June 25, 1957 N. E. KLEIN 2,796,726

YARN BALLOON CONTROLLER OR GENERATOR

Filed April 12, 1951 2 Sheets-Sheet 1

Fig. 1.

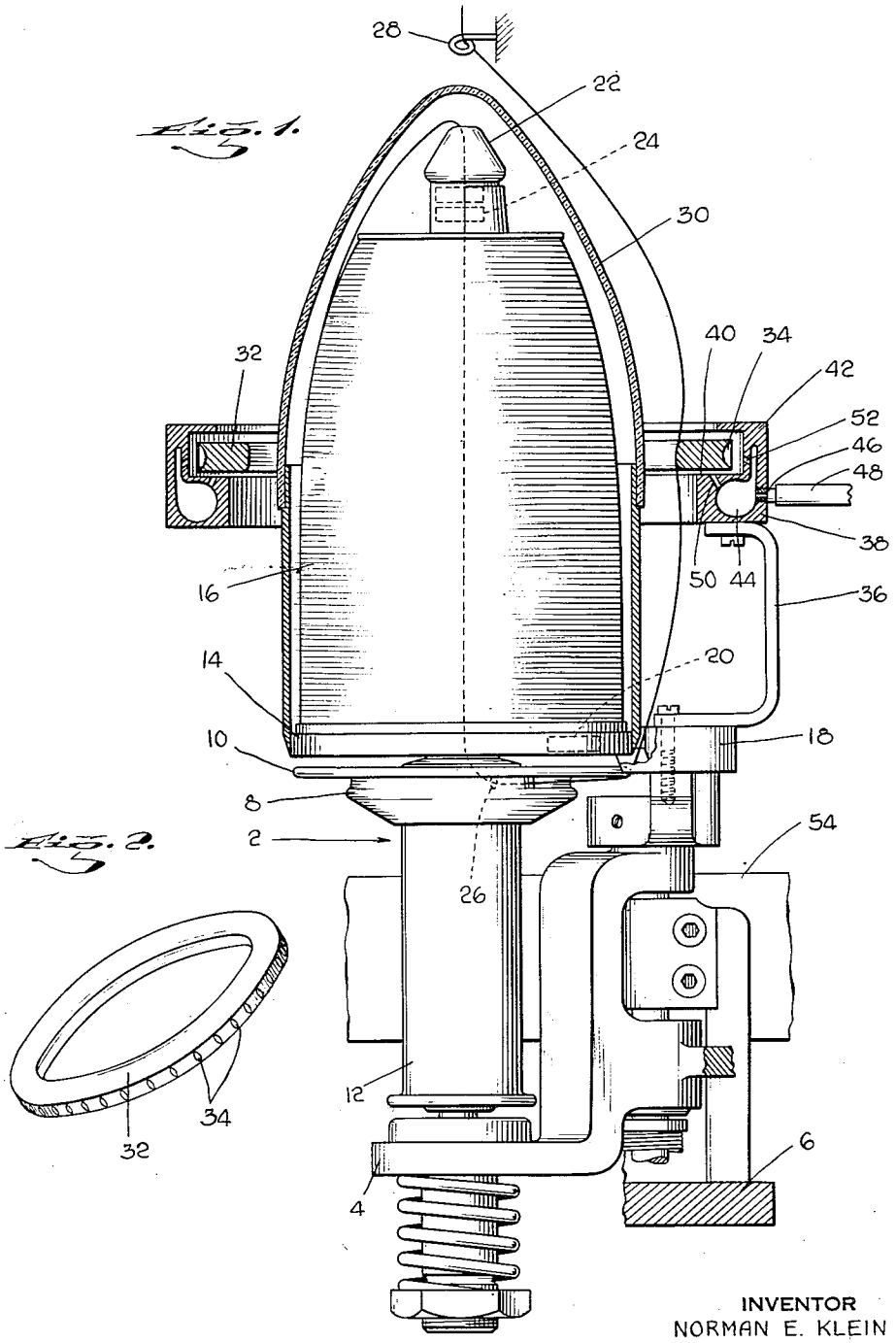


Fig. 2.

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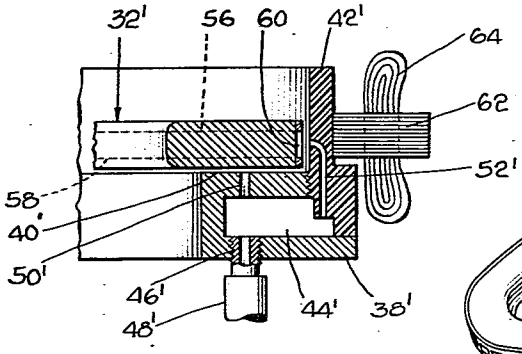


Fig. 3.

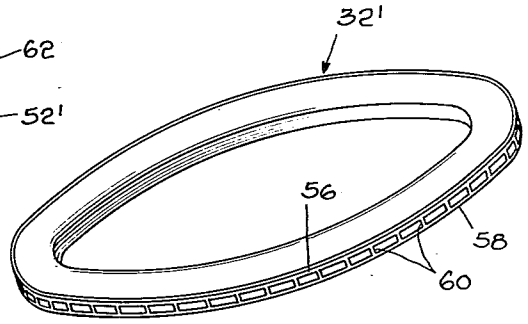
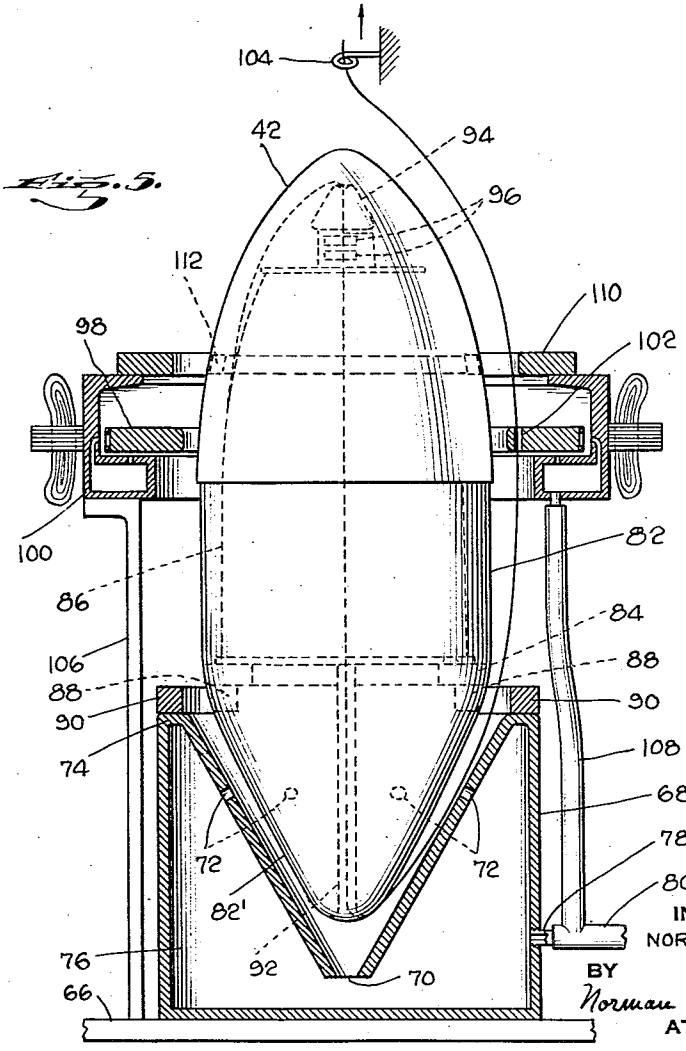


Fig. 4.

Fig. 5.



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YARN BALLOON CONTROLLER OR GENERATOR

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Application April 12, 1951, Serial No. 220,667

26 Claims. (Cl. 57—58.84)

The present invention relates to textile twisting or plying machines and more particularly to the type of textile machine wherein the path of the yarn traveling to or from the machine rotates about an axis and forms a so-called yarn "balloon." Machines of this character are ordinarily arranged side by side on long frames, each machine forming one unit of the frame. It is important from the stand point of maximum production that each unit occupy a minimum space and hence that the maximum diameter of the yarn balloon formed at each unit not be excessive.

In co-pending applications of the present applicant, Serial No. 133,047, filed December 15, 1949, now Patent Number 2,731,786, which issued January 24, 1956, and Serial No. 179,069, filed August 12, 1950, now Patent Number 2,625,786 which issued January 20, 1953, a two-for-one twister is disclosed and claimed which includes a fixed balloon confining ring positioned substantially at the level of maximum free balloon diameter. The fixed ring of the said applications serves together with a storage or "wrap-around" device on the rotating spindle of the twister to provide tension shape control for the yarn balloon and also serves to prevent tangling of the balloons of adjacent units and thus to permit close spacing of the units. The balloon confining ring of the twister of the said co-pending applications has been found to be of substantial value. When, however, certain yarns, such as viscose yarn of low denier made by the cuprammonium process or heat sensitive yarns, such as nylon, are twisted on devices provided with such fixed balloon confining rings, the tensile strength of the twisted yarn, particularly when high twist is being inserted therein, is unduly reduced. Examination under a microscope reveals many broken filaments in the yarn which have resulted, it is believed, from abrasion of the yarn by the ring or from heat engendered by fractional engagement of the ring by the yarn.

It is the primary object of the present invention to provide in a twister, or the like, yarn balloon confining means which have the advantages of the fixed ring of the said prior applications and yet will neither abrade nor overheat the yarn.

It is a further object of the invention to provide a novel two-for-one twister in which the balloon confining means serves also as the generator of the balloon, thus rendering unnecessary the provision of a spindle and a flyer and the driving means therefor, and thereby substantially simplifying the twister construction.

These and other objects of the invention are attained by the provision of a balloon confining ring which is itself rotated about the axis of the yarn balloon in such direction as to reduce or eliminate relative lateral movement of the yarn on the inner surface of the ring. Preferably the ring is supported on an air cushion. The ring may be provided with pockets or "buckets" and driven by air jets in the manner of a turbine, or the ring may be the armature-rotor of an induction motor. In either

case the yarn may freely engage the inner surface of the ring or it may pass through a suitable aperture in the ring. When the yarn engages the inner surface of the ring, the balloon is generated as in the twister of the said co-pending applications by rotation of a spindle and flyer secured thereto whereas when the yarn passes through the ring the balloon is generated by rotation of the ring.

For a better understanding of the invention and of specific embodiments thereof, reference may be had to the accompanying drawings of which:

Fig. 1 is a side view, partly in section, of a two-for-one twister provided with a balloon confining air floated and air driven ring embodying the invention;

Fig. 2 is a perspective view of the ring of Fig. 1;

Fig. 3 is an enlarged fragmentary sectional view of an inductively driven ring representing another embodiment of the invention;

Fig. 4 is a perspective view of the ring of Fig. 3;

Fig. 5 is a diagrammatic side view partly in section of a two-for-one twister equipped with a combined balloon confining and balloon generating ring.

The particular twister illustrated in Fig. 1 is that forming the subject matter of Serial No. 133,047 except that the fixed balloon confining ring of that twister is replaced by the rotatable ring of the present invention. The spindle 2 of the twister is rotatably mounted on a conventional swing gate 4 secured to the spindle rail 6 of the twister frame. A storage or "wrap-around" device 8 and disk flyer 10 are secured to the spindle above the whorl 12 and a package support platform 14 is rotatably mounted on the spindle above the disk flyer. The platform 14 and package 16 carried thereby are magnetically stabilized against rotation with the spindle by known means, as for example cooperating magnets 18 and 20 carried respectively by the gate 4 and platform 14. An apex yarn guide 22 is supported from the platform above the package 16. Suitable pretensioning means indicated at 24 are positioned in the yarn flow path between the guide 22 and the spindle orifice 26, the yarn flow path being from the outside of the package to the guide 22, down through the guide and pretension device along the axis of the spindle to the orifice 26 and thence to the annular surface of the storage device 8. The yarn wraps around that surface through a small and variable angle, then passes up over the disk flyer 10 to and through a fixed guide 28 to a take-up device (not shown), the yarn ballooning about the package and platform in transit from the flyer to the fixed guide. Preferably, as shown, the platform and parts carried thereby are enclosed in a suitable cover 30 of plastic or the like.

In accordance with the invention a rotatable ring 32 having a smoothly rounded and polished inner yarn engaging surface and provided around its outer periphery with a plurality of pockets or buckets 34 encircles the cover 30. During operation of the twister the ring is air supported and air rotated by means now to be described. Supported from the swing gate 4, as by a bracket 36, is an annular casing 38 which has a flat upper surface 40 serving as a seat for the ring 32 when the twister is not in operation and an upwardly extending rim portion 42 encircling the outer periphery of the ring. The casing 38 is formed with an interior cavity or chamber 44 which extends up into the rim portion 42 and which is connected by a nipple 46 to a hose 48. The hose 48 is connected to a suitable supply of compressed air (not shown). A number of small passages 50 forming air vents from the chamber 44 to the seat 40 are drilled or otherwise formed in the upper wall of the casing 38 and similar passages 52 are formed in the inner wall of the rim portion 42. The jets of air issuing from passages 50 provide an air

cushion for support of the ring 32 and the jets of air issuing from the passages 52 and impinging upon the ring 32 and buckets 34 serve to rotate the ring, the passages 52 being angularly disposed with respect to the axis of ring 32 to provide a tangential component of force on the ring in the direction of rotation of the yarn balloon.

The operation of the twister of Fig. 1 will be readily apparent from the foregoing description of the various parts thereof. During operation, air under pressure is delivered through hose 48 to chamber 44 for support and rotation of ring 32. The twister spindle is rotated, as by a belt 54 in engagement with the whorl 12. The yarn, under the pull exerted by the conventional take-up device (not shown) is drawn upwardly from the outer surface of the package 16, down through the guide 22 and pretension device 24 axially of the spindle and out through orifice 26 therein. From the spindle passage the yarn passes to the annular skirt of the storage device upon which it wraps for a quarter turn or so, depending upon the tension in the yarn, then over the under surface of the flyer 10 and upwardly between the magnet 18 and package platform 14. The yarn, in ballooning about the cover 30 in transit to the fixed guide 28, engages the inner periphery of ring 32 to a greater or less extent, again depending upon the tension in the yarn. As the ring is rotating in the direction of the yarn balloon, and preferably at or near the same rate of rotation, there will be but little, if any, lateral slippage of the yarn on the ring and therefore abrasion and overheating of the yarn will be substantially reduced as compared to that occurring when a fixed ring is employed. All the advantages, as distinguished from the disadvantages, of the fixed ring are retained with the rotating ring. It cooperates with the storage device in tension shape control of the yarn balloon in the same way as does the fixed ring and it also serves to prevent expansion of the balloon with resultant interference with neighboring units. The air cushion support for the ring avoids all necessity for lubrication and insures long life as there is no rubbing of one moving surface on a fixed surface.

Instead of driving the floating ring by air jets, the arrangement illustrated in Figs. 3 and 4 may be employed. In this embodiment of the invention, the ring 32′ forms the rotor of an induction motor. For this purpose it is provided around its outer periphery with circumferential upper and lower bands 56 and 58, respectively, of aluminum, copper, or the like, interconnected by strips 60 of similar metal which together serve, in effect, as a "squirrel cage winding." The supporting casing 38′ for the ring 32′ has a cylindrical wall 42′ of plastic or the like around the outer periphery of which is secured the stator for the ring 32′ comprising a laminated annular core 62 and winding 64. The casing 38′ the main portion of which can be of brass or other nonmagnetic metal is provided with an annular chamber 44′ connected by a nipple 46′ with a hose 48′ and connected by passages 50′ in the upper wall with the seat 40′ for the ring. Preferably passages 52′ leading from the chamber 44′ and terminating opposite the outer surface of the ring 32′ are provided in the cylindrical wall 42′. In this embodiment of the invention the ring is air supported but not air rotated, rotation being imparted to the ring by magnetic induction. The air jets from passages 50′ provide the air cushion support and the jets from passages 52′ provide a centering force on the ring preventing engagement thereof with the wall 42′. The above described construction permits the ring to be driven in either direction of rotation and therefore is a more flexible arrangement than that of Figs. 1 and 2. Also, particularly at high rates of rotation, the inductively driven ring is preferred because it is substantially noiseless. It will be understood that the ring 32′ of Figs. 3 and 4 will be positioned like ring 32 of Figs. 1 and 2 to engage and

control a yarn balloon of a twister such as that indicated in Fig. 1.

Instead of the yarn balloon freely engaging the inner periphery of the rotating air supported ring, as in the embodiment of the invention so far specifically described, a yarn guide passage could be formed in the ring for passage of the yarn therethrough in which case there would be no possibility of lateral motion of the yarn on the ring surface. When such a guide passage is provided, the ring, of course, must be rotated at the exact rate of the yarn balloon to avoid interference therewith. Any attempt at exact correlation of balloon rate of rotation with ring rate of rotation is avoided if the ring itself is made the generator of the balloon. Such an arrangement, which results in a new type twister having numerous advantages over conventional twisters heretofore known in the art, is illustrated diagrammatically in Fig. 5 to which reference may now be had.

The twister of Fig. 5 lacks many of the elements normally associated with twisters known in the art. There is no rotating spindle nor part equivalent thereto and hence no drive belt, no swing gate and no conventional spindle rail. Assuming, however, that the twister of Fig. 5 is one of many units mounted side by side along a frame, the platform 66 may be considered as a fixed longitudinal rail of such frame. Mounted on the platform or rail 66 at each twister location is a hollow cylindrical casing 68 having an inverted conical upper wall open at its apex 70 and provided with a series of openings 72 around its periphery intermediate the apex 70 and the upper lip 74 forming the base of the inverted cone. The chamber 76 within the casing 68 is connected by a nipple 78 to an air supply line 80. Above casing 68 and extending into the conical opening in its upper surface is a package container 82 which has a lower conical shape generally conforming with the upper surface of casing 68. When the twister is not in operation the lower part 82′ of the container 82 seats in the casing 68 but when air under pressure is delivered to chamber 76 the jets of air issuing through the opening at apex 70 and through orifices 72 support the container and maintain it out of engagement with the walls of the casing. The casing 82 may be, and preferably is, of plastic material. An annular ledge or shoulder 84 on the inner surface of the container adjacent the base of the inverted conical lower end 82′ thereof provides a support for the yarn supply package 86. Secured to the inner wall of the container on the under side of the ledge 84 are a pair of permanent magnets 88 which cooperate with magnets 90 mounted on the casing 68 to stabilize the container against rotation on its axis. The lower part 82′ of the container has an axially disposed tube 92 therein, the lower end of the tube having smoothly rounded flaring walls for passage of yarn thereover and the upper end of the tube extending into the core of the yarn supply package. A suitable apex yarn guide 94 and a pretension device 96 are carried by the package 86. A balloon confining and generating ring 98, supported like ring 32′ of Fig. 3 by air issuing from passages in the upper wall of an annular casing 100, and inductively driven like ring 32′ is provided with a yarn passage 102 therethrough. A guide 104 is fixedly positioned above the container 82 on the extended axis of the package.

The annular casing 100 carrying the stator structure for the ring armature 98 is supported by a bracket 106 from the rail 66 and compressed air for support of the ring is delivered to the annular air chamber of the casing 100 by means of line 108 connected to the line 80. Carried by the casing 100 is a ring 110 of magnetic material which is radially and permanently magnetized and which cooperates with a similar radially magnetized ring 112 mounted on the inner wall of the container 82, the magnetization of the rings 110 and 112 being such that like poles are presented to each other, that is, if the outer

periphery of ring **112** is considered as a north pole, the inner periphery of ring **110** is also a north pole. The magnetic repulsion between the rings **110** and **112** thus serve to center the container **82** and maintain its position in space.

With the above described construction, when air under pressure is delivered to chamber **76** of the support casing **68** and to the annular chamber of casing **100**, the container **82** is lifted from its seat in the upper wall of casing **68** and ring **98** is similarly air supported above the casing **100**. Energization of the stator winding causes the ring **98** to rotate about the axis of the package and to generate a yarn balloon. Yarn under the influence of a take-up device (not shown) is drawn up from the package, down through the guide **94** and tension device **96**, axially of the package and tube **92** then up between the conical walls of container **82** and casing **68** and through the passage **102** in ring **98** to and through the guide **104**, two twists being inserted in the yarn for each rotation of the ring **98**. The direction of twists is determined by the direction of rotation of the ring **98**. Thus, by utilizing the rotating air supported ring as a balloon generator a novel two-for-one twister having no other rotating parts is realized. The economy both from the standpoint of initial construction and of upkeep of the new twister as compared to conventional twisters will be apparent. Bearings, spindles, belts, flyers, swing gates and many other conventional parts of twister frames are dispensed with as is also all necessity for lubrication of moving parts. Also, as the only moving parts of the new twister are the ring and the yarn itself, very little wear and long useful life of the twister result.

The invention has now been described with reference to several embodiments thereof. Obviously, various changes in the specific constructions illustrated and described could be made without departing from the spirit of the invention or the scope of the accompanying claims. For example, although the yarn package container of the new twister has been shown as supported by a cushion of air, other means, for example magnetic means, could be provided for so supporting the package container as to permit formation of the yarn balloon thereabout. Other changes will be apparent to those skilled in the art.

The following is claimed:

1. The combination with a twisting device of the type wherein a yarn balloon is formed during operation of the device, of a ring surrounding and confining the balloon and rotating about the balloon axis in the same direction as the yarn, said ring being supported by a cushion of air.

2. The combination according to claim 1 wherein said ring is air rotated.

3. The combination according to claim 2 wherein said ring is cut away at intervals about its outer periphery to form buckets and rotation of the ring is effected by impingement of jets of air on said buckets.

4. The combination with a twisting device of the type wherein a yarn balloon is formed during operation of the device, of a ring surrounding and confining the balloon and rotating about the balloon axis in the same direction as the yarn, said ring being rotated by induction.

5. The combination with a twisting device of the type wherein a yarn balloon is formed during operation of the device, of a ring surrounding and confining the balloon and rotating about the balloon axis in the same direction as the yarn, said ring being substantially at the location of maximum free balloon diameter.

6. A two-for-one twister comprising in combination means for supporting a supply package, a ring surrounding said package and spaced therefrom, means for rotating said ring, and means for guiding yarn upwardly from said package, then downward axially of said package and then upwardly about said package and within said ring.

7. The twister according to claim 6 wherein said ring is provided with a yarn guide passage therethrough whereby rotation of the ring causes the yarn to balloon about the package.

8. The twister according to claim 6 including means for preventing rotation of said package support means.

9. The twister according to claim 6 including means for creating a cushion of air for support of said ring.

10. The twister according to claim 6 including an annular structure formed with an annular chamber and having an upper seat portion adapted to support said ring when the twister is not in operation, said structure being provided with a plurality of passages providing air vents from said chamber to said seat portion, and means for delivering air under pressure to said chamber for support of said ring above said seat by the jets of air issuing through said vents, said means for rotating said ring comprising an annular stator member carried by said structure and adapted upon energization to rotate said ring by induction.

11. The twister according to claim 6 including an annular structure formed with an annular chamber and having an upper seat portion adapted to support said ring when the twister is not in operation, said structure being provided with a plurality of passages providing air vents from said chamber to said seat portion, and means for delivering air under pressure to said chamber for support of said ring above said seat portion by the jets of air issuing through said vents, said structure having a shoulder surrounding said ring and provided with angularly disposed passages for directing jets of air from said chamber to the periphery of said ring, said last mentioned jets comprising said means for rotating said ring.

12. A twister comprising a supply package container having a yarn delivery passage in the lower end thereof, a housing having an upper apertured wall adapted to support said container when the twister is not in operation, means for delivering air under pressure for support of said container by air jets issuing through the apertures in said housing wall, a ring surrounding said container, and spaced therefrom, said ring having a yarn guide passage therethrough, means for rotating said ring to form a yarn balloon about said container, and means stabilizing said container against rotation.

13. The twister according to claim 12 including means for providing an air cushion support for said ring.

14. The twister according to claim 12 wherein said means for rotating said ring comprises an induction motor of which said ring is the rotor.

15. In a yarn twisting device of the type wherein a yarn package circumscribing ring engages the yarn and is adapted to be rotated for the insertion of twist in said yarn, of means for supporting said ring on a cushion of air.

16. In a yarn twisting device of the type wherein a member engages the yarn and is adapted to be rotated for the insertion of twist in said yarn, of means for supporting said member on a cushion of air, said member being rotated by induction.

17. A yarn twisting device as in claim 15 wherein said ring is air rotated.

18. In a yarn twisting device of the type wherein a member engages the yarn and is adapted to be rotated for the insertion of twist in said yarn, the improvement of means for supporting said member on a cushion of air, said member having a downwardly facing annular surface adapted to be acted upon by a jet of air, and said means comprising a plurality of air jets acting in upwardly unbalanced force relation on said annular surface.

19. In a yarn twisting device of the type wherein a member engages the yarn and is adapted to be rotated

for the insertion of twist in said yarn, the improvement of means for supporting said member on a cushion of air, said member having a downwardly facing annular surface adapted to be acted upon by a jet of air, said means comprising a plurality of air jets acting upwardly on said annular surface, said surface being part of an annular member adapted to serve as the rotor in an induction motor.

20. A yarn handling apparatus comprising a supply package container having a yarn delivery passage in the lower end thereof, a housing having an upper apertured wall adapted to support said container when the apparatus is not in operation, and air pressure supply means for delivering air under pressure for support of said container by air jets issuing through the apertures in said housing wall.

21. In a yarn twisting device of the type having a yarn package support, and a member adapted to engage the yarn and to be rotated for the insertion of twist in said yarn, the improvement of air supply means for supporting said yarn package support on a cushion of air.

22. A yarn twisting device as in claim 21 wherein means are provided for supporting said member on a cushion of air.

23. A yarn twisting device as in claim 21 wherein said member has a downwardly facing annular surface adapted to be acted upon by a jet of air and said means comprises a plurality of air jets acting upwardly on said annular member.

24. A twisting device as in claim 23 wherein said surface is part of an annular member adapted to serve as the rotor in an induction motor.

25. In a yarn twisting device of the type wherein a rotatable member engages the yarn and is adapted to be rotated for the insertion of twist in said yarn, the improvement of means for supporting said member solely on a cushion of air during rotation, said member being unencumbered during rotation.

26. A yarn twisting device comprising a member having a continuous substantially circular yarn engaging surface, said surface lying in a plane, said member being rotatable about an axis perpendicular to said plane, and air supply means for supporting said member solely on a cushion of air during rotation, said member being unencumbered during rotation.

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