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Dupeuble

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[54] **FRICTION FALSE TWISTING DEVICE**

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[63] Continuation of Ser. No. 329,987, Feb. 6, 1973, abandoned.

[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **57/77.4**

[51] **Int. Cl.** **D01h 7/92;** D02g 1/04

[58] **Field of Search** ..... 57/34 HS, 77.3, 77.45

[56] **References Cited**

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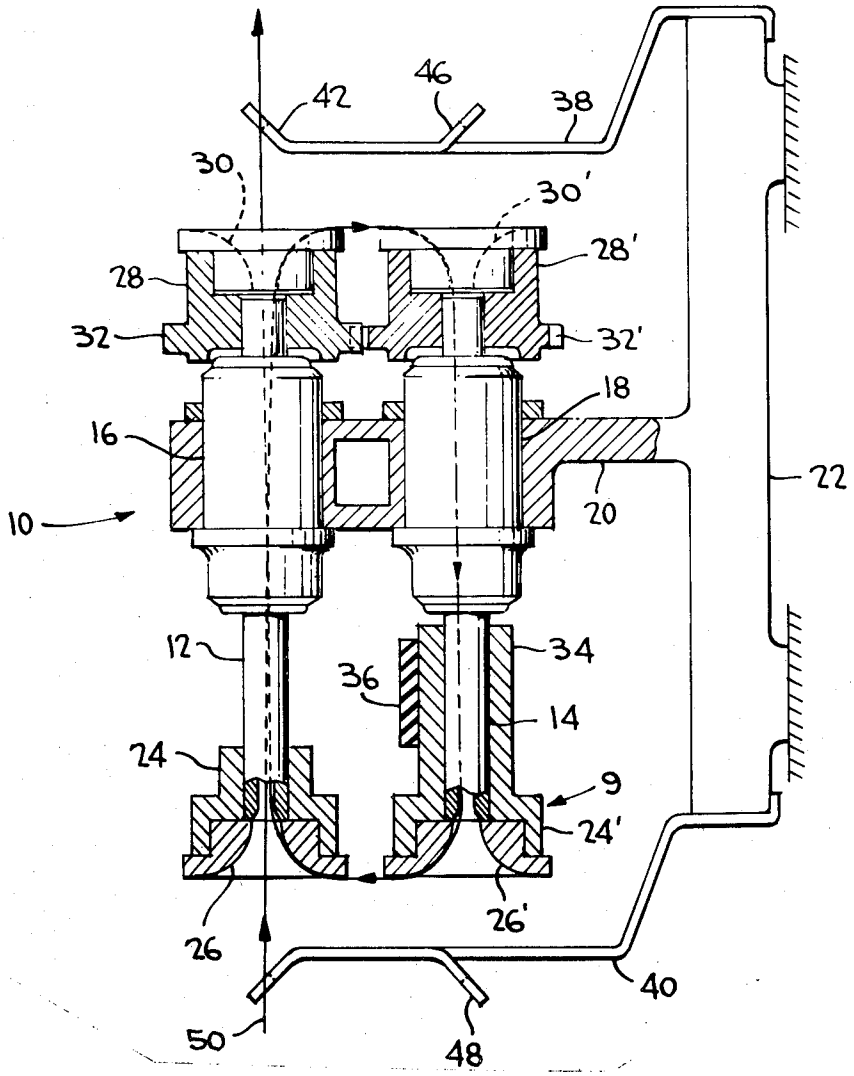
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[57] **ABSTRACT**

A friction false twisting device for texturizing yarn including at least three friction elements rotatably contacting yarn to be texturized, each of the friction elements being formed of a polished material having a coefficient of friction less than 0.5, high hardness and minimal elasticity, preferably the polished material being a ceramic with a high content of titanium oxide or fritted alumina having a Rockwell hardness HRC greater than 60, a coefficient of friction within the range of 0.410 to 0.450 and an elasticity of practically zero.

8 Claims, 2 Drawing Figures



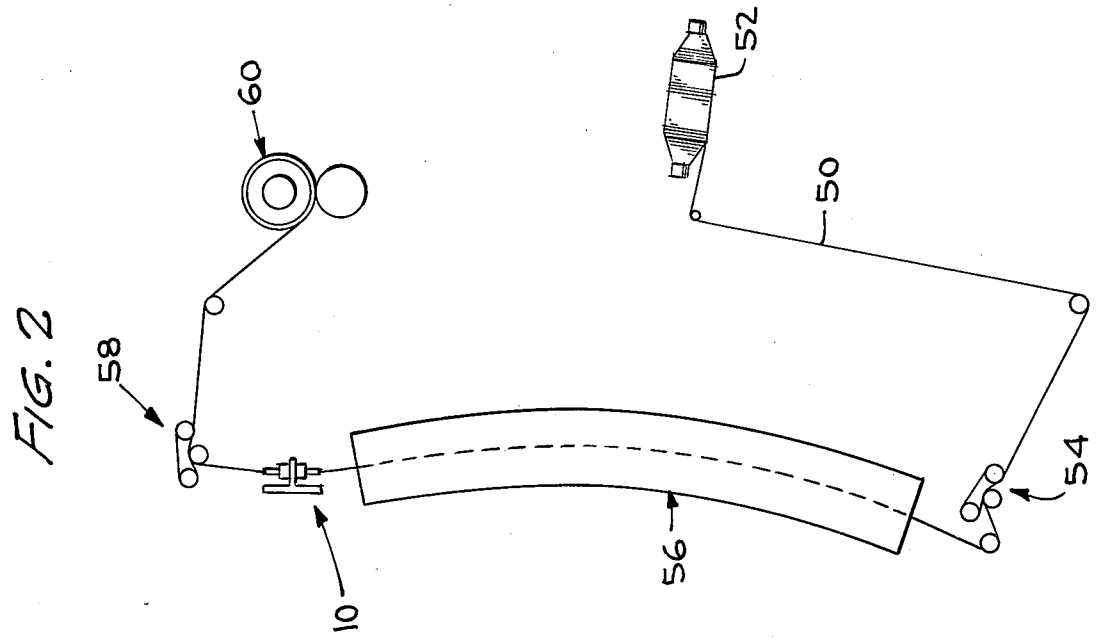

60
52
50
58
54
56
10

FIG. 2

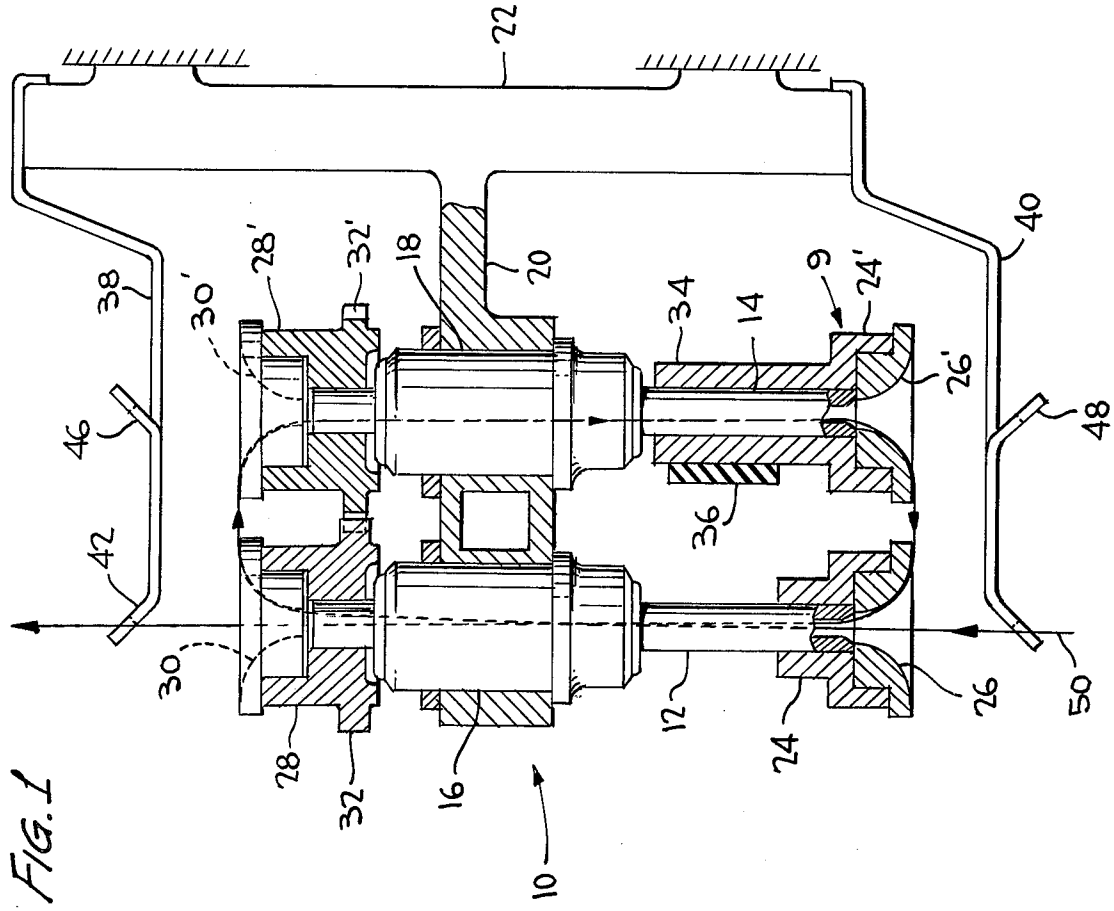

22
40
38
30'
28'
32'
18
20
34
14
9
24'
26'
48
46
42
36
30
50
12
26
28
32
16
24
10

FIG. 1

FRICTION FALSE TWISTING DEVICE

This is a continuation of application Ser. No. 329,987, filed Feb. 6, 1973, and now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to the false twisting of yarn and, more particularly, to a friction false twisting device for texturizing a yarn by contacting the yarn with a friction element.

2. Discussion of the Prior Art.

It is well known to texturize yarn with a false twisting process wherein a moving yarn is contacted with a friction element to modify the elasticity, diameter and/or texture of the yarn. This false twisting process is normally implemented by moving a yarn to be texturized over the friction surface of an element also being moved, the element being made of a material whose essential and principal characteristics are a high coefficient of friction, a slight hardness and a prescribed elasticity. The movement of the friction surface is such that the yarn receives a temporary twist which is set thermally by any suitable means.

Many devices have been proposed to implement the above described process. For instance, French Pat. No. 1,158,478 discloses a friction false twisting device constructed of a rotary twisting tube or spindle having an inner surface made of a non-abrasive material having a high coefficient of friction with the yarn to be texturized passing on the inside of the tube in contact with the inner surface. Such twisting tube is constructed of a rubber casing rounded at opposite ends with the yarn being held in contact along the entire length of the inner casing surface.

French Pat. No. 1,183,720 and Italian Pat. No. 698,343 are exemplary of friction false twisting devices constructed of two hollow, cylindrical tubes or spindles having parallel axes and rotating in opposite directions, the yarn to be texturized passing on the inner surface of the elements and rubbing against the ends thereof which are constructed of a material having a high coefficient of friction. The ends of these friction false twisting devices are constructed of a material that is non-abrasive in nature and has a high coefficient of friction, slight hardness and is relatively elastic, such as natural or synthetic rubber. In practice, such material has coefficients of friction above 0.5, and has a prescribed elasticity and a slight hardness of the order of 70° Shore. While such friction false twisting devices provide excellent test results, they have important disadvantages in practical, industrial applications in that it has been found that the friction surfaces have a tendency to wear and become dirty rather quickly such that the surfaces do not present a constant coefficient of friction, both with respect to time during continuous use thereof and from one spindle to another. That is, the properties and characteristics of the materials of the friction elements vary during operation from one fabrication lot to another and, of course, this represents a disadvantage when it is desired to produce large amounts of the same texturized yarn in that characteristics of the texturized yarn vary from one spindle to another and even vary on the same spindle with respect to time. These variations in the characteristics of the texturized yarn are reflected principally in the fabric or knit made with the yarn having a poor dyeing affinity, differing shrinkages, irregular surface appearance, and the like, either in the same article or from one article to the next.

French Pat. No. 2,034,422 is exemplary of a friction false twisting device wherein yarn is texturized by passing the yarn twice over an annular friction surface, the friction surface being made of a ceramic material having a high coefficient of friction. The use of ceramic material has been found to increase the life of the friction surface and increase the continuous characteristics of the friction surface; however, the use of the ceramic material has been found to have the disadvantage of decreasing the resistance to breaking of the yarn in comparison with the use of rubber friction surfaces.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a friction false twisting spindle assembly overcoming the above-mentioned disadvantages of the prior art.

More particularly, it is an object of the present invention to texturize yarn with a friction false twisting device utilizing friction elements formed of a material with high hardness, minimal elasticity and a low coefficient of friction to provide uniform texturizing during continuous use of the device and from device to device with minimal wear on the friction element without increasing breakage tendency of the yarn.

Another object of the present invention is to construct a friction false twisting device with at least three friction elements, the friction elements having a base of polished material with a coefficient of friction less than 0.5, and presenting high hardness, such materials including those with a Rockwell hardness HRC greater than 60 and practically non-existant elasticity.

An additional object of the present invention is to construct a friction false twisting spindle assembly having a plurality of friction elements wherein each friction element is in the form of a ring or toroid having a convex, internal surface against which the yarn is moved, there being at least three successive friction elements for contacting the yarn in order to obtain good results, while the thickness, elasticity and regularity of the yarn is further improved if the yarn contacts four successive friction elements.

A further object of the present invention is to provide a friction false twisting device for texturizing yarns to provide the yarns with high resistance to breaking and uniform characteristics from one such device to the next and on the same such device during continuous use thereof.

The present invention has another object in that a friction false twisting device utilizes at least three friction elements made of material having a slight coefficient of friction, high hardness and slight elasticity, such friction elements having any desired configuration such that yarn to be texturized contacts an inner surface thereof, such as for instance a rotating disc forming each friction element, the yarn contacting the surface of the disc and the device including at least three successive rotating disc friction elements.

Yet a further object of the present invention is to utilize two rotating, tubular spindles turning in opposite directions for friction false twisting yarn, the spindles carrying at each of their ends a friction ring and cooperating with thread guides positioned, respectively, above and below the rotating spindles to correctly position the yarn when the spindle assembly is started.

Some of the advantages of the present invention over the prior art are that yarn texturized by the friction false twisting device of the present invention has regular characteristics from device to device and during continuous use of a single spindle and the life of the friction elements is increased by utilizing materials to form the friction elements having a small coefficient of friction, high hardness and practically zero elasticity, such as a ceramic material having a high content of titanium oxide or fritted alumina.

The present invention is generally characterized in a friction false twisting device for texturizing yarn including at least three friction elements for movably contacting yarn to be texturized, each of the friction elements being formed of a polished material having a coefficient of friction less than 0.5.

Other objects and advantages of the present invention will become apparent from the following description of the preferred embodiment taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagramatic side elevation partly in section of a friction false twisting device according to the present invention.

FIG. **2** is a diagramatic representation of a texturizing process utilizing the friction false twisting device of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A friction false twisting device **10** according to the present invention is illustrated in FIG. **1** as a spindle assembly including parallel, hollow spindles **12** and **14** which are rotatably mounted by means of housings **16** and **18,** respectively, on a support **20** fixed to a frame **22.** Spindle **12** has a mounting cup **24** secured to a lower end thereof mounting a friction element **26** in the form of a ring having a toroidal friction surface. Similarly, at its upper end, spindle **12** has fixed thereto a mounting cup **28** mounting a friction element **30** in the form of a ring having a toroidal friction surface. Mounting cup **28** is provided peripherally with teeth **32** to permit opposite rotation of spindle **12** relative to spindle **14,** as will be described hereinafter.

Spindle **14** is constructed in substantially the same fashion s spindle **12** and, accordingly, the parts of spindle **14** have been given the same reference numbers with primes added and are not described again. Mounting cup **24'** housing friction element **26',** however, is elongated to provide a cylindrical drive surface **34** driven by tangential contact with a belt **36.**

Yarn guide members **38** and **40** are disposed above and below the spindle assembly **10** with the yarn guide members **38** and **40** including yarn guides **42** and **44,** respectively, aligned with spindle **12** and yarn guides **46** and **48,** respectively, aligned with spindle **14.**

The friction false twisting device **10** is illustrated in FIG. **2** for use in a process for texturizing yarn wherein yarn **50** to be texturized is pulled from a spool **52** by a delivery assembly **54** and passes through a heating unit **56** prior to being texturized by the friction false twisting device **10.** The yarn exiting friction false twisting device **10** is pulled by a delivery device **58** and wound on a spool **60.** If it is desired to set the false twist supplied by the assembly **10,** a second heating unit can be placed downstream of the friction false twisting device **10** and upstream of the winding system.

The yarn guides **42, 44, 46** and **48** are utilized to initially position the yarn extending through the spindle assembly and generally are not used in normal texturizing operations. As yarn **50** passes through spindles **12** and **14,** which rotate in opposite directions due to the meshing, of teeth **32** and **32',** the yarn successively contacts friction elements **30, 30', 26'** and **26.** If desired, however, the yarn guides may be utilized to permit the yarn **50** to contact only specific ones of the friction elements.

The friction elements **26, 26', 30** and **30'** are constructed of a polished material presenting high hardness and minimal elasticity, preferably such material being a ceramic having a high content of titanium oxide or fritted alumina, such as those marketed under the tradename "TITAL," particularly TS2, TS14 and T10. Such materials preferably have a Rockewell hardness greater than 60, practically zero elasticity and a coefficient of friction less than 0.5 and, thus, it will be appreciated that such materials could not have been used to form friction elements of prior art false twist devices since the above-mentioned characteristics of the materials utilized to form the friction elements of the present invention not only differ, but are opposite those characteristics desired by the prior art to provide contact with a yarn to be texturized in movement with a friction element. Preferably, materials to be used for the friction elements of the present invention have coefficients of friction between 0.410 and 0.450, the coefficients of friction being measured relative to friction elements having a curved surface on the Buckle and Politt apparatus, the arc made by the yarn on the curved surface being 80°. Of course, while ceramic materials are preferred, other materials can be utilized to form the friction elements of the present invention, such other materials including, for example, chrome steel, glass or any suitable materials having the above described characteristics of hardness, elasticity and coefficients of friction.

The following example is presented for purposes of illustration only and cannot in any way be construed as limiting the present invention.

EXAMPLE

A polyhexamethylene adipamide yarn, **22** dtex/**7** strands, was subjected to the action of friction elements of the spindle assembly of FIG. **1,** the travel of the yarn being that represented in the figure. The treatment conditions were the following:

Nature of the friction elements:
Material:TITAL type 14, diamond finish,
Rockwell hardness HRC:78,
Coefficient of friction:0.420
Speed of rotation of spindles 12 and 14:25,000 rpm
Speed of yarn (winding):300 meters per minute
Temperature of heating unit: 215°C.

The coefficient of friction was measured on a Buckle and Politt apparatus, the arc made by the yarn on the convex friction surface being 80°.

To show the advantages of the present invention, the yarn was treated under the same conditions on six spindle assemblies. The treated yarn presented the following properties:

Spindle Assembly No.	1	2	3	4	5	6
INSTRON Resistance in g/dtex	4.50	4.60	4.50	4.50	4.50	4.50
INSTRON Elongation in %	22	23	21	23	22	23

These yarns were knitted and the six samples obtained had an identical and regular appearance and, after dyeing, it was found that they presented a very regular dyeing affinity.

By way of comparison, the same yarn was treated on a spindle assembly of the same type but utilizing four standard friction elements of elastomer (polyurethane).

The operating conditions were the following:

Speed of rotation of the spindles **12** and **14**:20,000 rpm

Speed off yarn (winding):300 meters per minute

Temperature of heating unit:215°C.

The yarn thus treated presented the following characteristics:

INSTRON resistance:3.9 g/dtex

Elongation at breaking:25.5

It was found that the yarn treated on the device according to the present invention had excellent dynamometric qualities. In contrast with spindles with a ceramic friction surface previously known, the resistance to breaking was not diminished and in comparison with spindles with an elastomer friction surface, it was even improved.

The above example relates to a polyhexamethylene adipamide yarn, but it is obvious that the device of the present invention can be used to treat any type of yarn. Further, the winding speed given at 300 meters per minute is not a limit, and the yarn could be wound at considerably higher speeds without harming the qualities of the product obtained.

The above example clearly shows that the friction false twisting device of the present invention, in which the friction element surfaces have a base of a polished material with high hardness, practically zero elasticity and a relatively small coefficient of friction, makes it possible to obtain a resistant texturized yarn, with great regularity, without defect, and presenting remarkable touch, swelling and elasticity qualities, the yarn being reproducible easily from one friction false twisting device to the next and during continuous use of the same friction false twisting device.

Inasmuch as the present invention is subject to many variations, modifications and changes in detail, it is intended that all subject matter described above or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A friction false twisting device for texturizing yarn comprising at least three friction elements for movably contacting yarn to be texturized, each of said friction elements being formed of a polished material having a coefficient of friction less than 0.5, high hardness and minimal elasticity.

2. A friction false twisting device for texturizing yarn as recited in claim **1** wherein said polished material has a Rockwell hardness HRC greater than 60.

3. A friction false twisting device for texturizing yarn as recited in claim **2** wherein said polished material has a coefficient of friction within the range of from 0.410 to 0.450.

4. A friction false twisting device for texturizing yarn as recited in claim **3** wherein said polished material is a ceramic with a high content of titanium oxide or fritted alumina.

5. A friction false twisting device for texturizing yarn as recited in claim **4** and further comprising a pair of parallel, oppositely rotating, hollow spindles, one of said friction elements being disposed at each of the ends of said spindles and each of said friction elements having a toroidal configuration.

6. A friction false twisting device for texturizing yarn as recited in claim **1** wherein said polished material has a coefficient of friction within the range of from 0.410 to 0.450.

7. A friction false twisting device for texturizing yarn as recited in claim **1** wherein said polished material is a ceramic with a high content of titanium oxide or fritted alumina.

8. A friction false twisting device for texturizing yarn as recited in claim **1** and further comprising a pair of parallel, oppositely rotating, hollow spindles, one of said friction elements being disposed at each of the ends of said spindles and each of said friction elements having a toroidal configuration.

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