April 12, 1960 R. C. JACKSON 2,932,152

TEXTILE TWISTING APPARATUS

Filed May 28, 1958 2 Sheets-Sheet 1

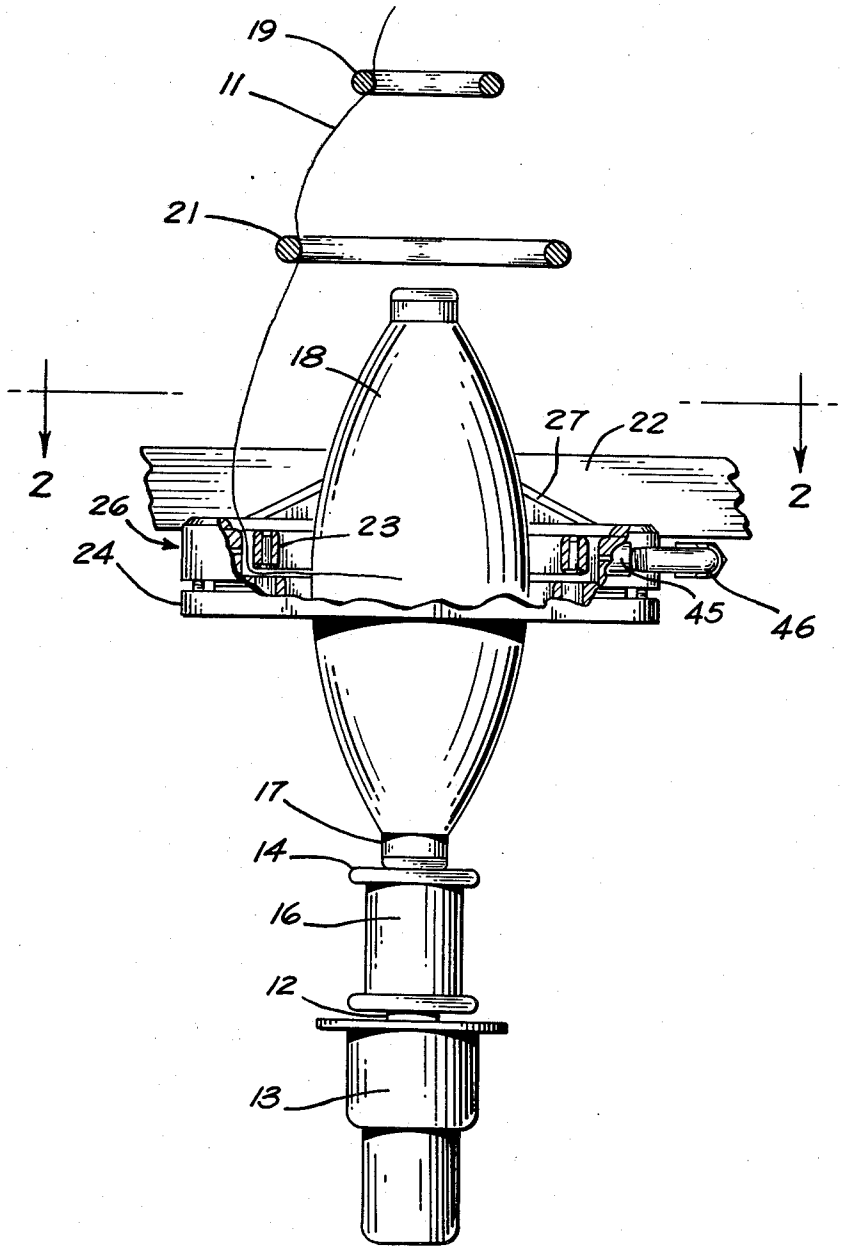

FIG. 1.

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TEXTILE TWISTING APPARATUS

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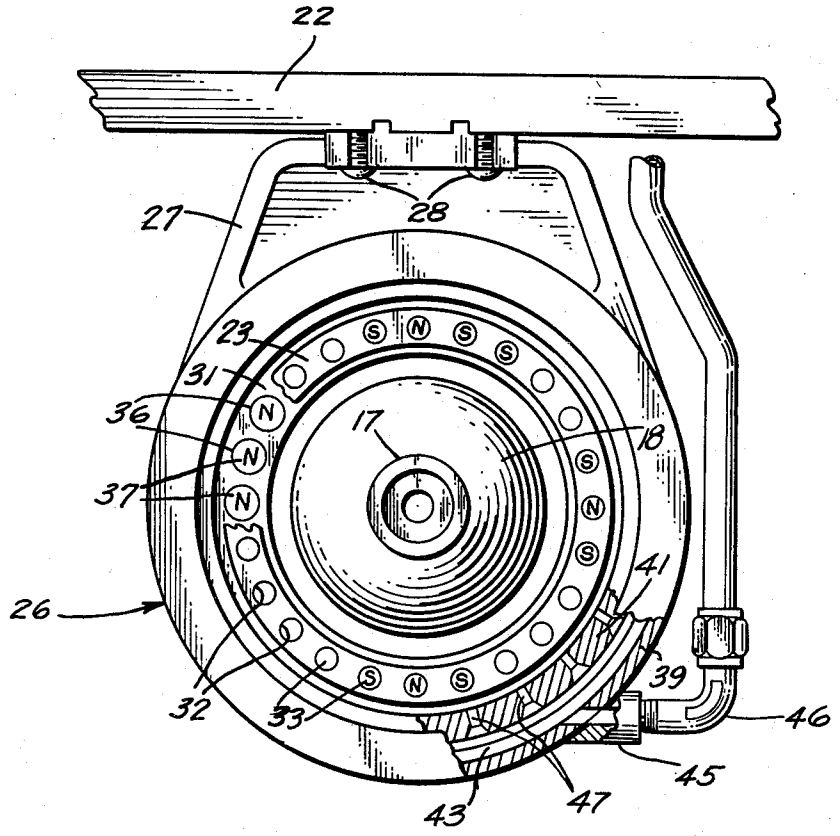

FIG. 2.

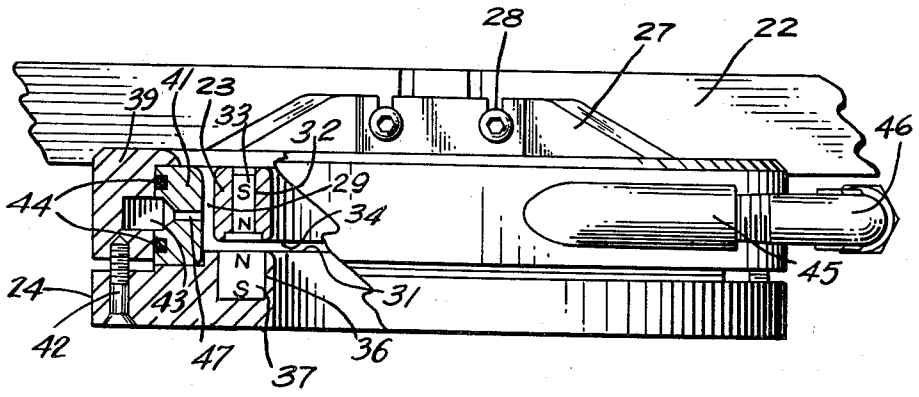

FIG. 3.

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TEXTILE TWISTING APPARATUS

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13 Claims. (Cl. 57—66)

This invention relates to textile apparatus and more particularly to an apparatus for introducing twist in filamentary material such as yarn, thread and the like during the winding of the material on a suitable holder such as a bobbin or spool.

In one class of textile manufacturing operation such as draw-twisting of artificial and synthetic fibers, cotton spinning and the like, a selected number of twists per inch is injected or introduced into yarn so that it will be able to withstand the rigors of handling, winding, beaming, and the like. In one of the most widely used types of yarn twisting apparatus, the yarn being processed is threaded through a device commonly known as a traveler which is loosely mounted on the inner periphery of an annular traveler ring. The traveler ring is positioned in encircling relationship with a rotating yarn holder such as a bobbin on which the twisted yarn is wound and the ring is arranged to be reciprocally moved between the nose and heel of the bobbin adjacent the bobbin effective winding surface. The traveler serves a dual purpose in that it both winds the yarn on the bobbin and twists the yarn as it is pulled around the inner periphery of the ring by the tension of the yarn.

As is well known, the weight and form of the traveler as well as the frictional drag of the traveler on the traveler ring must be selected for each application so that the yarn always pulls the traveler around the traveler ring and tension is maintained in the yarn. As these travelers rotate at very high speeds (6,000 to 8,000 r.p.m. and up) and as the yarn moves through the traveler at a relatively high speed, the wear on the traveler by the yarn and ring surfaces is severe. In many instances the traveler is replaced after each doff or at the completion of the bobbin winding operation. This, of course, means that yarn winding speeds are presently limited to ranges far below the commercial yarn processing speeds which competitive conditions dictate today. Furthermore, as a result of such rapid wear, these travelers frequently break during the winding and twisting operation prior to replacement creating a safety hazard to operators in the vicinity of the apparatus, as well as necessitating a shutdown of the broken position on the apparatus.

Although these travelers are relatively inexpensive individually, the large number of travelers which are required in a textile installation for operating the generally large number of bobbin winding and twisting devices generally found therein together with the need for their periodic replacement, soon become an economic burden of considerable consequence in a textile plant operation.

Accordingly, a primary object of this invention is to provide a new and novel textile twisting apparatus.

Another object of this invention is to provide a new and novel yarn twisting device for filamentary material which eliminates the need for a traveler.

A further object of this invention is to provide a new and novel textile twisting apparatus which is simple and inexpensive in construction, capable of prolonged use without breakdown, contains virtually no safety hazards, and

which permits the winding of a full package of twisted yarn on a holder without interruption.

A still further object of the invention is to provide a yarn twisting device which eliminates the need for traveler replacement and which produces a high quality package of twisted yarn.

This invention further contemplates the provision of a new and novel yarn twisting device which may be readily incorporated with existing textile apparatus such as a drawtwister in which drawn yarn is windingly guided onto a yarn bobbin across a surface of low friction by means of which both the yarn winding and twisting operations are carried out in a simple manner with a minimum of wear between the cooperating parts so that yarn breakage and destruction of the component parts of the twisting device are substantially eliminated.

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawing.

In general, the objects of the invention and related objects are accomplished by providing a yarn holder such as a bobbin. Means are provided for rotating the bobbin so that advancing yarn is wound thereon in the form of a package. An annular member is provided which is positioned in encircling relationship with the bobbin so as to guide the yarn toward the bobbin and wind it thereon. This annular member is suspended or floatingly positioned by magnetic means so that the yarn rotates freely around the annular member and permits the introduction of twist into the yarn as the yarn is wound on the bobbin.

The novel features which are believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation may be best understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is an elevation view, partially in section, of a textile twisting apparatus constructed in accordance with the invention;

Figure 2 is a sectional view taken substantially along line 2—2 of Figure 1; and

Figure 3 is an enlarged view, partially in section, of a portion of the apparatus of Figure 1.

Referring now to the drawings, there is shown in Figure 1 a yarn twisting device constructed in accordance with the invention which is preferably positioned in the manner commonly employed in twisting apparatus incorporated in textile apparatus such as a spinning frame or a drawtwister. For instance, in a conventional drawtwister, twisting apparatus of the type shown in Figure 1 is incorporated with yarn drawing means (not shown) such as cooperating feed and draw rolls which stretch or draw yarn traveling therebetween.

It should be understood that the twisting apparatus of Figure 1 may be employed to process both spun and continuous filament material either monofilamentary or multifilamentary, such as yarn or thread which may be composed of any suitable composition both natural, artificial and synthetic. For instance, as will be described hereinafter, the twisting device of Figure 1 is well adapted to be used in the processing of a filamentary yarn 11 composed of a synthetic material such as nylon.

As generally illustrative of the twisting apparatus of Figure 1, a vertically extending spindle 12 has been provided which is suitably mounted at its lower end for rotation in a conventional type of journal or bearing 13. In order to drive the spindle 12, a whorl 14 has been provided which is mounted for rotation with the spindle and is arranged to be driven by any suitable means such as a belt 16.

The spindle 12 is arranged to accommodate a yarn or thread holder such as a bobbin 17 which is suitably arranged in the conventional vertically extending position substantially coaxial with the spindle 12. The bobbin 17 is preferably arranged to wind yarn 11 on its peripheral surface throughout substantially its entire length to form a yarn package 18 as shown.

As previously explained, the yarn 11 which in the drawtwister has been drawn in the yarn drawing means, is generally arranged to be advanced in a downward direction through a yarn guide 19 and tends to expand outwardly to form what is commonly known as a "balloon." Preferably, confining means for this yarn balloon are provided which, as shown in Figure 1, may be in the form of an annular ring 21 suitably positioned adjacent the nose of the bobbin 17 so that the yarn passing through the ring in contact with its inner periphery is prevented from ballooning excessively.

As is well known in conventional equipment, means are provided for twisting and guiding the movement of the yarn 11 on the bobbin 17 to form the package 18 so that the yarn is wound throughout the effective winding surface of the bobbin. As is understood, this twisting and guiding means must be reciprocated vertically in an arrangement such as shown in Figure 1 in order to form the proper package on the bobbin 17 and a ring or lay rail 22 is generally provided which may be moved reciprocally by any suitable means (not shown) so as to simultaneously produce the proper reciprocating motion in all of the stations or positions in a drawtwister, one of which is shown in Figure 1.

In present day guiding and twisting arrangements, a ring traveler is generally provided of a selected size and shape according to the particular application, through which the yarn being fed is conducted. This traveler is supported by a traveler ring on the lay rail 22 and travels circumferentially around the bobbin 17 at a very high rate of speed under the pulling action of the yarn. As is well known, these travelers, although inexpensive singly, are used in large quantities and must be replaced constantly due to the high rate of wear. Furthermore, they are a source of frequent danger and annoyance in that as a result of this rapid wear they are prone to disintegrate and endanger individuals who may be working in the vicinity. Means have, therefore, been provided for winding and twisting the yarn 11 onto the bobbin 17 which eliminates the problems inherent in a guiding and twisting device incorporating such a traveler.

As specifically illustrative of the invention, an annular member or yarn guide ring 23 has been provided which is positioned as shown in Figure 1 in encircling relationship with the yarn holder or bobbin 17. In the preferred arrangement, the guide ring 23 lies in a plane which is substantially perpendicular to the vertical axis of the bobbin 17.

In order to support the yarn guide ring 23 in the position of Figure 1, supporting means have been provided which comprise an annular support ring 24 having an upstanding marginal flange designated generally by the numeral 26. The flange 26 may, if desired, be formed integrally with the support ring 24, but in the preferred embodiment the flange 26 is formed as a separate unit in a manner to be explained hereinafter. As shown best in Figure 2, the support ring 24 is positioned in encircling relationship with the bobbin 17 in the manner of the guide ring 23 and is suitably connected to the ring or lay rail 22 for reciprocating movement by means such as a bracket 27. Any suitable means such as bolts 28 may be provided for securing the bracket to the lay rail 22.

Means have been provided for supporting the guide ring 23 in a suspended or floating position above the support ring 24 within the area 29 defined by the upstanding support ring flange 26 so that the yarn 11 may travel freely along the outer periphery of the guide ring 23. More specifically, magnetic means are provided within the support ring 24 and guide ring 23 as shown best in Figures 2, 3, which produce a magnetic repelling force between these two rings. As a result of this repelling force, the guide ring 23 is maintained in spaced-apart relationship with the upper surface 31 of the support ring 24.

Referring now to Figures 2, 3, a plurality of vertically extending, radially spaced passages 32 are provided in the guide ring 23 which accommodate magnetic means such as a bar magnet 33 secured in each of the passages by any suitable means such as press fitting or the like. The lower end of the magnet 33 is positioned substantially flush with the lower surface 34 of the guide ring 23. In a similar manner, a plurality of radially spaced recesses 36 are provided in the support ring 24 which accommodate magnetic means such as magnets 37, the upper faces of which are arranged to lie substantially flush with the support ring upper face 31. As shown best in Figure 3, each of the magnets 37 is preferably vertically aligned with a magnet 33 in the guide ring 23 so that their opposed faces lie in spaced relationship as a result of the below-described magnetic action.

In order to obtain the necessary force to maintain the ring 23 in the suspended position of Figure 1 above the support ring surface 31, each of the vertically aligned magnets 33, 37 are arranged with their opposed ends of similar polarity so that a repelling action between the magnets and consequently the rings 23, 24 results. As the support ring 24 is rigidly supported, the guide ring 23 is forced upwardly into spaced parallel relationship with ring 24 and floats freely as shown in Figures 1, 3. It should be understood that in the inoperative condition, a side portion of the guide ring 23 moves into contact with the inner wall of flange 26 while at the same time the repelling force produced by the magnetic means maintains the rings 23, 24 in the spaced-apart relationship.

It has been found in practice that a magnetic strength sufficient to maintain the space between rings 23, 24 within the range of between 1/32 and 1/8 inch results in a satisfactory performance in the apparatus of Figure 1. It should be understood that since the magnets are uniformly distributed in a radially spaced manner throughout the rings 23, 24, the rings are maintained in a spaced, substantially parallel relationship.

During the operation of the apparatus of Figure 1, the yarn 11 is passed around the outer periphery of the ring 23 in the manner of Figure 1 so that as the spindle 12, and consequently the bobbin 17, is rotated and the lay rail reciprocated, the yarn 11 is wound or laid on the winding surface of the bobbin. At the same time, the yarn travels circumferentially along the outer periphery of the ring 23 so that twist is introduced into the yarn during winding. It should be understood that twisting of the yarn is accomplished in the conventional manner by advancing the yarn 11 using any suitable means (not shown) at a speed less than the linear speed of the surface of the bobbin 17 or package 18 so that the twisting will occur during the circumferential movement of the yarn 11 around ring 23. As is well known, the greater the speed differential, the greater the amount of twist inserted in yarn 11.

It can be seen that the guide ring 23 should be maintained substantially coaxial with the bobbin 17 and the support ring 24 during the above-described winding and twisting operation, and it has been found that when the apparatus of Figure 1 has reached normal operating speed, the radial forces exerted by the yarn 11 against the outer periphery of the ring 23 will provide a satisfactory ring centering force and the yarn guide ring will be maintained in the position of Figure 1. However, it may be desirable, particularly during start-up, to provide an additional radial force on the guide ring 23 to maintain the ring in this coaxial position.

Centering means for guide ring 23, therefore, have been provided for producing this additional radial force which will positively maintain the guide ring 23 in a co-

axial relationship with the support ring 24. More specifically, as shown in Figure 3, the support ring flange 26 is preferably formed of a pair of interfitting annular members 39, 41 which are arranged to be securely held in the position of Figure 3 by means such as a plurality of screws 42 positioned within the support ring 24. The annular members 39, 41 are provided with cooperating surfaces so as to form an annular passage or manifold 43 and sealing means such as O-rings 44 are provided as shown which prevent leakage from the manifold between the cooperating surfaces of the members 39, 41.

The manifold 43 is arranged to communicate by means of a tangential fitting 45 with a pressure line 46 (Figure 2) connected to a source of pressurized fluid such as compressed air. A plurality of radially spaced, inwardly extending passages or nozzles 47 are formed in member 41 as shown in Figure 2 which communicate at their outer ends with the manifold 43 and are arranged to direct a stream of compressed air from their inner ends radially inward against the outer periphery of the yarn guide ring 23.

When compressed air is flowing within line 46 and manifold 43, the air will flow simultaneously through all of the nozzles 47 and impinge on the periphery of the ring 23 with a uniformly distributed force directed radially inward. Thus, a positive centering force is obtained which maintains the ring 23 in uniformly spaced relationship with the annular member 41 in flange 26 and any force which tends to move the guide ring 23 out of coaxial alignment with the support ring 24 is immediately resisted. As has been previously explained, the admission of air through the nozzles 47 may be terminated after the apparatus of Figure 1 has attained its normal operating speed as the centering action of the yarn 11 at that time is sufficient to maintain the guide ring 23 in its properly centered position.

It has been found that the frictional engagement between the yarn 11 and the outer periphery of the ring 23 produces sufficient drag on the yarn to maintain the proper tension therein. This drag, of course, will produce some rotation of the guide ring 23 on its axis which is of no consequence in many cases. However, it has been found that in the processing of certain types of yarn, the guide ring 23 may tend to rotate to an excessive extent. When the guide ring 23 attains an excessive speed of rotation, it is extremely difficult to maintain the proper tension in the yarn 11 and consequently a soft or easily sluffed package 18 is obtained. Therefore, it may be desirable to provide a retarding force to limit the rotation of the guide ring 23.

Such a retarding force may be obtained by providing in a selected number of the guide ring recesses 32 a reversal of the magnetic relationship shown in Figure 3. That is, in each case one of the pair of magnets 33, 37 is inverted so as to provide opposed faces of dissimilar polarity whereby an attractive force is created between the reversed magnets in the rings 23, 24 which retards the rotational movement of the ring 23. For instance, as shown in Figure 2, four of the magnets 33 which are spaced at 90° along the ring 23 have been inverted in the above-described manner to provide a retarding force which limits the rotation of the guide ring 23. If desired, however, the ring retarding force may be obtained by pneumatic means which direct air against vanes or the like on the guide ring surface so as to provide a counter rotational force for overcoming the guide ring rotational force produced by the yarn friction.

It can be seen that with the novel construction of this invention it is now possible to obtain a wound and twisted package of filamentary material such as yarn without the use of the ring traveler, an item of considerable expense, both from the standpoint of initial investment and replacement time and cost. Through a relatively inexpensive construction, yarn may now be twisted and wound in the same or a more highly efficient manner

than heretofore, while the risk of position breakdown from traveler disintegration during the twisting operation has been eliminated. The problem of selecting the exact size and type of traveler need no longer be of any concern as the invention is readily adapted for use in winding and twisting a wide range of yarn types and sizes. If desired, the tension on the yarn being processed in the apparatus of the invention can be varied by making changes in such items as the guide ring surface finish, the contact area of the yarn on the guide ring or with the use of balloon guides, or any combination thereof. One of the most outstanding improvements which may be obtained with the invention described above is the higher winding and twisting speeds which may now be employed since the maximum speed limitation imposed by the traveler type of twisting apparatus is no longer present.

While there has been described what at present is considered to be the preferred embodiment of the invention, it will be understood by those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore, it is the aim of the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

Having thus described the invention, what is claimed is:

1. A yarn twisting apparatus comprising, in combination, a yarn holder, means for rotating said yarn holder, an annular member encircling said yarn holder and arranged to guidably wind said yarn on said holder, and means for magnetically supporting said annular member in a suspended position to permit said yarn to rotate freely around said annular member and introduce twist therein during the winding of said yarn on said holder.

2. A yarn twisting apparatus comprising, in combination, a yarn holder, means for rotating said yarn holder, an annular member encircling said yarn holder and arranged to guidably wind said yarn on said holder, means for magnetically supporting said annular member in a suspended position to permit said yarn to rotate freely around said annular member and introduce twist therein during the winding of said yarn on said holder, and means for centering said annular member substantially coaxial with said holder.

3. A yarn twisting apparatus in accordance with claim 2 wherein said annular member centering means is pneumatically actuated.

4. A yarn twisting apparatus comprising, in combination, a yarn holder, means for rotating said yarn holder, an annular member encircling said yarn holder and arranged to guidably wind said yarn on said holder, means for magnetically supporting said annular member in a suspended position to permit said yarn to rotate freely around said annular member and introduce twist therein during the winding of said yarn on said holder, and a plurality of radially spaced nozzles arranged to direct a fluid medium against the periphery of said suspended annular member and maintain said member substantially coaxial with said holder.

5. A yarn twisting apparatus comprising, in combination, a yarn holder, means for rotating said yarn holder, a guide ring encircling said yarn holder in a plane substantially perpendicular to the axis of said holder and arranged to guidably wind said yarn on said holder, and means for magnetically supporting said guide ring in a suspended position to permit said yarn to rotate freely around said annular member and introduce twist therein during the winding of said yarn on said holder.

6. A yarn twisting apparatus comprising, in combination, a yarn holder, means for rotating said yarn holder, a support ring encircling said yarn holder, an annular member encircling said yarn holder in overlying relationship with said support ring and arranged to guidably wind said yarn on said holder, magnetic means in said

support ring and said annular member for supporting said annular member in a suspended position to permit said yarn to rotate freely around said annular member and introduce twist therein during the winding of said yarn on said holder.

7. A yarn twisting apparatus in accordance with claim 6 including means for vertically reciprocating said support ring axially of said holder.

8. A yarn twisting apparatus comprising, in combination, a yarn holder, means for rotating said yarn holder, a support ring encircling said yarn holder, a yarn guide ring encircling said yarn holder in overlying relationship with said support ring and arranged to guidably wind said yarn on said holder, a plurality of radially spaced vertically aligned magnets in said support ring and said annular member, said magnets having opposed faces of similar polarity for supporting said annular member in a suspended position to permit said yarn to rotate freely around said guide ring and introduce twist therein during the winding of said yarn on said holder.

9. Yarn twisting apparatus in accordance with claim 8 including means for limiting the rotation of said annular member by the friction of said yarn.

10. Yarn twisting apparatus in accordance with claim 8 wherein at least one opposed pair of magnets are of dissimilar polarity to introduce an attractive force between said support ring and said guide ring and limit the rotation of said annular member by the friction of said yarn.

11. A yarn twisting apparatus comprising, in combination, a yarn holder, means for rotating said yarn holder, a support ring encircling said yarn holder, a guide ring encircling said yarn holder in overlying relationship with said support ring and arranged to guidably wind said yarn on said holder, and magnetic means in said support ring and said guide ring for supporting said guide ring in a suspended position to permit said yarn to rotate freely around said annular member and introduce twist therein during the winding of said yarn on said holder, said support ring having a plurality of radially spaced nozzles arranged to direct a fluid medium against the periphery of said guide ring and maintain said guide ring substantially coaxial with said holder.

12. A yarn twisting apparatus comprising, in combination, a yarn holder, a vertically extending spindle for accommodating said holder, means for rotating said spindle, a support ring encircling said yarn holder and lying in a plane substantially perpendicular to the axis of said holder, an upstanding marginal flange on said support ring, means for vertically reciprocating said support ring, a yarn guide ring encircling said holder concentrically within said support ring flange, said guide ring being arranged to guidably wind said yarn on said holder during the reciprocating movement of said support ring, a plurality of radially spaced vertically aligned magnets in said support ring and guide ring, each pair of said vertically aligned magnets having opposed faces of similar polarity for supporting said annular member in a suspended position to permit said yarn to rotate freely around the outer periphery of said guide ring within said support ring flange and introduce twist therein during the winding of said yarn on said holder, said support ring having an annular fluid manifold therein, and means for supplying pressurized fluid to said manifold, said flange having therein a plurality of radially spaced nozzles communicating with said manifold and arranged to direct a fluid medium against the outer periphery of said suspended guide ring and maintain said guide ring substantially coaxal with said holder.

13. A device for guiding a yarn onto a yarn holder, comprising means for rotating the yarn holder, support means adjacent to the yarn holder, guide means positioned above the support means for cooperating with said support means to guide the yarn therebetween, means attached to the support means for creating a first magnetic field, and means carried by the guide means for creating a second magnetic field having a polarity opposed to the polarity of the first magnetic field so as to cause the guide ring to be suspended a predetermined distance above the support means.

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