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Smith

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[54] **METHOD AND APPARATUS FOR FALSE TWISTING YARN**

[76] Inventor: **Joseph F. Smith,** 1901 E. Wendover Ave., Greensboro, N.C. 27405

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[52] **U.S. Cl.** ..... **57/77.4;** 57/157 TS

[51] **Int. Cl.²** **D02G 1/08**

[58] **Field of Search** ..... 57/77.3, 77.4, 77.45, 156, 57/157 TS

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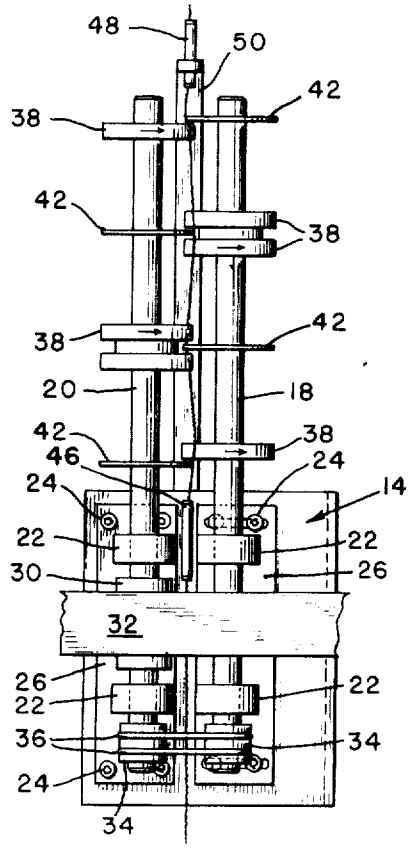
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Primary Examiner—Donald E. Watkins

[57] **ABSTRACT**

A system for applying a false twist to a continuously traveling synthetic yarn utilizing a plurality of axially spaced disks mounted for rotation upon spaced, parallel shafts. At least two disks are mounted upon each shaft, with one of the disks on each shaft having a yarn-engaging friction surface for cooperating in partial-overlapping peripheral relation with a disk on the other shaft to form yarn seats. The yarn-engaging surfaces of all disks are rectilinear, and increased surface contact with the traveling yarn is achieved due to the angle of the yarn passing in direct engagement and across the disks as the yarn passes to opposite sides of a plane extending through the shaft axes while engaging the disks.

13 Claims, 9 Drawing Figures



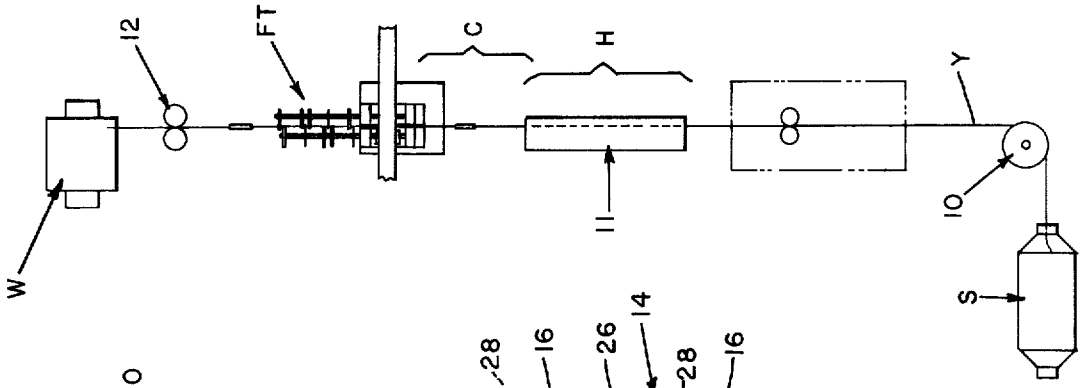


FIG. 1

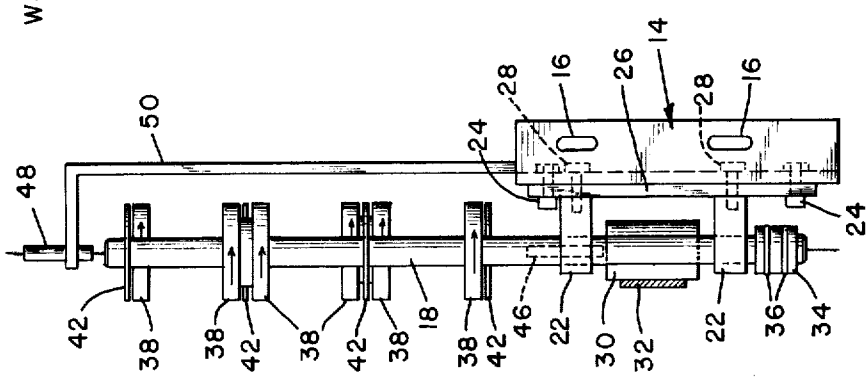


FIG. 3

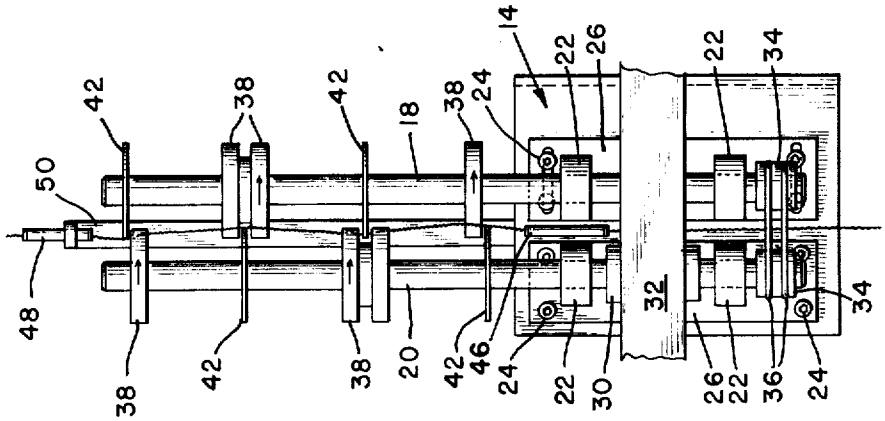


FIG. 2

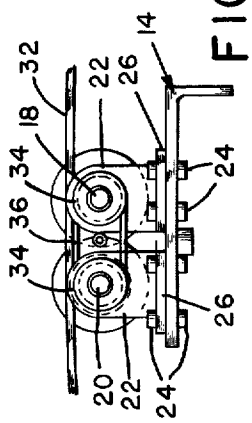


FIG. 4

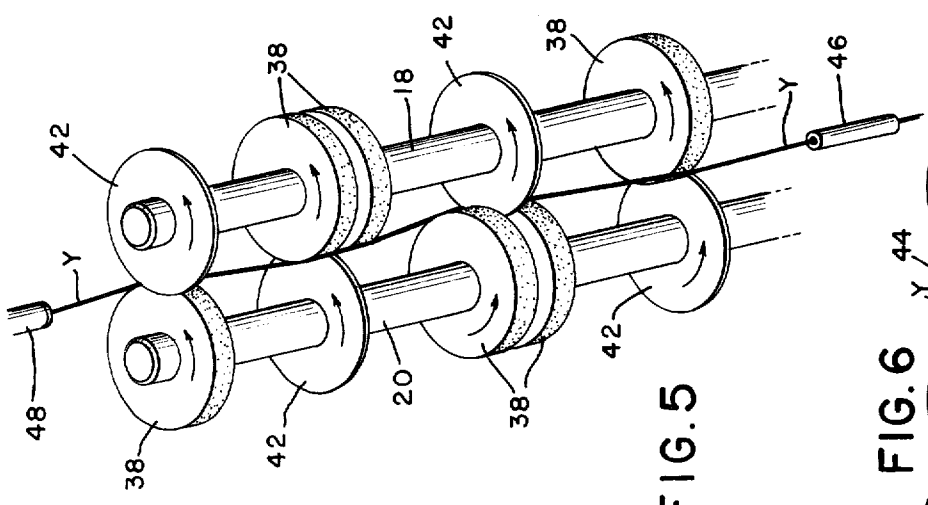


FIG. 5

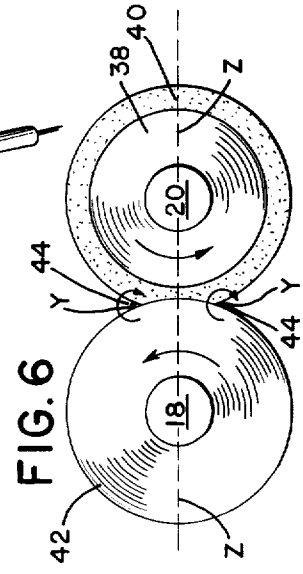


FIG. 6

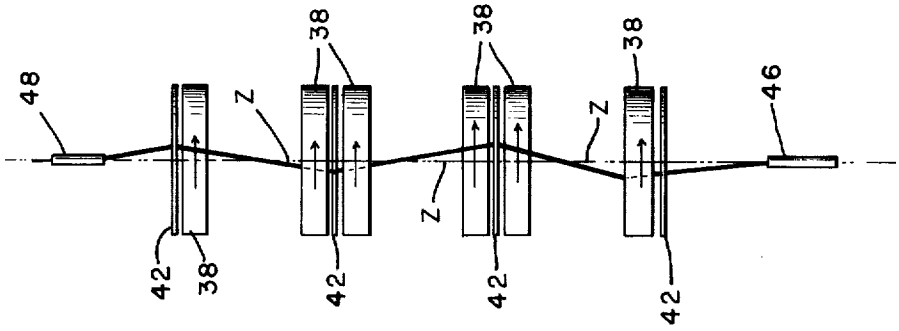


FIG. 8

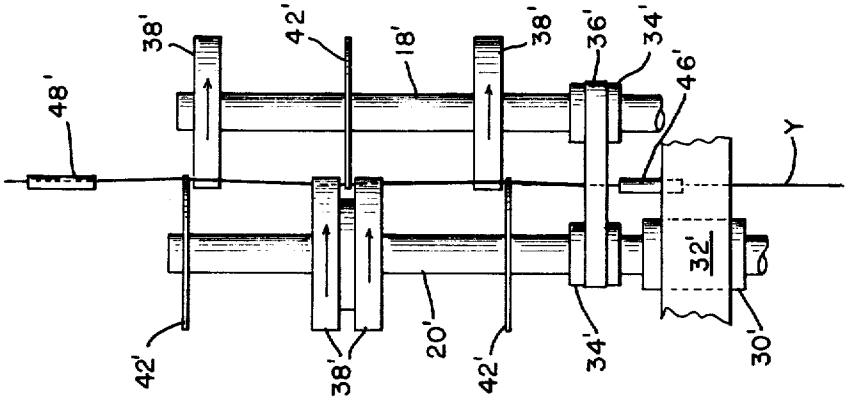


FIG. 9

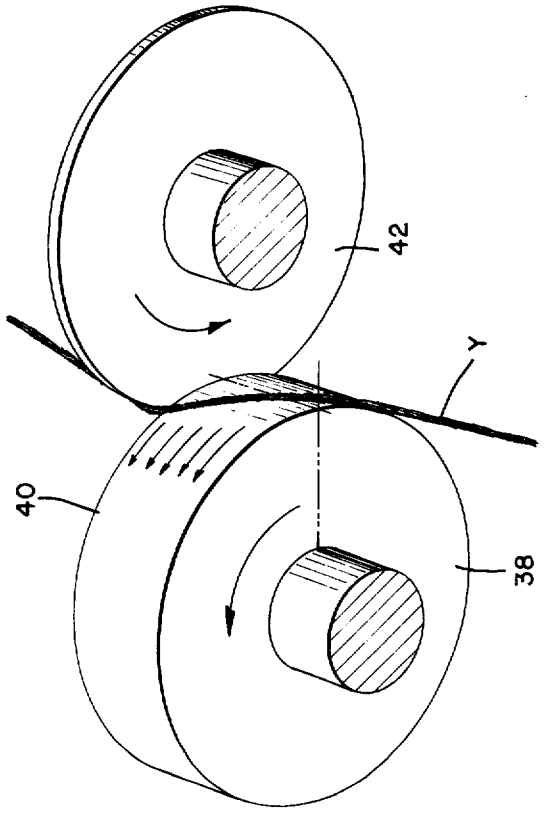


FIG. 7

METHOD AND APPARATUS FOR FALSE TWISTING YARN

BRIEF SUMMARY AND OBJECTS OF THE INVENTION

This invention relates generally to a system for applying a false twist to a continuously traveling yarn, and more particularly to a system for imparting a false twist to yarn by friction contact with rotating surfaces.

Friction twisting apparatus presently available and utilizing disks or grooved rollers, as disclosed, for example, in U.S. Pat. Nos. 1,030,179; 3,668,853; 2,939,269; and 3,156,084 permits slippage of the yarn resulting in a variation in the number of turns in the yarn per unit length and irregularities in the yarn. In many instances the friction disks are mounted to engage the yarn on one side only and the yarn is not retained in non-slipping engagement with the disks.

The friction twisting system of the present invention utilizes a series of yarn engaging disks axially spaced and mounted for rotation upon spaced, substantially parallel shafts. At least one disk on each shaft has a rectilinear yarn engaging peripheral frictional surface for cooperating in partial overlapping relation with a disk mounted on the other shaft to define seats for receiving the running yarn. As the yarn passes from one pair of cooperating disks to another pair of cooperating disks, it follows a tortuous course passing from one side of a plane extending through the axes of the disk shafts to the opposite side of the plane thereby retaining the yarn in engagement with the disks to impart efficient rotation and even twist to the yarn. Increased yarn contact with the surfaces of the friction disks is achieved due to the angle of the yarn across each disk friction surface. Guides are provided above and below the disks, and preferably have a guiding surface aligned within the plane passing through the axes of the disk shafts. An S or Z twist may be applied to the yarn depending upon the yarn path, engagement with the disks, and rotation of the disks.

One of the primary objects of the invention is the provision of a new method and apparatus for applying a false twist to yarns by direct frictional contact with rotatingn surfaces.

Another object of the invention is the provision of a new and improved system for imparting twist to yarn by urging the yarn into frictional engagement with a plurality of disks rotating at the same speed and in the same direction.

A further object of the invention is the provision of a friction twist spindle assembly wherein yarn is drawn over the peripheral, rectilinear frictional surfaces of driven disks at an angle to increase the frictional contact and eliminate slippage between the disks and yarn.

Other objects and advantages of the invention will become apparent when considered in view of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic, front elevational view of one embodiment of the friction twist assembly of the present invention in which yarn passes through a heating zone and a cooling zone and engages the rotating disks of the friction twist assembly before being directed to a yarn take-up assembly;

FIG. 2 is an enlarged, front elevational view of the friction twist assembly of FIG. 1;

FIG. 3 is a side elevational view of the friction twist assembly of FIG. 2;

FIG. 4 is a bottom plan view of the friction twist assembly;

FIG. 5 is an enlarged, perspective view of the friction disk and rotatable shafts of the friction twist assembly of FIGS. 2–4;

FIG. 6 is a top plan view of the friction twist assembly and illustrating the two uppermost cooperating disks, one middle disk and one disk having a friction surface, with yarn engagement therewith;

FIG. 7 is an enlarged, perspective view of two driven disks having rectilinear yarn engaging surfaces illustrating the angular yarn friction contact with the friction disk and the direction of rotation of the disk for imparting a twist to the yarn;

FIG. 8 is a schematic view illustrating a yarn path with respect to a plane passing through the axes of rotation of the disks and the shaft supporting the disks; and

FIG. 9 is a schematic view of another embodiment of the friction twist spindle assembly of the presennt invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawing, FIG. 1 schematically illustrates a portion of a twister machine which includes conventional apparatus such as a frame, drive mechanism, yarn guides and feed rolls, supply and take-up packages, etc. The machine generally includes a plurality of substantially identical assemblies mounted side-by-side on an elongated frame, with each assembly including an apparatus for applying a false twist (FT) to a yarn. the thermoplastic yarn Y is directed from a supply package S, over roll or guide **10**, through feed rolls and twist trap (FR-TT) of conventional construction, through heating zone H having a heating unit **11** and a cooling zone C, through the false twist applying apparatus FT, between take-up rolls **12** to a take-up package W. The rolls **10**, FR-TT, and **12** may cooperate in a conventional manner to obtain the desired yarn conditions such as tension and rate of yarn travel, as the yarn is drawn from the supply package S and through the heating zone H. In addition, suitable yarn tensioning and guiding means may be provided, as required. From the feed rolls **12**, the yarn Y is wound on the package W by a winding assembly according to conventional methods with suitable yarn and traverse guides.

Referring to FIGS. 2–4, the false twist apparatus FT is of the friction twist type and includes a bracket **14** having openings **16** for facilitating adjustably mounting the false twist apparatus FT upon a machine frame. The friction twist assembly FT also includes a pair of rotatable spindles or shafts **18** and **20** supported by bearings **22** upon the bracket **14**. The bearings for each shaft may be secured by fasteners **28** upon a plate **26** which, in turn, is adjustably secured to the bracket **14** by fasteners **24**. The plates **26, 26** preferably are mounted upon bracket **14** separately to provide adjustment to and from each other to align and position the shafts **18**, 20 selectively. The shafts **18, 20** are rotatably supported in spaced, parallel alignment with each other. At least one of the shafts, shaft **20**, is provided with a whorl **30** which frictionally engages and is driven by a belt **32**. A pulley **34** is secured to each of shafts **18** and **20** for receiving one or more endless friction bands **36**.

Displacement of the drive belt **32** rotates the whorl **30** of shaft **20** and the shaft **18** is driven at the same speed and in the same direction as shaft **20** by the pulleys **34** and bands **36.** The drive belt **32** may extend the entire length of the machine to rotate the shafts of a plurality of friction twist assemblies FT. Also, separate drive means for each unit may be employed, if desirable.

A plurality of axially spaced yarn engaging disks are fixedly mounted upon each of the shafts **18** and **20** such that selected disks are in opposed, overlapping relation, as shown by FIGS. **2–7.** The disks **38** selectively positioned upon shafts **18** and **20** have a circular periphery with relatively thick friction surfaces **40** of polyurethane or other suitable material for forming a yarn engaging surface having a high coefficient of friction to grip the yarn and prevent unnecessary slippage and to impart twist thereto. Also mounted upon each of the shafts **18** and **20** are thin metal disks **42** with cylindrical yarn-engaging surfaces. The metal disk **42** on shaft **18** cooperates in slightly overlapping peripheral relation with the friction-covered disk **38** on shaft **20.** While the metal disk **42** on shaft **20** cooperates in partial overlapping peripheral relation with the friction disk **38** of shaft **18.**

The yarn-engaging surfaces of each of the friction disks **38** and the metal disks **42** are rectilinear in the yarn path. As shown by FIG. **8,** the overlapping relation of cooperating metal and friction disks and the rectilinear yarn-engaging surfaces provide increased surface contacts for the traveling yarn Y resulting in a section of the traveling yarn Y engaging the friction surfaces **40** of the disks **38** at an angle and to contact the circumferential edges of each of the disks for increased frictional contact and guidance. The yarn extends across the frictional yarn-engaging surfaces of the disks at an angle relative to the axis of rotation of the disk and the direction of rotation of the disks. As the disks **38** and **40** are driven in the same direction of rotation, a false twist is applied to the yarn.

In the embodiment illustrated in FIGS. **2–5,** three friction disks **38** and two metal disks **42** have been provided on each of the shafts **18** and **20.** However, the number, type, size and combinations of various disks provided on the shafts **18** and **20** may vary depending upon the required false twist applied to the yarn Y achievable through the frictional coefficient between the yarns used and the contact surfaces. As the yarn Y enters and exits from the false twist assembly FT, a single disk **38** cooperates with a single metal disk **42** while the intermediate sections of the false twist apparatus FT includes single metal disks, each cooperating with two friction disks **38,** with the friction disks being on each side of and in close proximity to a metal disk **42.** Alternatively, a single friction disk or roller, provided with a groove for receiving a portion of a metal disk **42,** may be substituted for two closely spaced disks **38.**

As the traveling yarn Y progresses through the friction twist assembly FT, the yarn follows a path which alternates from one side to the other of a plane Z, FIGS. **6** and **8,** passing through the axes of the shafts **18** and **20,** due to the overlapping relation of the disks which form yarn-receiving throats or seats **44** for the continuous yarn. Since all disks **38** and **42** rotate in the same direction, the peripheral surfaces of the disks at the seats **44** move in opposite directions thereby imparting a twisting action to the yarn in the throats or seats **44.** the tortuous course of the yarn Y maintains the yarn in engagement with all disks **38** and **42.** The path of the yarn to be friction twisted is guided by ceramic tubular guides **46** and **48** before engaging the first disk in the yarn path and after leaving the last disk in the yarn path. The guide **38** may be supported by a bracket **50.** preferably the tubular guides **46** and **48** are axially aligned with a plane passing through the axes of the shafts **18** and **20.**

FIG. **9** refers to a modified embodiment of the friction twist assembly wherein yarn Y engages a different combination of friction disks **38'** and thin metal disks **42'** mounted upon spaced, parallel shafts **18'** and **20'.** The shafts **18'** and **20'** are coupled for rotation at the same speed and in the same direction of rotation by endless bands **36'** which pass around pulleys **34'** and the driven belt **32'** which frictionally engages whorl **30'.**

In FIG. **8,** the alternate positioning of the traveling yarn is shown in engagement with the metal and friction disks with the designation T referring to Top and B referring to Bottom when the apparatus is viewed when the yarn is traveling horizontally and the disks are overlapping each other to some extent.

Although the disks **42** have been indicated to be made of metal for control purposes in order to guide yarn in its directed path of travel, these disks may be made of a suitable hard urethane or other material which has a lower coefficient of friction than the yarn twisting disks **38,** but the surface engagement should be such that the friction imparted to the continuously traveling yarn will assist in twisting the yarn or resist slippage of the yarn as it is twisted by the surface frictional contact with the disks **38.** Some slippage of the yarn on the disks **42** is permissible and, as will be described, highly desirable in some application where the twist may back up or ram back to build up greater twist in some twist zones depending upon the specifid yarns being processed as well as taking into consideration the speeds of yarn travel. It is further contemplated that the friction disk **38** may vary in axial width in that, for one twist complement zone of two friction disks **38** and one control disk **42,** one friction disk **38** may be wider axially than the other which may be desirable to vary the yarn tension into and out of the twist zone or stage depending upon the yarns used and the end result desired.

It may further be desirable to vary the diameter of the disks **38** and **42** on their respective shafts **18** and **20** in order to generate a back up or cramming control of the twist in one or more stages or zones. A variation of the relative speed between the shafts will produce such twist back up or cramming depending upon the number of twist zones or stages employed in the assembly.

Should wear on the frictional surfaces for disks **38** become excessive, the sides of the disks **38** may either be faced with harder or denser material at one or both perimetrical edges thereby permitting a greater angle of traverse into the next stage thereby reducing undue drag or wear on the corners or edges of the friction disks. It should be readily recognized that although the preferred embodiments shown include control disks that rotate, stationary guides may be substituted for guiding the yarn in juxtaposition to the rotating frictional surfaces of the disks **38.**

I claim:

1. The method of false twisting a continuously traveling synthetic yarn in which the yarn passes through a heating zone and the twist is set in a cooling zone after

emerging from the heating zone comprising steps of; guiding the yarn in a continuous rectilinear path of travel, guiding opposed side portions of the yarn at longitudinally spaced intervals displace the yarn from its rectilinear path, and incrementally rectilinearly rotating the guided yarn to apply a twist thereto extending through the cooling zone and at least into the heating zone.

2. The method of false twisting a continuously traveling yarn as recited in claim **1**, wherein the yarn is displaced equally to opposite sides of the rectilinear path of travel.

3. The method of false twisting a continuously traveling yarn as recited in claim **1**, wherein the yarn is guided and rotated at spaced intervals by frictionally engaging, driven cooperating rotary members forming at least one seat for the yarn.

4. The method of false twisting a continuously traveling yarn as recited in claim **3**, wherein the yarn extends across the peripheral surface of a rotating member at an angle with respect to the axis of rotation and the direction of rotation of the rotating member.

5. The method of false twisitng a continuously traveling yarn as recited in claim **1**, wherein the guided, displaced yarn follows a tortuous course.

6. Apparatus for imparting a false twist to a continuously traveling yarn comprising; support means, a pair of parallel shafts mounted for rotation upon said support means, a plurality of axially spaced members mounted upon each shaft for rotation, each member having a cylindrical, peripheral yarn engaging surface guidably supporting a yarn rectilinearly, each member on one shaft cooperating in partial overlapping relation with a member on the other shaft to define yarn-receiving seats on opposite sides of a plane passing through the axes of said shafts, means for guiding the yarn prior to and upon emerging from said plurality of axially spaced members, said yarn guiding means having yarn guide surfaces aligned within the plane passing through the axes of said shafts, said guide means directing the yarn across the yarn engaging surfaces of selected members at an angle with respect to the direction of rotation and the axis of rotation of said selected members, each pair of cooperating members defining yarn seats being spaced apart sufficiently to permit the running yarn to alternate between yarn seats at opposite sides of the plane passing through the axes of said shafts, and means for rotating said members to impart twist to the yarn.

7. Apparatus for imparting a frictional false twist to a continuously traveling yarn as recited in claim **6**, wherein the yarn-engaging peripheral surface of at least one member on each shaft is rectilinear and includes a yarn-engaging surface having a high coefficient of friction.

8. Apparatus for imparting a false twist to a continuously traveling yarn as recited in claim **6**, wherein a rotatable yarn engaging surface of a member on one shaft is substantially wider than the yarn engaging surface of a cooperating member mounted upon the other shaft.

9. Apparatus for imparting a frictional false twist to a continuously traveling yarn as recited in claim **6**, wherein the outer surface of a yarn-engaging member on one shaft is grooved to receive the yarn-engaging surface of a member on the other shaft.

10. Apparatus for imparting a false twist to a continuously traveling yarn as recited in claim **6**, wherein the yarn-engaging peripheral surfaces of all members are rectilinear, and the yarn-engaging surfaces of each cooperating pair of members are of different widths.

11. Apparatus for imparting a false twist to a continuously traveling yarn as recited in claim **6**, wherein said plurality of axially-spaced members rotate in the same direction and at the same speed.

12. Apparatus for imparting a false twist to a continuously traveling yarn comprising; support means, a shaft rotatably mounted on said support means, a yarn-engaging twist member mounted on said shaft for rotation therewith, said yarn-engaging twist member having a cylindrical, peripheral yarn-engaging surface, means for guidably supporting the continuously traveling yarn across the peripheral yarn-engaging surface of said twist member, and means for rotating said shaft.

13. Apparatus for imparting a false twist to a continuously traveling yarn as recited in claim **12**, a second yarn-engaging twist member mounted on said shaft in spaced-axial relation to said other yarn-engaging twist member and having a cylindrical, peripheral yarn-engaging surface forming a yarn-receiving throat therebetwen, said yarn-engaging twist members straddling said means for guidably supporting the continuously traveling yarn whereby the yarn engages the cylindrical, peripheral yarn-engaging surfaces of both of said twist members when said yarn emerges from the yarn-receiving throat between said twist members.

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