other direction. Of course, it is contemplated that the yarn may be unbalanced; i. e., portions or a portion of the yarn twisted in one direction may be thirty inches long and the adjacent portions or portion of the yarn twisted in the other direction may be sixty inches long, for example.

Present demand for lively yarns is predominantly for sheer or monofilament yarns and this invention will have its primary use with such yarns. It is to be understood that, however, it may be used equally as well with multifilament or thermoplastic yarns of any practical size or denier and which are capable of being heat set to produce lively or stretchable characteristics. For example, such yarns as "Arnel"; a triacetate, "Dacron"; a polyester, or other thermoplastic yarns may be used.

In twisting monofilament yarn it is preferable that each heating unit 23 subjects the corresponding strand of yarn to a temperature of 450° F., although this temperature may vary from 300° F. to 500° F. just so long as the temperature exceeds any subsequent temperatures to which the yarn or fabric produced therefrom may be subjected.

Yarns of all denier from seven denier to forty denier may be twisted from five to seventy-five turns per inch although it is preferred that the number of turns of twist per inch imparted to the yarn be varied according to the denier of the yarn substantially as appears in the following table:

Denier of yarn	Preferred number of turns per inch
7	45
10	40
12	35
15	30
20	30
30	30
40	30

It is thus seen that I have provided an improved method of and means for producing single ends of yarn having contiguous oppositely twisted portions therein throughout the length thereof, which method is made

possible by the provision of means for instantly reversing the direction of rotation of the twister head spindles without any lag or delay between the intervals of rotation of the spindles in one direction and rotation of the spindles in the opposite direction. There are many different types of twister machines with which the present apparatus may be used and, accordingly, only so much of the twister machine has been described as is deemed necessary to a clear understanding of the present invention. It is also apparent that many modifications may be made to the machine and to the particular mechanism used for shifting the spindles inwardly and outwardly relative to the belt or belts, as the case may be, or between the adjacent runs of the belts without departing from the spirit of the invention.

In the drawings and specification there have been set forth preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. A method of imparting reverse twist to a yarn which comprises passing the yarn through a twister head spindle while applying heat to the yarn and while rotating the twister head spindle in one direction by engagement of the spindle with one of a pair of moving belts for a predetermined period to impart twist to a predetermined length of the yarn, shifting the spindle out of engagement with said one of the belts and into engagement with the other belt to impart rotation to the twister head spindle in the opposite direction without any delay between the intervals of rotation of the spindle in one direction and the intervals of rotation of the spindle in the other direction.

2. In a twisting machine having a plurality of twister spindles thereon and having continuously moving belt means movable adjacent said spindles; the combination therewith of pattern controlled means for imparting lateral reciprocatory shifting movement to the spindles, and said belt means being adapted to impart rotation to the spindles in one direction when the spindles occupy one position and being adapted to impart rotation to the spindles in the opposite direction when the spindles occupy the other position.

3. In a twisting machine having constantly moving belt means thereon and a plurality of twister spindles positioned adjacent the belt means, means to impart movement to the spindles laterally of their respective axes and said belt means being adapted to rotate the spindles in one direction with lateral movement of the spindles in one direction and being adapted to impart rotation to the spindles in the opposite direction with lateral movement of the spindles in the other direction.

4. In a twisting machine; a pair of closely spaced, parallel constantly moving belt runs thereon, a plurality of twister spindles positioned between the belt runs, means to impart reciprocatory movement to the spindles laterally of their respective axes with a dwell between each movement in each direction for moving the spindles from engagement with one of the parallel belt runs to engagement with the other whereby one of said belt runs rotates, the spindles in one direction upon lateral movement of the spindles in one direction and the other belt run imparts rotation to the spindles in the opposite direction upon lateral movement of the spindles in the other direction.

5. In a structure according to claim 4, said means to impart reciprocatory movement to the twister spindles comprising a swing arm in which each of said spindles is journaled, means supporting said swing arm for pivotal movement thereon about a substantially vertical axis, an elongated member mounted for longitudinal movement in said machine, a link connecting each of said swing arms to said elongated member, and pattern controlled means

for selectively shifting said elongated member in opposite directions in alternation longitudinally of said machine to impart corresponding inward and outward movements to the swing arms.

6. In a twisting machine having a plurality of twister heads each comprising a spindle, the combination of a pair of constantly moving substantially parallel belt runs movable in a common direction and extending past opposite sides of said spindles, and means for swinging the spindles into engagement with the two belt runs whereby one of the belt runs imparts rotation to the spindles in one direction and the other of the belt runs imparts rotation to the spindles in the other direction.

7. A structure according to claim 6 wherein said means for alternately shifting the spindles into engagement with the two belt runs is cam controlled.

8. In a twisting machine having at least one row of substantially upright twister spindles thereon and a continuously moving belt normally engaging said spindles for imparting rotation thereto in one direction; the combination of a dummy spindle disposed in spaced parallel relation to each of said twister spindles, said belt extending between each twister spindle and its dummy spindle, means to swing each twister spindle out of engagement with the belt at predetermined intervals and serving to swing the corresponding dummy spindles into engage-

ment with said belt whereby the belt imparts rotation to dummy spindles in the opposite direction from which rotation is imparted to the twister spindles, and means for transmitting rotation from each dummy spindle to the corresponding twister spindle in the same direction as the dummy spindle whenever the dummy spindle engages said belt.

9. In a structure according to claim 8, said means for swinging the twister spindles into and out of engagement with the belt and for alternately shifting the dummy spindles into and out of engagement with the belt comprising a swing arm in which said spindles are journaled, means supporting said swing arm for pivotal movement thereon about a substantially vertical axis, an elongated member mounted for longitudinal movement in said machine, a link connecting each of said swing arms to said elongated member, and pattern controlled means for selectively shifting said elongated member in opposite directions, in alternation, longitudinally of said machine to impart corresponding inward and outward movements to the swing arms.

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