United States Patent [19]

Ruddell

[11] 3,751,894

[45] **Aug. 14, 1973**

[54] **FALSE TWISTING OF YARNS**

[75] Inventor: **James Nelson Ruddell,** Portadown, Northern Ireland

[73] Assignee: **Lambeg Industrial Research Association**

[22] Filed: **Mar. 5, 1970**

[21] Appl. No.: **16,915**

[30] **Foreign Application Priority Data**

Mar. 17, 1969	Great Britain	13,848/69
Mar. 8, 1969	Great Britain	12,344/69
Mar. 17, 1969	Great Britain	13,847/69

[52] **U.S. Cl.** ..... **57/34 HS,** 28/72.13, 57/77.45, 57/157 TS, 57/167

[51] **Int. Cl.** **D02g 1/02,** D02g 1/04

[58] **Field of Search** ..... 57/34 HS, 157 TS, 57/167, 156, 77.3, 77.45, 58.89–58.95; 28/72.11, 72.13, 1.3

[56] **References Cited**

UNITED STATES PATENTS

3,516,240	6/1970	Fain	57/157 TS
3,035,396	5/1962	Biggers	57/34 HS
3,148,520	9/1964	Biggers	28/72.13 X
3,178,795	4/1965	Warthen	28/72.11
3,360,838	1/1968	Comer et al.	28/72.13
3,423,924	1/1969	Comer et al.	57/157 TS
3,112,600	12/1963	Stoddard et al.	57/34 HS
3,137,119	6/1964	Crouzet	57/157 TS
3,180,074	4/1965	Smith	57/77.45

FOREIGN PATENTS OR APPLICATIONS

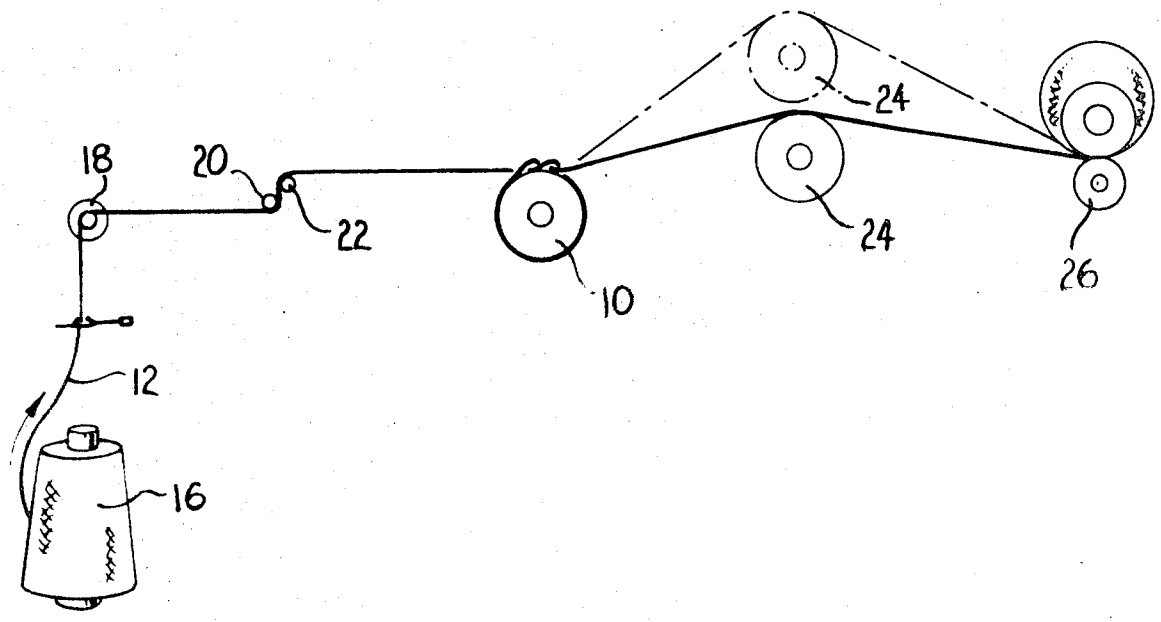
227,591	4/1960	Australia	57/152 TS
1,074,322	3/1954	France	57/34 HS

Primary Examiner—John Petrakes
Attorney—Fleit, Gipple & Jacobson

[57] **ABSTRACT**

This invention concerns the false twisting of strands as for example, yarns, tapes and films. The false twisting is effected as the strand is continuously travelled around a freely rotatable roller in the form of a loop, the beginning and end of which constitutes a close simple knot in contact with the roller periphery. The frictional contact of the strand with itself at the knot causes false twist to run back in the strand. The stand leaves the roller in a non-tangential direction. This method of false twisting may be used as a substitute for known methods in the production of modified continuous filament yarns, or to produce preliminary or additive false twist in such cases; in the treatment of wet-spun linen yarns to improve their characteristics; and in the treatment of film either to separate pre-formed filaments therein or to fibrillate it.

15 Claims, 8 Drawing Figures



Patented Aug. 14, 1973 3,751,894

FIG 1

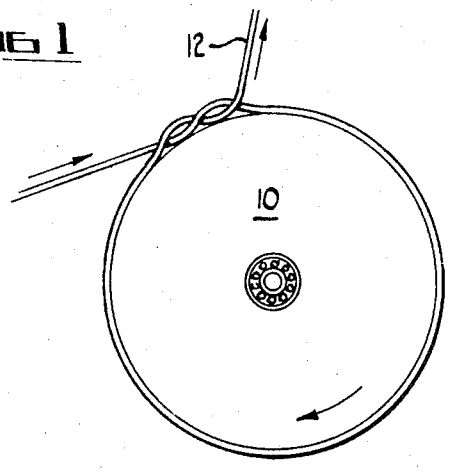
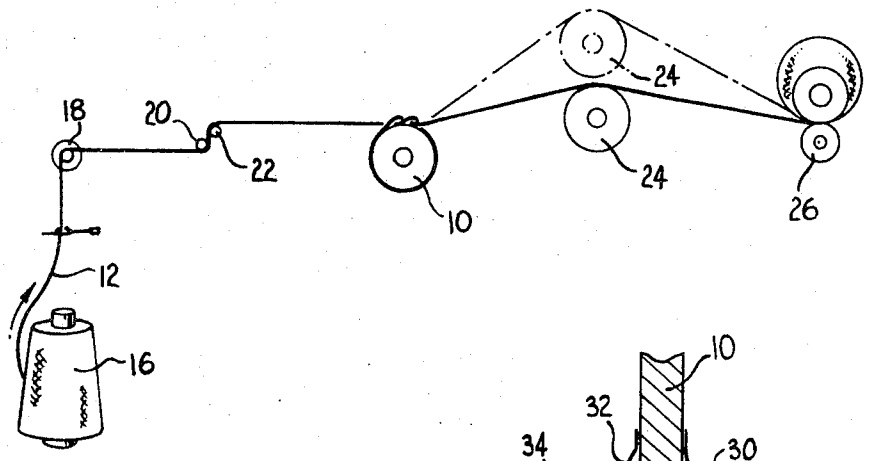


FIG 2



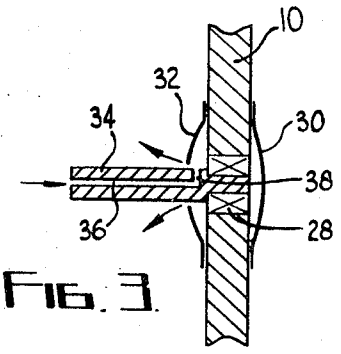
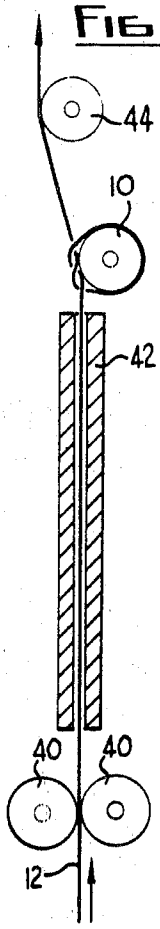


FIG. 3

INVENTOR:
James Nelson Ruddell
BY
Fleit, Gipple & Jacobson
Attorneys

FIG. 4.



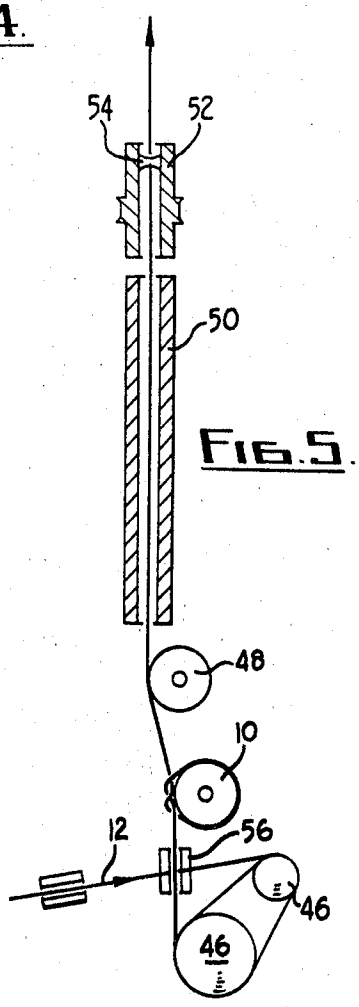


FIG. 5.

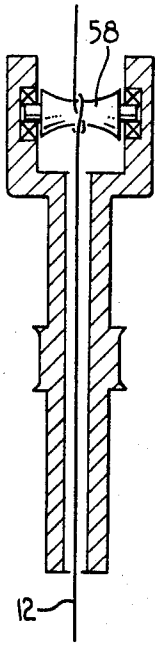
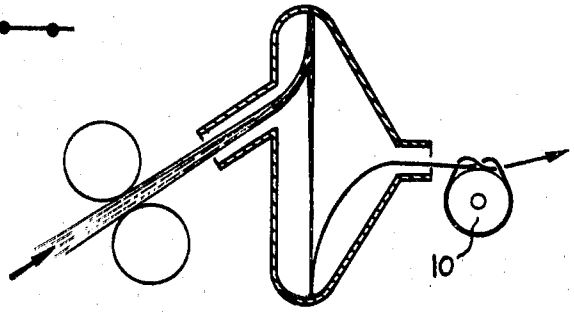


FIG. 6.

FIG. 8.



FIG. 7.



FALSE TWISTING OF YARNS

This invention concerns the false-twisting of strands. As will later be apparent the term "strand" is intended to include different kinds of elongated flexible material, such as, for example, yarn, tape and film.

False-twisting is a known technique in certain processes carried out on yarns. For example, it is known to modify the properties of certain continuous filament yarns by a continuous process which includes a false-twisting step. Basically this process involves passing the yarn continuously through a false-twising device and causing the false-twist which is not put into the yarn upstream of the false-twisting device to be set. The removal of the fasle-twist which occurs as the yarn passes through the false-twisting device results in a yarn which has high bulk and stretch properties, and as such is a valuable commercial product, both for direct use in textile materials and garments, and for such use after further modification.

The present invention encompasses new and advantageous false-twist processes and apparatus; useful modifications to known false-twist processes and apparatus; and the products of such processes and made on such apparatus.

According to the present invention in a method of false-twisting a travelling stand in which the strand in its continuous travel is caused to pass as a loop around a freely rotatable roller, the beginning and end portions of the loop combining to form a close simple knot in contact with the roller periphery, and to leave the roller periphery in a non-tangential direction, thus causing false twist to be generated in the stand as it approaches the roller.

By the term "close" is meant that the parts of the strand which form the knot are in contact; and the end portion of the loop is therefore able frictionally to rotate the beginning portion to generate the false-twist.

According to a more particular aspect of the present invention yarn or the like is continuously processed by subjecting it sequentually to two false-twisting operations, at least one of which, but especially the earlier, false-twisting operations may be carried out wholly or partly frictionally in the manner previously described. This aspect of the invention is especially useful in the processes involving the passage of the yarn through a rotating false-twist tube having a transverse member which acts as the twist-trapping device, because, in spite of continuous efforts to improve the design of machinery for carrying out such processes in order to ensure insertion of a uniform and high level of false-twist which is to be set in the yarn it has been found that, particularly at the extremely high spindle speeds common today, there is a tendency for twist to slip past the twist-trapping device of the false-twist tube, which leads to a level of false-twist upstream of the twist tube which is less than that which should theoretically be present and also to some irregularity of false-twist insertion. Obviously these two phenomena lead to a need to drive the spindle at a speed higher than that which is theoretically necessary (or to reduce the linear speed of the yarn) and to certain irregularities in the finished yarn. It has been found that by subjecting the yarn to a preliminary false-twisting operation frictionally in the manner previously described, and in the same sense as the later false-twisting operation, preferably at a lower level of false-twist, and preferably setting the preliminary false-twist at least to some extent, the yarn is predisposed for the insertion of the later false-twist, and as a result the incidence of the two phenomena previously referred to is diminished.

According to another more particular aspect of the present invention a frictional method of false-twisting as set out hereinbefore is used when passing the material through a rotating false-twisting device and around a freely rotatable roller, which is the twist-trapper thereof. In this way, and by ensuring that the sense of the frictional false-twist is the same as that of the false-twist which arises by virtue of the rotation of the device, an additive effect is achieved, and this allows a higher level of false-twist to be obtained with the same rotational speed of the false-twisting device or the same level of false-twist with a lower rotational speed. Preferably the roller is mounted in air bearings, and whilst it may be mounted transversely of the device at right-angles to the axis of rotation the latter in some cases it may be mounted at some other angle to that axis.

According to yet another aspect of the present invention wet-spun flax yarn is false-twisted by the frictional method hereinbefore described. This "softens" the yarn and renders it much more manageable in subsequent use, especially in warp-knitting and weaving processes.

According to yet another more particular aspect of the present invention a film of interconnected filaments or longitudinally oriented material is false-twisted in the frictional manner hereinbefore described. This facilitates the rapid and effective separation of the individual filaments or the fibrillation of the film, as the case may be.

According to another more particular aspect of the present invention yarn spun by break-spinning is false-twisted as it is made, in the frictional manner hereinbefore described.

The invention will now be described further, by way of example only, with reference to the accompanying drawings, in which,

FIG. 1 is a diagram showing one way in which strand material, such as yarn, may be false-twisted according to the invention;

FIG. 2 is a diagram showing the application of frictional false-twisting according to the invention to the processing of wet-spun linen yarn;

FIG. 3 is a sectional view of the roller used in the apparatus of FIG. 2;

FIG. 4 is a diagram showing one application of frictional false-twisting according to the invention to the processing of continuous filament nylon yarn;

FIG. 5 is a diagram showing another application of frictional false-twisting according to the invention to the processing of continuous filament nylon yarn;

FIG. 6 is a sectional view of a false-twisting device which may be employed according to the invention in the processing of continuous filament nylon yarn;

FIG. 7 is a cross-sectional view of a film of interconnected filaments which may advantageously be false-twisted according to the invention; and

FIG. 8 is a diagram illustrating a break-spinning process including frictional false-twisting according to the invention.

Referring first to FIG. 1, there is shown a wheel, roller or pin 10 (which element is for convenience hereinafter referred to as a roller) and passing around the roller 10 a yarn 12. The roller is mounted for rotation on a bearing designed to reduce the frictional resis-

tance to rotation to a minimum. The strand **12** approaches and leaves the roller **10** and the roller **10** rotates, in the directions indicated by the arrows. It passes once around the periphery of the roller **10** and at its approach and departure therefrom the strand moves through a simple knot configuration which configuration is exaggerated somewhat in FIG. **1** in the interests of clarity. As part of this exaggeration the two halves of the knot are shown separate; in fact they must necessarily be in contact as previously described. If the strand is continuously travelled over the roller **10** in the manner illustrated it has been found that false-twist is imparted to that portion of the strand approaching the periphery of the roller, which false-twist is no longer present in that portion of the strand which leaves the roller periphery. The false-twist arises due to the frictional contact between the two portions of the strand which form the knot. It has been found that the degree of false-twist can be varied within limits in one or more of three ways. It can be increased by increasing the diameter of the roller **10** by decreasing the angle between the approaching and departing strand, (this angle however must be non-tangential, that is to say, the angle between the approaching and departing strand must be less than 180°); and by increasing the tension in the approaching strand.

FIG. **2** illustrates the false-twisting of a wet-spun linen yarn using a roller **10** and knot configuration as described with reference to FIG. **1**. The yarn **12** passes from a supply package **16**, over a tensioner, **18** between bars **20** and **22** (which together form a twist stop), then around the roller **10** with a close simple knot configuration, over a support bar **24**, and finally to a winding head **26**. The bar **24** is mounted in such a manner that it can be adjusted relative to the roller **10** so as to enable the direction of the yarn leaving the roller **10** to be varied. Alternatively the bars **20, 22** may be adjustable for the same purpose. In this way the angle between the yarn approaching the roller **10** and the yarn leaving the roller **10** can be changed as required for the purpose, previously referred to, of varying the degree of false-twist. In FIG. **2** an alternative position for the bar **24** is shown in dotted line.

When processing linen yarn in this way we have found that the angle between the yarn approaching and leaving the roller **10** can conveniently be about 140°. This angle cannot be reduced much further without causing the knot to leave the surface of roller **10** and consequent loss of control over the false-twisting. The best angle for any particular strand material can readily be determined by simple experimentation.

The roller **10** is constructed and mounted in the manner illustrated in FIG. **3**. The roller **10** is mounted on a spindle **34** with an interposed ball bearing **28**, and is provided with a dust-proof sealing member **30** on its outer face. An annular sealing member **32** is provided on its inner face. The spindle **34** has an axial bore **36** terminating in a outlet **38** which directs air, supplied through the bore **36**, to the space between the sealing member **32** and the roller **10**. By designing and mounting the roller **10** in this way the frictional resistance to rotation thereof is reduced to a very low value indeed.

The arrangement illustrated diagramatically in FIG. **2** may also be employed for the false-twisting of film in the form of interconnected filaments or longitudinally oriented polymeric material in order to facilitate separation of the filaments, or fibrillation of the film as the case may be. A cross-sectional view of such a film is shown in FIG. **7**. FIG. **4** illustrates the processing of continuous filament nylon yarn to increase its bulk stretch characteristics, again using a freely rotatable roller **10** around which the yarn passes in a close simple knot configuration. Flat yarn **12** passes in a vertically upwards direction between a pair of feed rolls **40** and then through an elongated heater **42** which is heavily insulated and the temperature of which is very closely controlled. On emergence from the heater the yarn passes around the roller **10** in the same manner as previously described and then over a support bar **44** before being collected on a winding head (not shown). The false-twist generated in the knot over pulley **10** runs back over that portion of the yarn between the pulley **10** and the feed rolls **40.** The yarn is heated appropriately curing its passage through the heater **42** and is cooled and thereby set in the interval between the end of the heater **42** and the roller **10** and before the false-twist disappears.

FIG. **5** also illustrates the processing of continuous filament nylon yarn but in this case the false-twist arising by virtue of the passage of yarn through a knot configuration on the pulley **10** is a preliminary false-twist. The flat yarn **12** is taken from a yarn supply and then moves over a feed roll assembly **46** before moving vertically upwards to pass around the roller **10** and through the knot configuration. On departure from the roller **10** it passes over a bar **48**, through an elongated heater **50**, and then a false-twist tube **52**, before moving away to further feed rolls and a winding device (neither being shown in the drawing). The false-twist tube **52** is of conventional type, being driven at a very high speed by suitable means applied to a whorl on its outer periphery, and having mounted transversely on its bore a twist trapper in the form of a sapphire pin **54.** Apart from the provision of the roller **10** and the passage of yarn therearound and through the knot configuration the set-up just described is, in general, that conventionally used for producing torque stretch yarn. It has been found, particularly at very high speeds, and as has been previously mentioned, that undesirable twist slippage can occur irregularly past the pin **54** of the false-twist tube **52.** However, it has been found that preliminary false-twisting of the yarn between the roller **10** and the feed roll assembly **46** pre-conditions or pre-disposes the yarn to the later false-twisting which occurs as the yarn passes through the heater **56** and up to the pin **54** and that as a consequence twist slippage is diminished. In the arrangement illustrated the preliminary false-twist will be of a lower degree than that which occurs in the heater **56** and may not be set in the yarn. It may however be set to a lesser degree than the set acquired by the main false-twist.

Turning now to FIG. **6** there is shown a false-twisting device which may be substituted for the roller **10** in FIG. **4** or the false-twist device **52** of FIG. **5.** It differs from the false-twisting device of FIG. **5** and its general shape and in that instead of the fixed sapphire pin **54,** a steel roller **58** is used and which is mounted in low friction e.g. air bearings which ensure that during processing it rotates. In use the yarn **12** passes around the pin and through a close simple knot configuration, as in the previous example when it passed over the roller **10.** In this way the false-twist which is generated upstream of the false-twisting device by virtue of its rotation is supplemented by the false-twist which is gener-

ated by the frictional contact of the two portions of the yarn at the knot, provided of course that the hand of the knot is of the appropriate sense. Consequently, as previously indicated, a higher level of false-twist may be generated than in the conventional arrangement for the same speed of rotation of the false-twisting device, or alternatively the same level of false-twist may be attained with a lower rotational speed.

In FIG. **8** a break-spinning process is illustrated. The yarn **12** on emergence from the rotating pot of the break-spinning apparatus passes over the roller **10** and through a close simple knot configuration. It has been found that in this way the yarn is better consolidated.

I claim:

1. A method of false twisting a strand comprising the steps of travelling the strand continuously onto and around a cylindrical surface, which surface is freely mounted for rotation about its cylindrical axis, passing the strand just prior to leaving said surface over and then under that part of itself which is then just arriving on the surface to form a close simple knot in contact with the surface, and conveying the strand leaving the surface away in a non-tangential direction with respect to the surface.

2. A method of processing a strand continuously which includes subjecting the yarn sequentially to two false-twisting operations, at least one of which is carried out wholly or partly by the method of false twisting as claimed in claim **1**.

3. A method as claimed in claim **2** in which the yarn is passed through a rotating false-twist tube having a transverse pin which acts as a twist-trapping device, the false-twist thus generated being set upstream of the tube, and in which the yarn is first subjected to an earlier false-twisting operation in the same sense.

4. A method as claimed in claim **2** in which the level of the earlier false-twist is less than the level of the later false-twist.

5. A method as claimed in claim **4** in which the earlier false-twist is set, but to a lesser degree than that of the later false-twist.

6. A method as claimed in claim **1** in which the surface is that of the roller which is the twist-trapper of a rotating false-twisting device.

7. A method as claimed in claim **6** in which the sense of the false-twist generated by virtue of the knot is the same as that of the false-twist which arises by virtue of the rotation of the device.

8. A method as claimed in claim **6** in which the roller is mounted transversely of the device at right-angles to the axis of rotation of the latter.

9. A method as claimed in claim **6** in which the roller is mounted transversely of the device, but at an angle to the axis of rotation of the device.

10. A method as claimed in claim **1** in which the surface is that of the roller which is mounted on air bearings.

11. A continuous method of processing a strand in the form of wet-spun flax yarn which includes the step of false-twisting the yarn, according to the method as claimed in claim **1**.

12. A continuous method of processing a strand in the form of a film of interconnected filaments which includes the step of false-twisting the film, according to the method as claimed in claim **1**.

13. A method of fibrillating a strand in the form of a longitudinally oriented polymeric film which includes the step of false-twisting the film according to the method as claimed in claim **1**.

14. A method of making yarn by break-spinning in which the yarn as it is made is false-twisting by the method as claimed in claim **1**.

15. Apparatus for false twisting strand material including: means for causing said strand continuously to travel from a supply package to a wind up means; and disposed therebetween, in sequence, a freely rotatable roller having a concave periphery around which the yarn may loop and at the same time form a simple knot; a guide over which the yarn may then pass, said guide being capable of adjustment for the purpose of varying the angle between the strand approaching and leaving the roller; a heater disposed after said guide; and a false twisting device disposed after said heater, said false twisting device comprising a rotatable false twisting tube including a twist-trapper in the form of a freely rotatable roller mounted transversely thereof about which the yarn may loop and at the same time form a simple knot.

* * * * *