

Oct. 29, 1968

R. G. HILBERT
YARN HANDLING APPARATUS

3,407,585

Filed June 7, 1967

2 Sheets-Sheet 1

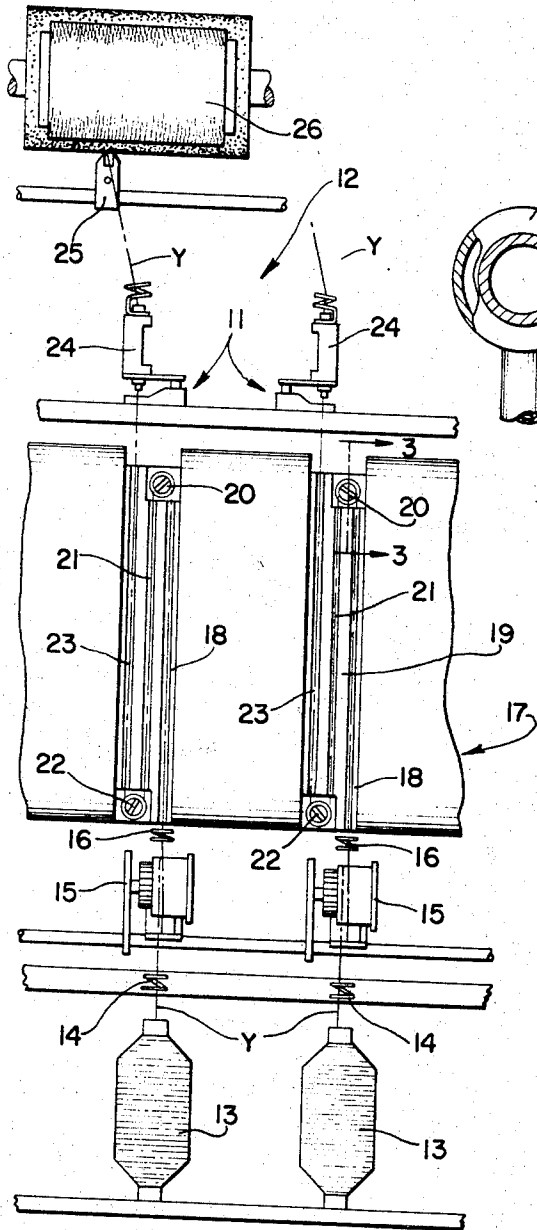


FIG. 1

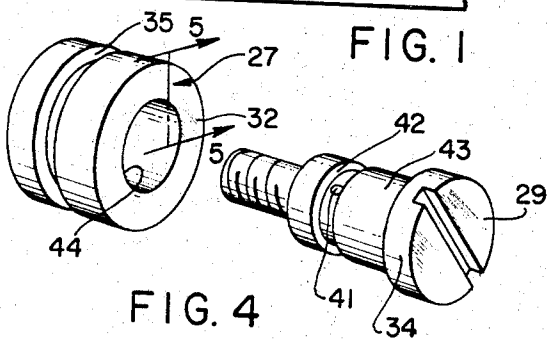


FIG. 4

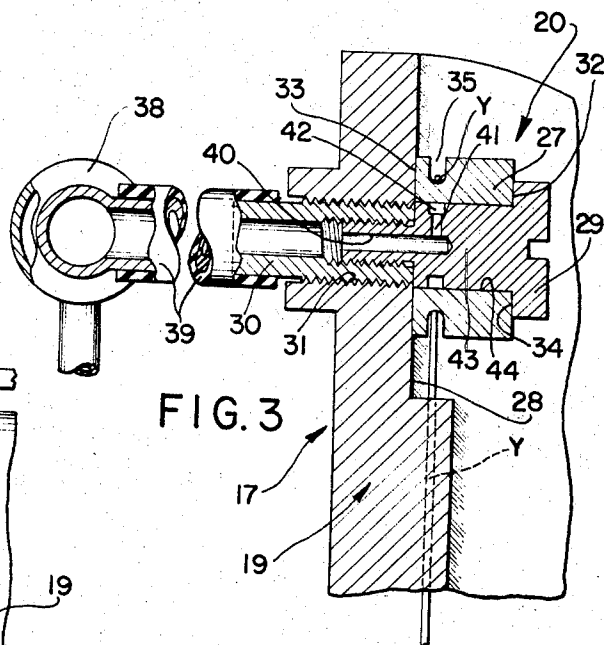


FIG. 3

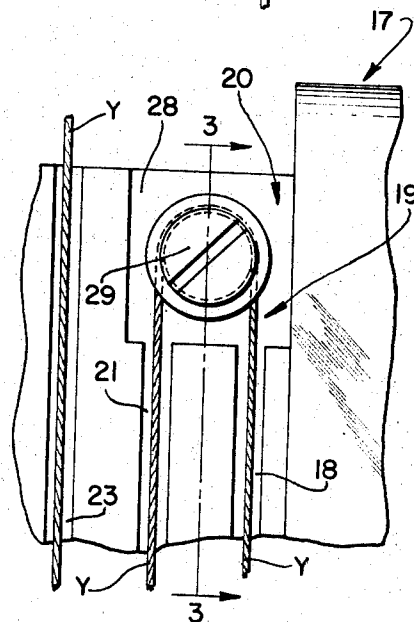


FIG. 2

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2 Sheets-Sheet 2

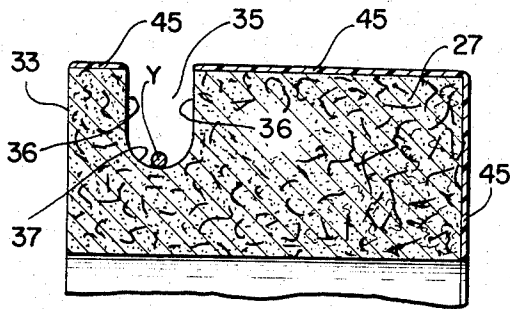


FIG. 5

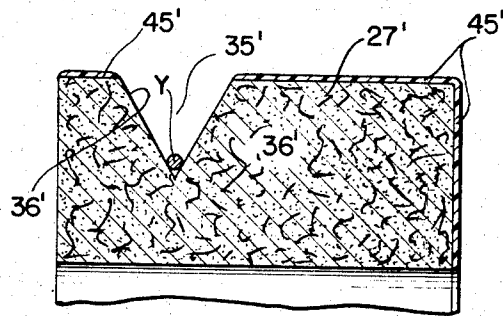


FIG. 8

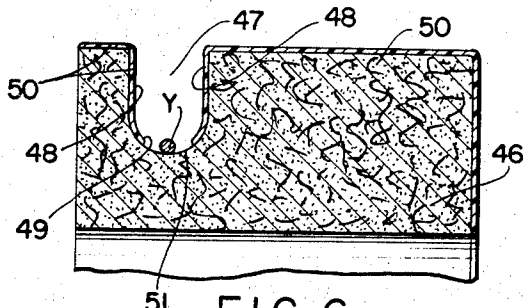


FIG. 6

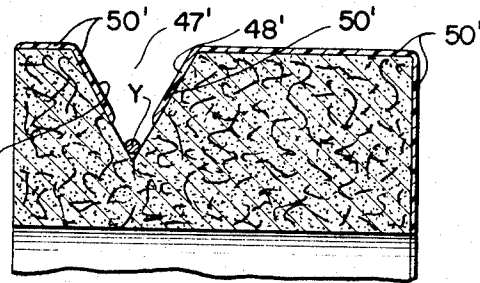


FIG. 9

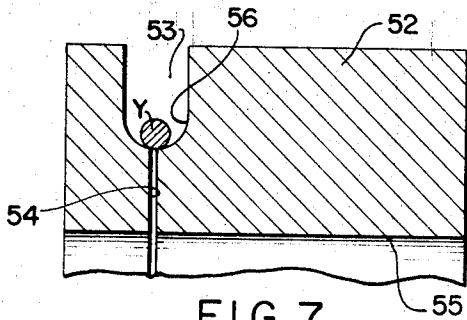


FIG. 7

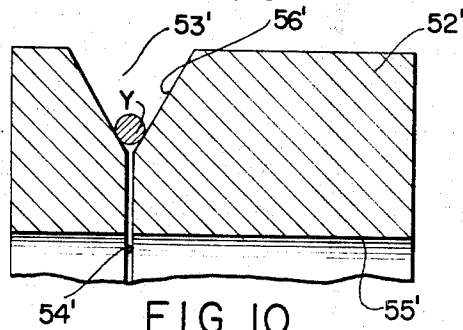


FIG. 10

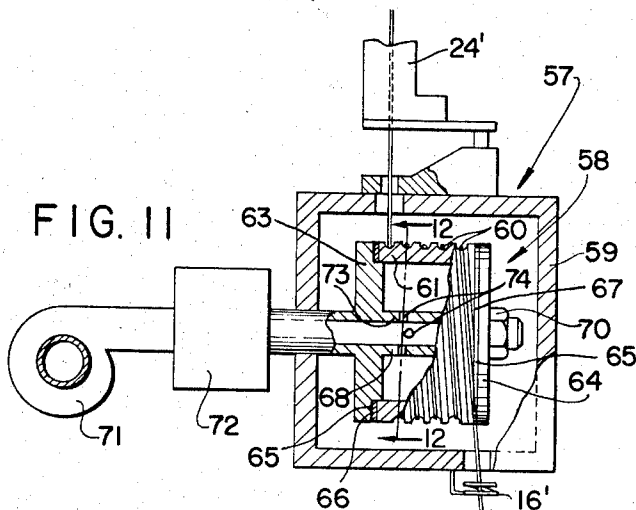


FIG. 11

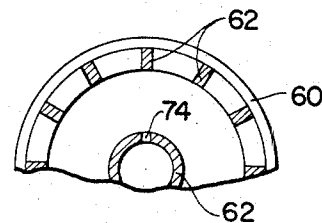


FIG. 12

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YARN HANDLING APPARATUS
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ABSTRACT OF THE DISCLOSURE

False twist apparatus in which twist migrates along an advancing strand of yarn passing around one or more guides. A thin layer of air between a groove surface of the guide and the strand of yarn reduces frictional contact sufficiently so that the twist may pass freely around the guide. In one embodiment a plurality of guides direct the strand in a circuitous path across a plate-type heater and in another embodiment the yarn follows a helical guide groove in a drum-type heater.

This invention relates to apparatus for false twisting yarn and, more particularly, to guiding a strand of yarn being twisted in such a manner that the twist may migrate along the strand.

During the operation of conventional false twist machines, a continuously advancing strand of yarn passes through a twist stop (such as feed rolls which stop migration of the twist) and a heater (which heats the yarn to a desired processing temperature), and then through a false twist spindle (to provide a twist which migrates through the strand to the twist stop). Then the strand of yarn is wound on a take-up spool. It should be noted that the twist imparted to the advancing strand of yarn migrates through the yarn. The nature of the process is such that in order to speed up the passage of the yarn and increase capacity, the length of the yarn path in the heater must be increased to maintain the desired processing temperature. This results in lengthening the heater and poses a limiting factor in the capacity of commercially successful false twist equipment.

It has been found commercially impractical to use multipath heaters in false twist equipment. The reason is that guides proposed for directing the advancing strand of yarn through a plurality of passes in the heater act as twist stops in preventing or substantially retarding migration of the twist through the strand and back to the intended twist stop previously mentioned. Also, many proposed guides are too expensive or mechanically undesirable in the operating environment of a false twist machine. For example, vibrating guides as well as guide wheels rotated in a direction opposite the direction of the advancing strand of yarn have not been found to be industrially adequate.

The invention, in brief, is directed to false twist apparatus in which an advancing strand of yarn is directed by guides in a circuitous path through a heater. Frictional contact between the guides and the advancing strand of yarn is effectively reduced by providing a thin layer of fluid, for example air, therebetween so that the twist imparted to the strand of yarn may migrate over the guides. In one embodiment the guides are utilized in conjunction with a plate-type heater for guiding the yarn through a plurality of passes across the heater and, in another embodiment, the advancing strand of yarn is guided through a helical groove in the cylindrical face of a drum-type heater. Utilizing either embodiment results in substantially reducing the overall size of the heater in comparison with commercially successful present day false twist heaters.

A primary object of the invention is to provide new and useful apparatus for false twisting yarn.

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Another object is to provide new and useful yarn processing apparatus in which a low frictional contact is maintained between a guide surface and an advancing strand of yarn. A related object is provision for maintaining a thin layer of air along the guide surface to assure low frictional contact with the advancing strand.

Other objects and advantages of the invention will be apparent from the following descriptions and the drawings in which:

FIG. 1 is a fragmentary, schematic front elevational view of a false twist machine with a heater embodying features of the invention;

FIG. 2 is an enlarged fragmentary front elevational view of a portion of FIG. 1 showing details of a yarn guide;

FIG. 3 is a fragmentary, sectional view taken generally on the line 3—3 in FIG. 2 (and in FIG. 1);

FIG. 4 is an exploded view of the yarn guide;

FIG. 5 is an enlarged, fragmentary, sectional view of a guide body, taken generally on the line 5—5 in FIG. 4;

FIGS. 6—10 each show additional embodiments of the guide body;

FIG. 11 is an elevational view of another embodiment of a false twist heater, with parts broken away and removed for clear illustration; and

FIG. 12 is an enlarged fragmentary view taken generally along the line 12—12 in FIG. 11.

Referring to FIG. 1 of the drawings, two false twist assemblies 11 in a false twist machine 12 are shown. Each assembly includes a supply bobbin 13 from which a strand of yarn Y passes through a yarn guide 14 and a suitably twist stop device 15 shown as feed roll apparatus for controlling the tension of the yarn. From the twist stop the yarn passes through another yarn guide 16 and into a false twist heater 17 of the plate-type. The strand of yarn passes through a groove 18 in a heated plate 19 and around a guide 20 where its direction is reversed, then through another heater groove 21 and around a second guide 22 from which the strand of yarn passes through a third heater groove 23. From the heater 19, the strand of yarn passes through a false twist spindle 24 and traversing mechanism 25 for guiding the yarn onto a driven take-up spool 26.

FIGS. 2 and 3 are enlarged detailed views of an upper one of the guides 20 shown in FIG. 1, the other guide 22 being identical except for orientation. Each guide includes a porous, hollow, cylindrical guide body 27 secured in a recess 28 in the heater plate 19 by a special bolt or fitting 29 threaded into a coupling 30 which is in turn threaded into a bore 31 extending through the heater plate. The opposite guide body ends 32 and 33 are tightly clamped between an annular shoulder 34 on the head of the bolt 29 and the face of the heater plate recess 28 to prevent escape of air therebetween. A U-shaped groove 35 in the guide body 27 receives the strand of yarn Y. This guide groove, shown in greater detail in FIGS. 4 and 5, is shown as annular and it should be noted that the width of the groove between its side surfaces 36 is much greater than the diameter of the strand of yarn on the bottom or inner surface 37 of the groove so that any slubs (enlarged portions in the yarn) may pass easily through the groove as the yarn path conforms generally to the circular configuration of the inner or bottom surface 37 of the groove.

Migration of twist along the yarn Y is assured by low frictional contact provided between the advancing strand of yarn and the groove surface. Suitable fluid, such as air, and preferably hot air to prevent cooling the yarn, is supplied through a manifold 38 (FIG. 3) to a tube 39 connected with the hollow coupling 30 and then through an axial passage 40 in the bolt 29 which communicates with a radial passage 41 opening into an annular channel 42 in a cylindrical shank portion 43 of the bolt. From the

channel 42 the air passes through the porous guide body 27 into the guide groove 35 to provide a thin layer of air between the advancing strand of yarn Y and the surface of the guide groove 35.

The guide body 27 shown in FIGS. 1-5 is of a porous material such as sintered aluminum or bronze or preferably stainless steel, or an adequately porous ceramic material. The pores in the body provide passages for the air into the guide groove 35. In order to reduce escape of the air from the guide body 27, the cylindrical shank 43 has firm sliding engagement with the bore 44 of the guide body. The opposite ends 32 and 33 of the guide body are in tight engagement with the face of the heater plate recess 28 and the annular shoulder 34 of the bolt 29 to effectively prevent escape of the air through these paths. The remaining surfaces of the guide body 27, other than the groove surfaces 36 and 37, are sealed by a suitable coating or by smearing 45 (FIG. 5) of the porous surfaces. Desired migration of the twist as the yarn Y moves across the guide surfaces is assured by an air pressure in the manifold 28 in a range of 40 to 50 p.s.i. and a volume of .01 to .02 c.f.m. for 70 denier yarn (such as nylon).

Other suitable guide groove structures are shown in FIGS. 6-10. In FIG. 6 a porous guide body 46 has a U-shaped cross-section slot 47 but its side surfaces 48 and bottom surface 49 are sealed, as at 50, to prevent the escape of air except for an annular portion 51 of the bottom surface 49 about 3 to 5 times the diameter of the yarn Y, thus providing greater concentration of the discharged air and requiring a smaller volume of air. FIG. 7 shows a non-porous guide body 52 with a U-shaped cross-section guide groove 53. A small slot 54 extends from the surface of the bore 55 of the guide body at the annular channel 42 (FIGS. 3 and 4) in the bolt shoulder, and through the center of the bottom surface 56 of the guide groove 53 along the portion of the groove surface over which the strand of yarn Y passes (about 180°). The modification of FIGS. 8, 9 and 10 correspond to the modifications shown in FIGS. 5, 6 and 7 (with reference numerals primed, as 35'), respectively, but the guide grooves are V-shaped in cross-section.

FIG. 11 shows another embodiment of a false twist machine yarn heater 57. A drum-type heater 58 is stationary within an insulated chamber 59. The yarn Y advances as previously described through the twist stop (not shown) and guide 16' into the chamber 59 and then makes several convolutions through a helical guide groove 60 in the sidewall 61 of the drum 58 before passing out of the chamber to the false twist spindle 24' and then to the take-up spool (not shown). The guide groove structure in the body of the drum-type heater 58 may be of any of the previously discussed types shown in FIGS. 5-10. Similarly, the sidewall of the body 58 may be of a porous material in which event the groove 60 may be of the types shown in FIGS. 5, 6, 8 or 9, or of a non-porous material in which event the groove may be of the type shown in FIG. 7 or 10, noting that the slot may be continuous, or interrupted by connecting portions 62 of the body, as shown in FIG. 12. A pair of generally disk-shaped end plates 63 and 64 and suitable sealing gaskets 65 are seated at adjacent opposite ends 66 and 67, respectively, of the cylindrical side wall 61. A stud 68 extends from the left-hand disk 63 through a hole in the right hand disk 64 and has a threaded end 69 for receiving a nut 70 to clamp the gaskets 65 and end disks 63 and 64 against the ends 66 and 67 of the side wall 61 to prevent leakage of air around the gaskets.

The drum may be heated in any desired manner such as by an electric resistance heater in the drum sidewall 61 or within the drum hollow, or by steam or the like. As illustrated in FIG. 11, pressurized hot air is supplied by a suitable compressor 71 and an air heater 72 which communicates with an axial passage 73 extending partway into the disk stud 68. Suitable radial holes 74 from the passage 73 open into a space between the stud 68 and the

sidewall 61 of the drum 58 for the passage of the air through the porous sidewall 61 and into the groove 60. The sidewall 61 of porous material drums is preferably sealed, as at 75 on its outer surface 76 (other than the groove surface), all as previously described. In either type of heater, any suitable fluid may provide the layer between the guide surface and the yarn, and a gas such as air is preferred, in part because of availability and ease of handling.

While the invention has been described with particular reference to various features and embodiments, additions and changes may be apparent to one skilled in the art. The invention is therefore not to be limited to the disclosed features and embodiments except as set forth in the appended claims.

What is claimed is:

1. Apparatus for processing a strand comprising, means for advancing said strand along a path, guide means having surface means for receiving the strand and guiding the strand through a change in direction conforming generally to the configuration of said surface means, and friction reducing means for maintaining sufficiently low frictional contact between said surface means and said strand to permit easy passage of said strand around said surface means, said friction reducing means being operable to maintain a thin layer of fluid along said surface means for providing said low frictional contact.

2. Apparatus as defined in claim 1 in which said guide means comprises a body and a groove in said body, said groove being defined by said surface means, said friction reducing means comprises passage means in said body opening through said surface means for the flow of said fluid through said passage means to said surface, and said passage means comprises a slot opening into the bottom of said groove.

3. Apparatus as defined in claim 1 in which said guide means comprises a porous body and a groove in said body, said groove being defined by said surface means, said friction reducing means comprises passage means in said body opening through said surface means for the flow of said fluid through said passage means to said surface, and said passage means includes the pores in said body.

4. Apparatus as defined in claim 3 in which said body includes sealing means along at least a portion of the surface of said body other than said surface means for effectively confining the discharge of said fluid from said pores to within said groove.

5. Apparatus as defined in claim 4 in which said pores open through said surface means at the bottom of said groove, and the sealing means further seals the remainder of said surface means to restrict the discharge of said fluid to the bottom of said groove.

6. Apparatus for processing a strand of yarn comprising, means for advancing said strand along a path, guide means having surface means for receiving the strand and guiding the strand through a change in direction conforming generally to the configuration of said surface means, means spaced from said guide means along said path for twisting said strand as it moves along said path, and friction reducing means for maintaining sufficiently low frictional contact between said surface means and said strand to permit the twist imparted to said strand to migrate around said surface means, said friction reducing means being operable to maintain a thin layer of fluid along said surface means for providing said low frictional contact.

7. Apparatus as defined in claim 6 in which said guide means comprises a body and said surface means is on said body, and said friction reducing means comprises passage means in said body opening through said surface means for the flow of said fluid through said passage means to said surface.

8. Apparatus as defined in claim 7 in which said guide means further comprises a groove in said body, said groove being defined by said surface means, and said

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passage means comprises a slot opening into the bottom of said groove.

9. Apparatus as defined in claim 7 in which said body is porous, said guide means further comprises a groove in said body, said groove being defined by said surface means, and said passage means includes the pores in said body.

10. Apparatus as defined in claim 7 in which said guide means further comprises a groove in said body, said groove being defined by said surface means and extending about said body for not more than one convolution.

11. Apparatus as defined in claim 7 in which said body comprises a drum-like member, said guide means comprises a groove in the side wall of the drum, said groove being defined by said surface means and being generally helical and extending around the side wall of the drum for more than one convolution.

12. Apparatus as defined in claim 11 in which said drum-like member is a heater.

13. In a false twist machine having a twist stop device and a false twist spindle for twisting a strand of yarn advancing through the machine from the twist stop to the spindle, the improvement comprising a heater for receiving and heating the strand as it passes from said twist stop to said false twist spindle, guide means including a body member having surface means for receiving the strand and guiding the strand within said heater through a change in direction conforming generally to the configuration of said surface means, and friction reducing means for maintaining sufficiently low frictional contact between said surface means and said strand to permit the twist imparted to said strand by said false twist spindle to migrate across said surface means to said twist stop, said friction reducing means being operative to maintain a

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thin layer of hot air along said surface means for providing said low frictional contact.

14. A machine as defined in claim 13 in which said body member is porous, and said friction reducing means includes means for heating said air and passing the heated air through the pores and said surface means.

15. A machine as defined in claim 13 in which said guide means comprises a groove in said body member, said groove being defined by said surface means, and means for effectively confining the discharge of said air to within said groove.

16. Apparatus as defined in claim 15 in which said groove extends about said body for not more than one convolution.

17. Apparatus as defined in claim 15 in which said body comprises a drum-like member, and said groove is generally helical and extends around the side wall of the drum for more than one convolution.

References Cited

UNITED STATES PATENTS

2,251,879	8/1941	Akaboshi	57—66
3,032,246	5/1962	Fritze	226—97
3,114,235	12/1963	Griset	57—77.3 XR
3,156,398	11/1964	Lauxen	226—97
3,161,484	12/1964	Bagnoli et al.	28—62 XR
3,166,822	1/1965	Starkie et al.	28—62 XR
3,189,240	6/1965	Emslie	226—97 XR
3,204,396	9/1965	Foster et al.	57—34
3,270,933	9/1966	Dekker	226—97
3,321,904	5/1967	Horvath et al.	28—62 XR

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