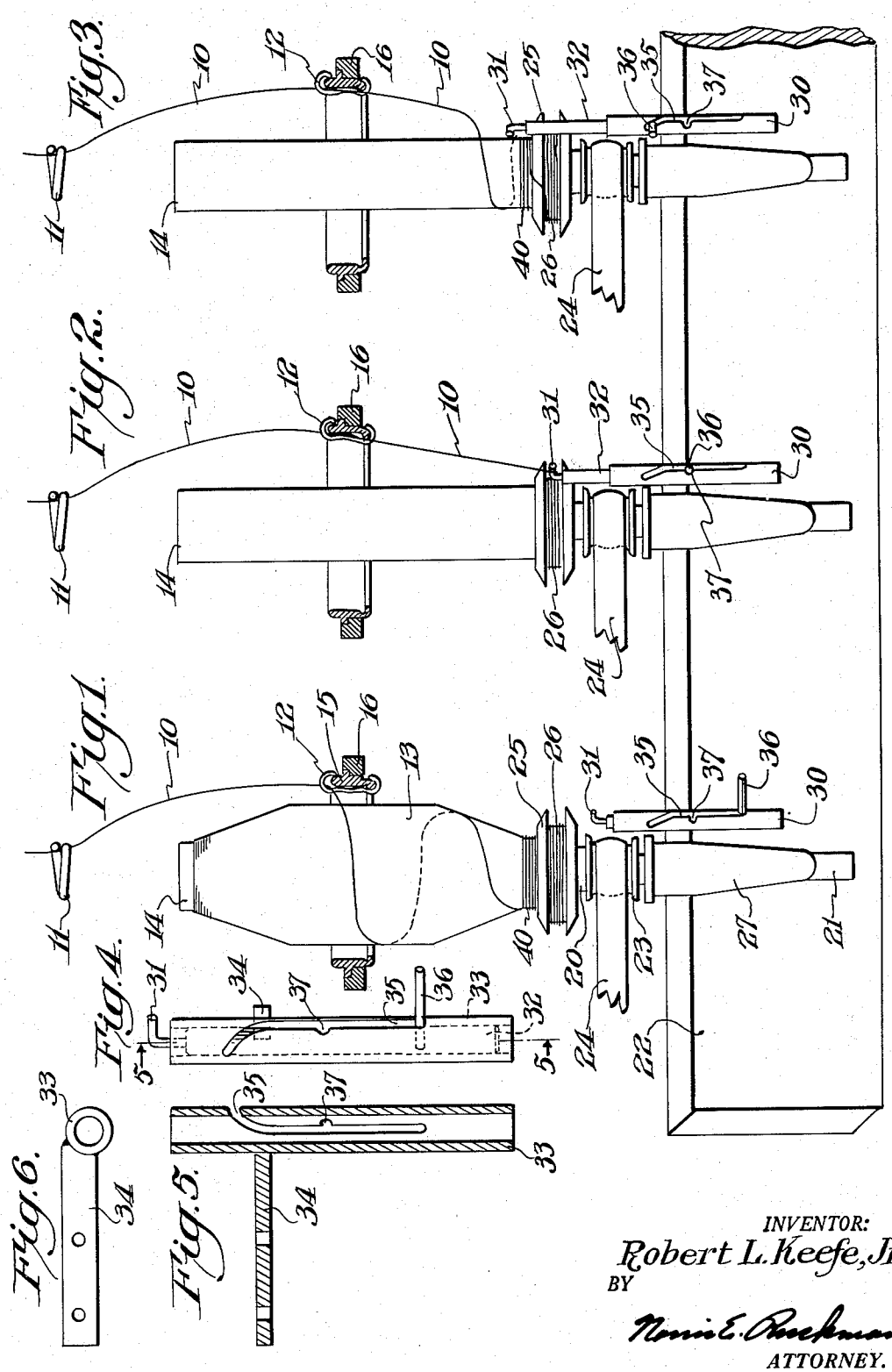
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PROCESS AND APPARATUS FOR WINDING
HEAVY DENIER YARN PACKAGES
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PROCESS AND APPARATUS FOR WINDING HEAVY DENIER YARN PACKAGES

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This invention relates to a process and apparatus for winding yarn packages, and relates more particularly to twist winding heavy denier yarn, which is travelling at constant speed from a drawing operation, to produce yarn packages having a transfer tail and free from any objectional non-uniformity of properties.

Drawable yarn, such as nylon, is commonly processed into packages with an apparatus known as a drawtwister, with which the yarn is stretched to a multiple of its original length and wound into a package under tension while simultaneously applying a twist to the yarn. The yarn is supplied at constant speed by a feed roll to a draw roll, which rotates at a higher speed to draw the yarn, and then travels directly to a ring twister which winds the package under tension. The ring twister customarily comprises a vertical spindle, the bottom portion of which rotates in and is supported by a bearing called a bolster, a belt-driven pulley called a whorl mounted on the spindle above the bolster, an upper portion of the spindle adapted to hold a bobbin or other core for the yarn package, a horizontal ring surrounding this upper portion of the spindle, a traveler guide slidably supported on the ring for guiding the yarn onto the bobbin, and automatic means for moving the ring up and down to build the desired shape of yarn package. Yarn is fed downward to the traveler and thence to the package being wound at a rate slower than the surface speed of the rotating bobbin, the traveler being forced to rotate and impart twist to the yarn.

In stringing up a ring twister of the kind described, it is common practice to take the end of the yarn from the supply package and secure it to the bobbin while holding the spindle at rest with a knee brake, and to thread the yarn through the traveler and the balloon pigtail before allowing the spindle to rotate. The next step is to thread the yarn around the various feed and draw rolls which the twister contains. It is, therefore, apparent that the yarn wound onto the bobbin while performing the operation of string-up takes the yarn directly from the supply package without imparting to it any draw except that imparted by the handling. Consequently, this initially wound yarn in an undrawn or partially drawn state has widely different properties from the uniformly drawn yarn produced after normal winding conditions are attained. For example, this incompletely drawn yarn will dye differently, have a different denier, and have different physical properties from the rest of the yarn and, if included in the yarn package, will constitute a serious quality defect in textiles made from the yarn.

It is usual to provide a transfer tail on a yarn package to enable an uninterrupted flow of yarn to be maintained, when a yarn package is depleted, by tying into a full package on the creel or other multiple package holder supporting the yarn package. The transfer tail is wound on the bobbin before winding the main part of the package, this inner end being so disposed as to be positively secured during the winding of the yarn package and yet

be readily available for tying directly to the outer end of the yarn on another package.

If the transfer tail were initially wound yarn, the package would be objectionably non-uniform as discussed above. This difficulty can be overcome by collecting the initial yarn on a waste spool during start-up before winding the transfer tail, as for example, by depressing the traveler ring below the normal winding range to the level of the waste spool. However, in the process for handling heavy denier yarns in which much larger packages are normally wound (4 to 10 or 20 pounds as compared with ½ to 1 pound packages for the fine denier textile yarns), the engineering problems involved in adapting the above-mentioned design of tail winder to the heavy denier draw-twister result in a cumbersome and high-cost device which also entails some safety hazards in operation.

An object of this invention is to provide a method for winding heavy denier yarn under tension to produce a package having a transfer tail and free from any objectionable non-uniformity of properties. Another object of the invention is to provide a safe, effective and economical method for starting the winding of heavy denier yarn with a ring twister so as to produce a package which is free from undrawn yarn and has a secure but readily available transfer tail. A further object is to provide an improved ring twister winding machine for accomplishing the above objects. Other objects of the invention will become apparent from the following description and claims.

The invention will now be described with reference to the preferred embodiment illustrated in the drawings, in which

Figure 1 is a front elevation of essential parts of the improved winding apparatus of this invention as it appears when nearly finished winding a yarn package,

Figure 2 is a similar view of the winding apparatus while starting to wind a package,

Figure 3 is a similar view of the winding apparatus while winding the transfer tail of a package,

Figure 4 is a front elevation, on an enlarged scale, of a string-up guide used when starting up and when winding a transfer tail,

Figure 5 is a cross-section of the outer sleeve of the string-up guide, taken on the line 5—5 of Fig. 4, and

Figure 6 is a top view of the sleeve shown in Fig. 5.

Since the apparatus is an improvement in a winding machine of known construction, only such parts as are necessary to an understanding of the invention are shown in Fig. 1. Yarn **10** is supplied at constant speed by suitable means, passes downward through pigtail guide **11**, through traveler guide **12**, and is wound into yarn package **13** on bobbin **14**. Traveler **12** is slidably supported on ring **15**, which is held by ring holder **16**. The ring holder is moved up and down by conventional means to build a package of the desired shape. The bobbin is held by a spindle **20** which rotates in a spindle bolster **21** supported by machine frame **22**. The spindle is rotated by spindle whorl **23** driven by conventional means through belt **24**. A waste spool **25** is provided on the spindle to collect preliminary windings **26** while stringing up the bobbin on the spindle. A knee brake **27** is used to stop the spindle when a full bobbin is doffed. The brake presses against the whorl **23** and holds it stationary, the belt **24** being arranged so that it will slip over the whorl without grabbing when the brake is applied.

A string-up device **30** is used when starting up the winding of a new package. This device is shown in greater detail in Figs. 4, 5 and 6. A yarn guide **31** is mounted on the end of rod **32** which slides inside of sleeve **33**. A bracket **34** is welded to the sleeve and serves to hold the assembly in position on the machine. A slot **35** is machined through the side of the sleeve, and a handle

36 is inserted through the slot and screwed into the rod 32. This slot extends lengthwise of the sleeve from near the bottom of the sleeve to near the top. Midway of the slot is a notch 37 adapted to hold the handle at this intermediate position. The top portion of the slot curves to one side so that the slot and notch in the sleeve form an f-shaped aperture, or its mirror image, depending on the direction of rotation of the spindle.

The use of the string-up device is illustrated in Figs. 2 and 3. In starting up with a new bobbin at a standstill, the yarn 10 is fed down through the traveler ring 15, attached to waste spool 25 by winding in a turn or two of the yarn, threaded around yarn guide 31 of the string-up device so arranged that handle 36 is supported by notch 37 in a position opposite waste spool 25, thence placed under traveler 12 and through balloon pigtail 11. The operator then releases the knee brake 27 which allows the driving belt 24 to rotate the spindle, and yarn is wound on the waste spool 25. Now with a few quick deft motions, the operator completes the string-up of the position by threading the yarn around the arrangement of feed rolls and draw rolls to permit the production of the desired drawn yarn. As soon as this string-up is completed and the desired yarn is being produced, handle 36 of the string-up device is disengaged from notch 37 and quickly raised to the top extremity of the slot 35, as shown in Fig. 3. This simple motion first guides the yarn away from the waste spool and onto the bobbin to wind transfer tail 40, and then the curvature of the slot 35 turns the handle to one side and disengages the yarn from guide 31 when the position shown in Fig. 3 is reached. The traveler 12 then takes over guiding the yarn in the conventional manner with a ring twister winding machine.

The yarn in the resulting transfer tail is identical in every respect to the yarn wound onto the bobbin in the course of normal operation, except that the yarn in the transfer tail is wound without twist under somewhat higher tension. Since the preferred operation of the drawtwister is at a low level of twist, for example, from 1/10 up to 1 turn per inch, the difference in twist in the transfer tail and the normally-wound yarn is immaterial. Furthermore, when the yarn is unwound from the package, as for example, in a warping operation, the twist in the transfer tail becomes nearly identical with that in the rest of the yarn because of a backing up of the twist caused by running over thread guides and because of an equalization of twist which occurs in the unsupported yarn length between two guiding surfaces.

The application of this invention is restricted generally to heavy denier yarn, in that the breaking strength of the yarn must withstand the tangential force at the waste spool which is imparted by the frictional drag of the driving belt on the spindle whorl. The waste spool 25 is not a slip spool but is positively driven by the spindle which also positively drives the bobbin 14. When winding on the bobbin, the action of the traveler guide in applying twist to the yarn reduces the effective wind-up speed of the bobbin to a level equal to the rate at which the yarn is fed to it, and the winding machine is designed to provide a bobbin surface speed which is sufficiently higher than the rate of yarn feed to produce the desired amount of twist. The spindle is normally driven at a high rotational speed, for example, 3000 to 5000 R. P. M. or even higher and, since no twist is applied at the waste spool, because the yarn is fed to it around fixed yarn guide 31, the surface speed of the waste spool is considerably higher than the speed at which the yarn is delivered to it. Therefore, the yarn must act as a brake on the whole spindle assembly and cause the driving belt to slip on the spindle whorl to compensate for this difference in speed.

Consequently, it is seen that this invention is limited to the handling of those yarns whose breaking strength exceeds the frictional drag of the driving belt on the spindle whorl.

It will be seen from the foregoing description that this invention, although described in connection with the ring twister, would be equally applicable to a cap twister or other similar device, whether winding a spool-type package, a single taper package, a double taper package or any permutations thereof. This invention has particular utility in combination with the drawing of fibers which stretch irreversibly, as it provides for eliminating incompletely drawn yarn from the package and winds a transfer tail which has the same state of draw, denier and other characteristics as the rest of the yarn in the finished package. In this respect, it should be noted that the tangential force on the yarn at the waste spool should be less than the drawing force exerted on the yarn in the stretching operation. Otherwise, additional drawing might be produced at the transfer tail string-up guide. The invention is also useful for winding strong yarns which are not drawable, although in this instance satisfactory results can be obtained with devices of the prior art for winding packages with transfer tails.

This invention is also valuable for repairing yarn breaks occurring during the winding of a package. When drawing and/or twisting yarn on winding machines equipped with individual spindle control, it is impractical to tie the new end to the broken end, since the new end for a distance of several yards is different from the rest of the yarn in either the state of draw, or the twist, or both, as the case may be. Packages of yarn containing such irregularities would cause much economic loss in the trade where, if such yarn irregularity occurred in the warp of a fabric for example, it would render the finished fabric valueless for the entire length of the irregularity. Hence, it has been the practice to unwind the partial package, along with the others, and rewinding a new package, which of course, involves stripping out the defective yarn at the ends of these packages before tying the ends together to make a continuous length of yarn. However, this is a costly method and it is frequently more economical to discard the partial packages. By an adaptation of the current invention, a new method has been worked out which prevents this economic loss.

With the aid of the removable yarn support described in U. S. Patent No. 2,585,584 issued February 12, 1952, to Frank S. Pollock, Jr., and assigned to the assignee of the present application, the invention of the current application provides a practical means for repairing yarn breaks without having to rewind the partially finished packages and likewise provides a means for positively eliminating the off-standard yarn lengths which normally occur when starting up a spindle on a drawing or twisting machine. When a break occurs, the broken end of the incomplete package is threaded through the removable yarn support (a thin sleeve of paper, plastic, metal or other suitable material) and held taut while the removable yarn support is slipped onto the base of the bobbin and over the first transfer tail. The broken end is thus caught under the thin sleeve and is held firmly in place until wanted. Winding of the package is resumed as if starting up a new package with a transfer tail. That is, the yarn is first wound to a waste take-up spool at the base of the spindle to receive the first yarn prior to operating the individual device for winding the transfer tail.

If no more breaks are obtained, the winding of the package is continued until one of normal size is obtained. This package is then doffed and the removable yarn support is removed from the base of the bobbin to free the last wound transfer tail (yet leave the first wound transfer tail in place), and to permit the loose end thus obtained and the broken end of the first portion of package to be tied together close to the package. After trimming the loose ends of the knot, the resulting package does not differ in appearance from a package of unbroken yarn except for the presence of this knot and may be used equally well for many purposes.

Of course, if more than one break occurs during the winding of the package, the operation simply involves the

doffing of the package at each break, the tying of the knot to connect the first two portions of this partial package, followed by a duplication of the procedure described above for winding another transfer tail on the removable yarn support and winding the yarn to the package until another break occurs or until the package is of the size desired.

It should be further understood that the removable yarn support, described above, is not essential to the process of winding continuous length yarn when a break occurs in the winding operation. When the removable yarn support is not used, it is necessary merely to wind a somewhat larger first transfer tail, which has its first portion partially overwound by the subsequent portion to give a firmly anchored tail. At a yarn break, when it is necessary to wind an additional transfer tail, this tail is limited in length so that no portion is overwound by a subsequent portion. The result is a tail which falls freely from the bobbin when the package is lifted to repair the break. The removable yarn support is simply one convenient means for making it possible to end up with a finished package containing the initial transfer tail.

As many different embodiments of the present invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments disclosed except to the extent defined in the appended claims.

What is claimed is:

1. A winding machine for twist-winding yarn packages of heavy denier yarn supplied at constant speed which comprises a rotatable spindle carrying a whorl, bobbin and a waste spool, said spool being located on the spindle below and in axial alignment with said bobbin, constant speed driving means making frictional contact with said whorl and arranged to rotate said spindle at high speed, a traveler guide slidably supported on a ring surrounding said spindle for guiding yarn onto said bobbin when winding a package, a stationary guide supported in position to guide yarn onto said waste spool while stringing up the yarn preparatory to winding onto said bobbin, means for moving said stationary guide to a position opposite said bobbin for winding a transfer tail, and means for releasing the yarn from said stationary guide after the transfer tail has been wound.

2. In a ring-twister winding machine for twist-winding yarn packages on a rotating bobbin carried by a rotating spindle the improvements which comprise a waste spool on the spindle below and in axial alignment with the bobbin and arranged to be rotated with the bobbin, a yarn guide supported in position to guide yarn onto said spool

while stringing up the yarn preparatory to winding onto said bobbin, manually operated means for moving said guide to a position opposite said bobbin for winding a transfer tail, and means for automatically releasing the yarn from said guide as soon as the transfer tail has been wound.

3. In a ring-twister winding machine for twist-winding yarn packages on a rotating bobbin carried by a rotating spindle, the improvements which comprise a waste spool mounted on the spindle below and in axial alignment with the bobbin so as to rotate with the bobbin, a fixed sleeve mounted in axial parallelism with the bobbin below the waste spool, a rod slidably supported in the sleeve, a yarn guide hook supported by said rod in position to guide yarn onto the waste spool with the rod in a lower position and to guide yarn onto the bobbin with the rod in an upper position within the sleeve, a handle attached to said rod and projecting through a slot cut through the wall of the sleeve for moving the rod up and down, and said slot having a portion curved to turn the handle to one side as said hook reaches a position opposite said bobbin, said curved portion being arranged to cause the hook to turn sufficiently to release the yarn.

4. In a process for twist-winding yarn packages with heavy denier yarn fed at constant speed on a twister comprising a waste spool and bobbin mounted for positive driving by a spindle, the improvement for winding a yarn package having a transfer tail and free from objectional non-uniformity of yarn properties which comprises rotating said spindle with a frictional driving force which provides a uniform free-running speed, feeding heavy denier yarn from a fixed position beyond the end of said bobbin at a constant speed which is less than the free-running surface speed of the bobbin, guiding the yarn onto said waste spool from a fixed position to wind the yarn under tension without twisting it, said frictional driving force being such as to place the yarn under a higher tension than the subsequent twist-winding tension, guiding the tensioned yarn from the waste spool to an end portion of the bobbin to wind a transfer tail, and then immediately twist-winding a package under tension on the bobbin adjacent to the transfer tail by guiding the yarn back and forth along the bobbin while revolving the yarn around the bobbin to apply a twist to the yarn.

References Cited in the file of this patent

UNITED STATES PATENTS

478,269	West	July 5, 1892
2,572,138	Griset	Oct. 23, 1951