Aug. 1, 1972 | H. A. GIRARD | 3,681,007

CORE TRANSFER PROCESS

Filed Jan. 12, 1971 | 2 Sheets-Sheet 1

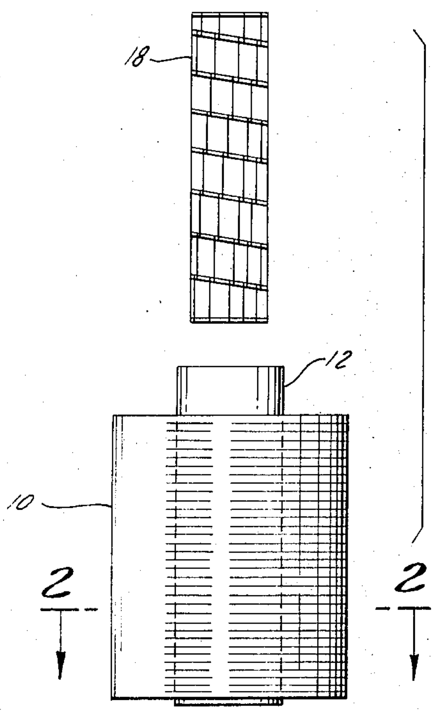

FIG. 1

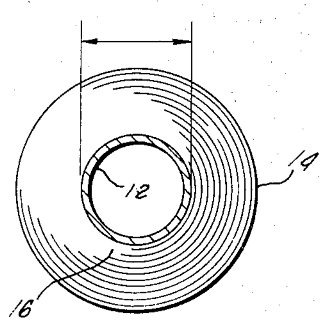

FIG. 2

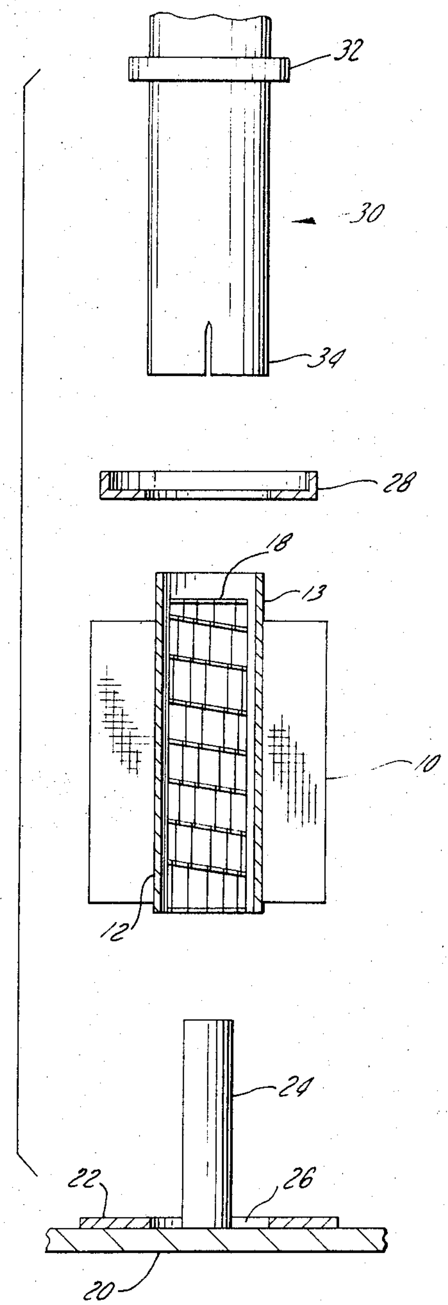

FIG. 3

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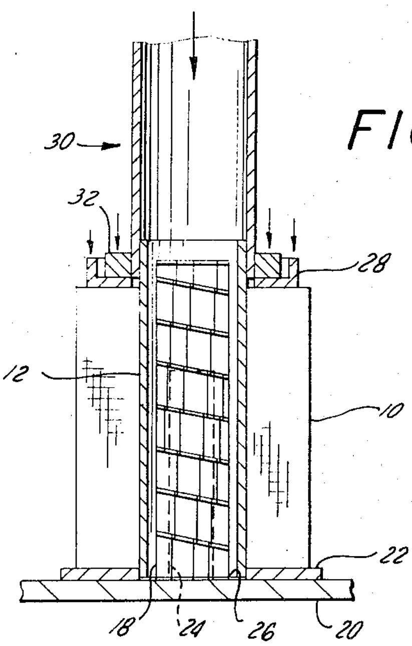

FIG. 4

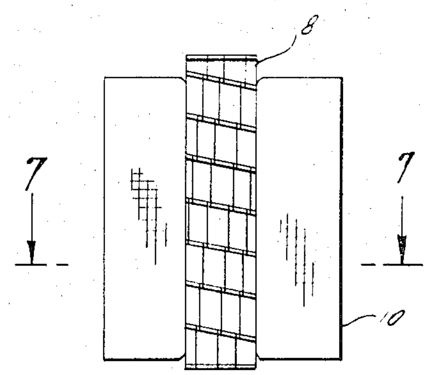

FIG. 6

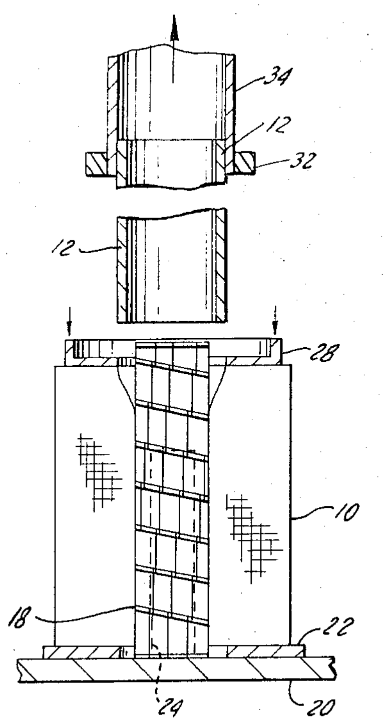

FIG. 5

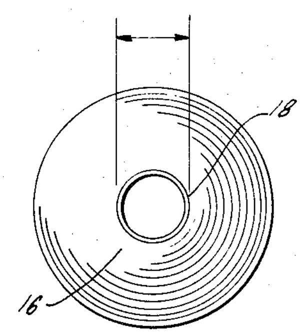

FIG. 7

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CORE TRANSFER PROCESS

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U.S. Cl. 8—155 7 Claims

ABSTRACT OF THE DISCLOSURE

A method and apparatus for transferring a package of yarn supported by a rigid imperforate transfer core to a foraminous, resilient dye core of predetermined smaller diameter comprising, in sequence, the steps of inserting the resilient core into the transfer core; and, removing the transfer core while preventing axial movement between the yarn package and resilient core.

BACKGROUND OF THE INVENTION

The invention relates to the processing of yarns and, in particular, to a method for replacing the rigid impervious transfer core in a yarn package with a foraminous, resilient core.

A long standing problem in the textile industry involves treating yarn and, particularly, bulked, continuous filament, thermoplastic yarns such as polyester, nylon or cellulose triacetate yarn, and spun yarns, such as direct spun rayon having residual shrinkage of up to 20% when exposed to conditions of high humidity or immersion in aqueous bath, or turbo acrylic yarn having high residual shrinkage by reason of unrelaxed heat sensitive fibers in the yarn. Such yarn is generally wound into package form about a paper core such that the outer portion of the package is at substantially a desired bulk level and the inner portion of the package is below such desired bulk level. As disclosed in U.S. Pat. No. 3,425,110, the bulk level of the inner portion of the package may be increased by simultaneously removing the package core while inserting a rigid, metal perforate core of a predetermined smaller diameter than the package core. The inner portion of the highly stretchable yarn then contracts (and gains bulk) about the perforate core.

Thereafter the package is axially compressed to obtain a more uniform density throughout and then the package is generally treated with a heated liquid often containing dye, to stabilize the entire package of yarn at substantially the desired bulk level. This treatment is carried out in a conventional package machine which circulates dye from outside to inside of the yarn package and viceversa. Layers of yarn packages are loaded into the machine. The stabilized package is dried and generally rewound onto a cone for further processing.

The core transfer process as set forth in the above-identified patent is subject to various defects. Owing to the fact that both the paper transfer tube and perforated dye tube simultaneously move through the yarn, one exiting, and one entering, it has been found necessary to sandwich a paper or knit sleeve or sock between the yarn and the transfer tube, to serve as a bridge or shield during transfer. Without such sleeve it has been observed that some of the strands of yarn become trapped between the ends of the transfer tube and the dye tube during the operation, thereby disturbing the continuity of the yarn. This procedure requires extra tucking operations and is expensive and unduly time consuming. Also, there is a tendency of the yarn package to come apart and unduly distort during the above core transfer process owing to the pressure and movement of the entering perforated tube, with a consequent increase in damaged yarn packages. Further, package dyeing machines have been limited in the volume of yarn which can be loaded into them by the rigidity of conventional dye cores, which cannot be compressed to permit addition of more dye cores.

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During stabilizing treatment and storage rigid-core supported yarn packages are subjected to yarn sagging. Sagging is produced by unduly relaxed inner layers of yarn and by the spaced stacking of rigid core supported yarn packages. Rigid core packages are separated from each other by a spacer seal. Yarn can sag into the interstices between yarn packages caused by such spacer seal. Further, yarn contained on the rigid core does not cover the complete core, thereby allowing yarn to sag under the above conditions, exposing holes in the rigid perforate dye core.

After conventional dyeing or setting processes employing perforate metal dye cores it has been difficult to rapidly dry the yarn package employing radio frequency dielectric drying systems owing to the undesirable dielectric properties of the metal core. Additionally, uneven rewinding of the dried yarn package often results from rigid dye cores. Such cores do not respond to changes in the tension of the yarn in the inner portion of the package on rewinding.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of this invention to provide a simplified method with minimum yarn package distortion for removing the rigid, imperforate transfer core from a wound package of filament or spun yarn and inserting, in lieu thereof, a resilient, foraminous dye core or replacement core in order to permit free flow of liquid therethrough and through the package during stabilizing treatment.

It is another object of the invention to provide a replacement core for a yarn package adapted to provide increased capacity for package machines for dyeing and/or setting.

It is an additional object of the invention to provide a replacement core adapted to control potential yarn sagging problems during processing and short term storage.

The above and other objects are met in a method for transferring a package of yarn supported by a rigid, imperforate transfer core to a foraminous, resilient dye core of predetermined smaller diameter comprising, in sequence, the steps of inserting the resilient core into the transfer core and removing the transfer core while preventing axial movement between the yarn package and resilent core. The elimination of the core replacement method by which the dye core is pushed into the yarn package as the transfer core exits, also negates the use of the dye sleeve or sock with its attendant disadvantages. Distortion in the yarn package is minmized, since the package merely shrinks about the resilient core as the transfer core is removed. Further, owing to the ability of the replacement core to axially compress, the capacity of dye package machines can be increased from 30 to 50% over machines filled with yarn packages with rigid dye cores.

In addition, this axial compression feature permits stacking of yarn packages with no gaps therebetween, thus overcoming yarn sagging and also permits yarn to completely cover the stacked cores, further preventing yarn sagging.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages will become apparent from the following detailed description of the invention which is to be taken in conjunction with the accompanying drawings illustrating a preferred embodiment of the invention and in which:

FIG. 1 is an elevational view illustrating the insertion of a replacement core into the transfer core of a yarn package;

FIG. 2 is a top view of a yarn package and a central transfer core;

FIG. 3 is an exploded view, partially in section, of an apparatus suitable for replacing and inserting cores of and into yarn packages and also illustrating the relative position thereon of a yarn package containing a transfer tube and replacement tube;

FIG. 4 is a fragmentary, vertical sectional view of a yarn package engaged by the core replacing and inserting apparatus of FIG. 3;

FIG. 5 is a fragmentary, vertical sectional view of the assembly of FIG. 4 illustrating the removal of the transfer core from the yarn package;

FIG. 6 is a vertical sectional view of a yarn package contracted about a replacement core; and

FIG. 7 is a top view of the yarn package of FIG. 6.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings and particularly FIGS. 1 and 2, there is illustrated the first step in the transfer process. A spun yarn 10 is wound onto a rigid imperforate transfer core **12** by conventional processes. The process is applicable to various types of yarn, including continuous filament yarn. A typical yarn bulking process is disclosed in U.S. Pat. No. 3,425,110 and illustrated in FIG. 1 of said patent. The conventional bulked yarn package produced by such a process varies in bulk level. The bulk level of the yarn in the outer portion **14** of the package is at the level which is ultimately desired, while the bulk level of the yarn in the inner portion **16** of the package is below such level. The difference in bulk level is produced by the transfer core **12** which prevents the inner portion **16** of the yarn package from contracting. The bulked yarn suitable for the present process, has a strong tendency to contract owing to its highly stretchable nature after it is wound into package form.

Initially, a foraminous, resilient replacement core is introduced into the transfer core in concentric alignment therewith. The replacement core should be of a lesser diameter than the diameter of the transfer core to permit sufficient expansion of the yarn package **10** to achieve the desired uniform bulk level. This difference in diameter will vary with different types and deniers of yarns.

The replacement core is a foraminous, resilient dye core and, most preferably, a resilient, spring tube. The replacement core should permit free flow of liquid therethrough and through the yarn packing during later stabilizing treatment. Further, the core should be susceptible to axial compression in order to substantially increase the carrying capacity of a yarn package dyeing machine. A particularly suitable dye spring tube is disclosed in U.S. Pat. No. 2,670,852 and consists of a spiral spring provided with a sheath formed from a single wire which extends in the form of a spiral around adjacent turns of the spiral spring, the turns of the spiral wire which extend between any three turns of the spiral spring being arranged so that they alternate with one another on the intermediate turn of the three turns.

After the replacement core has been coaxially inserted within the transfer core, suitable means are employed to axially remove the transfer core while fixedly retaining the yarn package against axial movement with respect to the replacement core. As illustrated in FIGS. 6 and 7, once the transfer core is removed from the yarn package, the package contracts about replacement core **18**. The amount of contraction of the inner portion of the yarn **16** is controlled by varying the thickness of the transfer tube **12** or by varying the inside diameter of the transfer tube **12** in relation to the outside diameter of the replacement core.

After replacement of the transfer core with the replacement core, the yarn package may be compressed and

thereafter further stabilized by forcing a heated liquid through the package, as will be discussed hereinafter.

A satisfactory assembly for indexing the replacement core properly within the transfer core and for removing the transfer core from the yarn package is illustrated in FIGS. 3–5. Turning now to FIG. 3, the apparatus includes an annular base plate **20** having an annular upraised shoulder portion or spacing plate **22** for receiving the yarn package **10**. A vertical cylindrical mandrel **24** is centrally disposed in base plate **20**. The mandrel is of smaller diameter than replacement core **18** and serves to retain the replacement core from longitudinal movement during the core transfer process.

An annular recessed channel **26** is spaced between shoulder **22** and mandrel **24**. The channel permits entry of the transfer tube and replacement core to the proper depth for transfer purposes. The mandrel **24**, spacing plate **22**, and channel **26**, provide a fixed base for yarn package **10** thereby preventing longitudinal movement during the core transfer process.

Annular top plate **28** is of greater diameter than the transfer tube **12** and is adapted to restrain yarn package **10** against axial movement during removal of the transfer tube **12**.

The physical removal of transfer tube **12** from yarn package **10** is accomplished by means of vertically movable clamping assembly **30**. The assembly is adapted to engage the protruding end **13** of transfer tube **12** by means of jaw clamp **34** and pull the tube out of the yarn package.

As illustrated in FIGS. 4 and 5, during operation of the transfer core replacement apparatus, spiral spring replacement coil **18** is inserted over mandrel **24** (in phantom lines). Yarn package **10** is seated on spacing plate **22** and transfer tube **12** is seated in recessed channel **26**. Top plate **28** is seated over yarn package **10**.

Vertically movable assembly **30** is actuated and engages the protruding portion **13** of transfer tube **12** by means of locking collar **32** and jaw clamps **34**. After engagement, locking assembly **30** is withdrawn, thereby pulling transfer tube **12** from yarn package **10**. To facilitate withdrawal of the transfer tube, it is preferred to employ a replacement coil which is shorter than the transfer tube so that the jaw clamps will have sufficient space to engage and remove the transfer core. It is an important advantage of the invention that as transfer tube **12** is withdrawn from the yarn package, spiral spring replacement core **18**, spaced apart from the transfer tube, undergoes no axial movement. Thus, yarn strands are not displaced during core transfer, a significant advantage over the prior art. To further prevent axial movement of the replacement core during removal of the transfer core, a clamping assembly may be concentrically disposed within the jaw clamps to grip the spring coil during core transfer. This assembly may consist of jaw clamps or other conventional gripping devices.

The thus-modified yarn package may be subjected to various finishing operations such as compressing, dyeing and heat setting. It is known that yarn has a tendency to build up and form hard spots at the top and bottom of the yarn package. In order to break up such hard spots in the package and achieve a more uniform density, a compressing operation may be carried out immediately after the core replacement operation employing the vertically movable assembly to compress the yarn package.

After compression, the yarn package may be stabilized by conventional "wet setting" and steam setting means. In practice yarn packages are selectively dyed after compression and/or core replacement in conventional package dyeing machines, wherein a plurality of yarn packages are spaced on a package carrier. The carrier is lowered into a kier or pressure-dyeing chamber and dye liquor is circulated through the yarn packages therein. By employing resilient spring dye cores, the carrying capacity of the conventional package machines, for example, the

Gaston County package machine, may be increased from 30 to 50%.

After dyeing or stabilizing, it is often desirable to dry the yarn packages by high speed systems, as dielectric drying systems, rather than by conventional mechanical water extractors, such as centrifugal extractors or port dryers. However, metal dye cores do not favorably respond to a radio frequency drying field owing, in part, to their undesirable dielectric properties. Further, it is desirable to minimize the requirement for metal, particularly stainless steel dye cores, to increase their lifetime. For the above and other reasons, it is preferable to replace the resilient, foraminous dye cores, after dyeing, with a plastic support core, and particularly a spline-type plastic spring. The use of resilient plastic cores in yarn packages permit high speed dielectric drying processes and minimize the requirement for metal dye cores for yarn packages. Further, resilient, plastic cores, and particularly splined plastic springs facilitate uniform rewinding of the yarn package to winding cores, since such splined springs are particularly adapted to take up any sag and slack on the inside portion of the yarn package.

The aforesaid plastic cores are inserted into the metal spring supported yarn packages in the manner described hereinbefore. Such plastic cores are of lesser diameter than the resilient metal dye spring cores and are readily inserted into the dye spring cores. Suitable gripping means (not shown) are employed to remove the spring core, thereby permitting the yarn to contract about the plastic core.

The following examples are given to further illustrate the nature of the invention and are not limitative of scope.

EXAMPLE I

A spun cotton yarn is formed into a package on a cardboard takeup tube having an outside diameter of 2.25 inches and a wall thickness of 0.09 inch.

A spring steel replacement core, 1.94 inches in outside diameter, is placed over the mandrel of a suitable core replaced apparatus. The yarn package is seated over the replacement core. The cardboard tube is withdrawn from the yarn package by the core replacement apparatus.

The yarn package is thereafter compressed to a 60 to 100% overload by applying an axial compressive force thereto. The compressed package is then placed in a package dyeing machine and dyed. The dyed and stabilized yarn package is then pressure extracted and dried in a conventional manner.

EXAMPLE II

The yarn package of Example I is processed according to the procedures of Example I with the exception that a spline type plastic spring core is inserted into the dyed yarn package. The spring steel core is removed by suitably modified core replacement apparatus. The yarn package is thereafter dried by a dielectric drying system and rewound onto a take-up cone for further processing.

Further advantages are obtained by the unique process disclosed hereinabove. By replacing the transfer cores with resilient cores, more uniformity is obtained during yarn dyeing. Individual differences in spring tension between resilient cores can be corrected by applying sufficient axial pressure to each column of resilient cores to produce the same volumetric density in the yarn packages. With conventional rigid dye cores such density differences cannot be so compensated, thereby creating problems with uneven bulking or shrinkage of filament or spun yarns.

The above invention is not to be limited except as set forth in the following claims.

I claim:

1. A method for transferring a package of yarn supported by a rigid imperforate transfer core to a foraminous, resilient dye core of predetermined smaller diameter comprising, in sequence, the steps of:

(a) inserting the resilient core into the transfer core; and

(b) removing the transfer core while preventing axial movement between the yarn package and resilient core.

2. The method of claim **1** in which the replacement core is a spiral spring dye tube.

3. The method of claim **2** including the steps of dyeing the spring core supported yarn package and thereafter replacing said spring core with a resilient plastic core of smaller diameter than said spring core, said plastic core-supported yarn package being adapted for dielectric drying.

4. The method of claim **3** in which the plastic core is a splined spring core.

5. A method for processing a package of yarn supported by a rigid imperforate transfer core comprising:

(a) replacing said transfer core with a resilient foraminous dye core, according to claim **1**; and

(b) dyeing said yarn package.

6. The method of claim **5** including the step of replacing the dye core with a plastic support core capable of sustaining dielectric drying.

7. The method of claim **6** wherein the plastic support core is a splined spring core adapted to facilitate uniform rewinding of said yarn package.

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