The present invention relates to up-twisting of filament materials on spindles of the type particularly adapted to impounding two twists to the thread for each revolution of the spindle.

An object of this invention is to provide a novel double-twist spindle, capable of twisting by two-for-one principle yarns of fine tier at comparatively very high speeds, from large supply packages.

Another object of the invention is to provide a spindle so compact that it can be readily interchanged with present up-twisting spindles on ordinary up-twisting frames.

Another object of the instant invention is the provision of apparatus whereby the novel double-twist spindle structure herewith presented can be coupled with improved means for taking-up or collecting the twisted yarn. Although not herein shown or claimed, these improved collecting means involve a new principle of winding the twisted yarn into pinecone cones.

By the use of double-twisting spindles of the character herein involved, the yarn is withdrawn over-end from a supply package, which is relatively stationary with respect to a rotating hollow spindle-stub. Thence the yarn passes through a tensioning device, down through the hollow spindle, and emerges from a lower rotating cup and thence passes outwardly and upwardly around the package in the form of a so-called ‘free balloon.’ From the hollow spindle the twisted yarn passes through a pivot to a suitable take-up device. This take-up device may be of any suitable nature but particularly may be of a character which involves the aforesaid new principle of pineapple-coning of the twisted yarn as disclosed in my patent application Ser. No. 713,766 of February 6, 1958.

The different present designs of double-twist spindles on the market, both upright and inclined, and even of the suspension type, all have a common disadvantage in that too much tension is exerted on the yarn during the double-twisting operation. This disadvantageous tension is usually due to the fact that the yarn is subjected to too much friction during the double-twist operation and consequently yarn breakages frequently occur. This disadvantage is obviated by the novel double-twist spindle herein presented, this novel spindle having advantages which are summarized as follows:

It can be used for twisting of very fine denier yarns, from 15 denier up, at high spindle speeds of 16,000 r.p.m. and more. A floating mounting arrangement of the bobbin is provided whereby the spindle operates with no vibration. A short spindle-stub only rotates at the full speed, and thus there is low power consumption. A simple yarn-tensioning device is utilized, consisting only of a steel ball resting in a funnel, which steel ball is easily interchangeable according to different deniers of the twisted yarn.

Yarn-conveying sheaves are utilized, producing the least yarn friction known in two-for-one spindles, thus resulting in low yarn tension during the twisting, and infrequent breakage.

The spindle unit is compact and mounted upright whereby it can be easily interchanged with ordinary spindles. A novel lubricating structure is provided which has no drip-off and is very economical in oil consumption.

The novel spindle herewith presented is very simple in design and easy and economical to manufacture, can be initially set up without the necessity of later realignments, and is of low up-keep cost.

No part of the double-twist spindle herewith presented is subject to much wear so that small depreciation and long life of the spindle can be expected.

The annexed drawings and the following description set forth in detail certain means illustrating the improvements in double-twist spindles, such drawings and description showing only one of the various forms in which the principle of the invention may be embodied.

In said annexed drawings:

Figure 1 is a side elevation of the improved double-twist spindle;

Figure 2 is a top plan taken in the planes indicated by the line 2—2, Figure 3, with parts broken away;

Figure 3 is an axial section, taken in the plane indicated by the line 3—3, Figures 1 and 2, the view showing a yarn package mounted on the spindle and in the process of having the thread drawn over-end therefrom and double-twisted;

Figure 4 is a sectional plan view taken in the plane indicated by the line 4—4, Figure 3;

Figure 5 is a sectional plan view taken in the plane indicated by the line 5—5, Figure 3; and

Figure 6 is a fragmentary transverse vertical section taken in the plane indicated by the line 6—6, Figure 1. Referring to the annexed drawings, in which the same elements are indicated by the same respective numbers in the several views, a rail frame 1 designed for the mounting of a plurality of spindles is provided in its top flange with equally spaced openings 99 for each plurality of spindles, said openings 99 being arranged in line, and one of the spindles so mounted being shown in Figure 1. The main bearing bolster of the spindle comprises a body 3 having an upper spherical bed for a standard roller bearing insert 7 having an internal non-rotating damper sleeve 8. The bearing body 3 is fastened to a bottom horizontal flange of an upwardly-extending inclined bracket 2 by three screws 6. On the top of an upper horizontal flange of the bracket 2 is mounted an outer stationary concave ring 43. Within the lower periphery of the ring 43 are set in a plastic bed three permanent magnets 44 which form with the ring 43 a perfectly smooth spherical surface having its center in the line O, Figure 3. The ring 43 is secured to the upper horizontal flange of the bracket 2 by three screws 52 and secured against any displacement by two dowel-plugs 53, Figure 2. Within and adjacent the lower edge of the ring 43 is welded a block 46 and adjacentl extending thereof, and exterior of the ring 43 on the upper horizontal flange of the bracket 2, is provided an eye-shaped bracket 47 within which is mounted a vertical pig-tail post 48 whose lower end is secured in the ring 47 by a screw 51.

The insert 7 comprises a roller bearing 13 which runs in an outer ring 14, the insert 7 being covered by a top plate 15. The insert 7 is secured against rotation by a screw 9. A compressed spring 11 which serves to give the spindle 18 proper yielding properties against an unbalanced condition is positioned in a lower cavity 100 intermediate the body 3 and the roller bearing insert 7, this spring 11 being properly set by two nuts 12 engaging the lower end portion of the insert 7. In the lowest part of the insert 7 is positioned a cast iron bearing 19 within which on its bottom-end conical point the spindle
Mounted on swivel bracket 36 is a sickle-like part 58 secured by two screws 59. Underneath the sickle-like member 58 is a pig-tail guide 60 secured by screws 61 and serving as a yarn guide flier at slow rotation as the yarn 54 is drawn off the package 42.

The spindle 18 is set into bearing 19 and secured against pull-out by a catch 55 secured to the bracket 2 by a shoulder-screw 57 and a compression spring 56.

The curled end portion of the pig-tail arm 49 is adjusted precisely into the center of the spindle 18 and its opposite end secured to the post 48 against any undesirable movement by a set screw 56. As the twisted yarn passes through the pig-tail end 49, there are mounted, two stationary grooved sheaves 23 on ball bearings 40 centered on pins 24 which are secured against fall-out by cotter pins 25 on each side. In the rotatable spindle mechanism two opposed slots 22 are milled, also, on both sides of an intermediate portion of the spindle proper, thus forming an opening on each side of the spindle leading through the top tubular column 22 of the cup-like part 22. These slots 22 are of circular formation and are milled precisely to the center line of the spindle 18. An axial bore 22 is drilled in the spindle from the top, while the spindle is rotating, of a depth sufficient to enter the milled-out slots 22. However, this drilled bore 22 is not so deep as to reach the lower edge of the milled-out slots 22.

A stationary floating bobbin-holding member 32 is provided, of the configuration clearly indicated in Figure 1, the lower part of which bobbin-holding member 32 is provided with three keepers 45 opposed to the magnets 44, which are spaced 120° apart and which are filled with thermo-plastic material and carefully machined so that the radius R is perfectly identical in all planes. The outer units of spherical ball bearing parts 26 are pressed into the lower part of a central tower 91 of the bobbin-holding member 32, with the inner units of the ball bearing parts pressed onto the exterior surfaces of the upper end of the spindle 18, a lubricating cone 27 laid in under the bearing 26 and around the spindle 18, said lubricating cone 27 being covered by an oil sealing ring 28. Within the oil sealing ring 28 and resting on the upper tubular part 22 of the rotating cup-like member 22 is an oil reservoir 29. A cover 30 is fastened to and within the lower part of the bobbin-holding member 32 by screws 31 around the lower part of the oil reservoir 29. This whole assembly is pressed onto the spindle-stub 18 unit, until, as stated, the oil magazine 29 rests on the upper tubular column 22 of the cup-like member 22.

Between the lower curved surface of the stationary floating bobbin-holding member 32 and the concave top ring 43 is a clearance area 77 forming a path for the yarn 54 as it travels from the groove of the sheave 23 to the balloon area.

The permanent magnets 44 and the keepers 45 maintain the same axis for the floating bobbin-holding member 32 and the main spindle 18. It will be noted that between the upper part of the whorl 20 and the lower part of the cap 22 there is provided a space 62. This space 62 serves as a trap for the loose ends of any broken yarn.

There is an upper V-grooved sheave assembly mounted on the central tower 91 of the bobbin-holding member 32, which upper sheave assembly slowly rotates as the yarn 54 is wound off the package 42 mounted on the bobbin 41. This upper sheave assembly has bearings 35 in a funnel 33 pressed into an upper bore 33' of the column 91 and provided with the loose tensioning ball 34. This upper sheave assembly comprises a swivel bracket 36 into which the ball bearing 35 is pressed. Thus the thread 54 drawn over-end from the package 42 and traveling around a sheave 37 mounted in the outer end of the bracket 36 cannot cut itself into the sheave surface. This sheave 37 is provided with a bearing 40 and is swivelly mounted on a pin 38 held in the bracket 36 against fall-out by end cotter pins 39.
This bearing 26 is lubricated every time the spindle is started which is sufficient lubrication.

What I claim is:

1. A double-twist spindle unit for up-twisting of yarn comprising, a frame having a curved upper surface, a spindle mounted on the frame and having a part thereof formed with a curved upper surface concentric with and slightly spaced from said frame surface, a sheave mounted on said spindle part for rotation through the surface of said spindle part and in a plane radial to the spindle axis, a stationary floating bobbin-holding member mounted on and around the spindle and having a surface concentric with and slightly spaced from said frame surface, the two spaces forming a thread path leading outwardly, a two-part ball bearing between the spindle and the bobbin-holding member, means for rotating the spindle, a second thread path formed axially through the spindle and leading to the aforesaid thread path, the thread being engaged with the sheave as it moves into said first-mentioned thread path, means for holding the thread on the sheave, means countering the pull of the thread on the sheave to maintain the bobbin-holding member concentric with the spindle, thread-guiding means, including a thread-tensioning device, from a thread package on the bobbin-holding member to the entrance of the second thread path through the spindle, and drawing means for the twisted thread.

2. A double-twist spindle unit for up-twisting of yarn, characterized as in claim 1, in which said part of the spindle has two curved upper surfaces symmetrically arranged relative to the spindle axis, and in which the counterweighting means is a second sheave identical with and positioned oppositely to the first sheave, the two sheaves being of a grooved type, the outer edges of the grooves abutting and forming thread guides leading into spaces between the respective sheaves and the curved upper surfaces of the spindle.

3. A double-twist spindle unit for up-twisting of yarn, characterized as in claim 2, in which the two parts bearing and the axis of the bobbin-holding member are identical.

4. A double-twist spindle unit for up-twisting of yarn, characterized as in claim 1, in which the thread-guiding means comprises an upper grooved sheave, means swivelly mounting the sheave on the upper end of the bobbin-holding member and receiving the thread drawn from a package on the bobbin on said member, a support for the thread-tensioning device being rigidly mounted in the upper sheave-mounting means within ball-bearings engaging the sheave mounting, and the thread tensioning device being automatically adjustable according to the pull of the thread.

5. A double-twist spindle unit for up-twisting of yarn, characterized as in claim 4, in which said swivel means is provided with a protective guard having a segment preventing the catching and stopping of the thread balloon, and in which there is a pig-tail guide on the swivel means for conducting the twisted thread into the groove of the upper sheave.

6. A double-twist spindle unit for up-twisting of yarn, characterized as in claim 2, in which said spindle part comprises a whorl secured to the spindle and a cup-shaped head symmetrically-secured to the spindle on the top of the whorl, said head being formed with the curved upper surfaces, and said head and spindle having opposed and symmetrical cutaway sections in which the grooved sheaves rotate through said curved surfaces.

7. A double-twist spindle unit for up-twisting of yarn, characterized as in claim 2, in which the frame has an upper concave ring structure, the bobbin-holding member having a lower convex surface opposed and slightly spaced from the ring structure, all points of said convex surface being the same radial distance from the center of the ball-bearing, the ring structure carrying a plurality of equally-spaced magnets, and the bobbin-holding member having keepers opposed to said magnets, the outer surfaces of the keepers being in the lower convex surface of said bobbin-holding member.

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