ABSTRACT

This invention relates to a process for the continuous formation of various types of core yarn. Specifically this invention relates to the use of electrostatic, physical and chemical means for producing a core yarn. More specifically, this invention relates to a process for electrostatically, peripherally surfacing or plating a coring element with individual fibers to produce a core yarn. Still more specifically, this invention relates to a process for electrostatically, peripherally surfacing or sheathing a coring element with individual fibers and means for treating the coring element with a crosslinking chemical formulation to permanently set the yarn configuration.

1 Claim, 6 Drawing Figures
PROCESS FOR PRODUCING CORE YARN


A non-exclusive, irrevocable, royalty-free license in the invention herein described, throughout the world for all purposes of the United States Government, with the power to grant sublicenses for such purposes, is hereby granted to the Government of the United States of America.

It is well known to those skilled in the art that present methods of producing a core yarn are limited to the process of twisting a surfacing yarn around the coring element. Prior to the disclosure of the instant invention, it was common to the art to produce core yarns either on spinning frames or on twisters. The art also frequently makes use of texturing means to obtain desired yarn types.

The main object of our invention is to provide a process to produce core type yarns by a unique and novel method.

A second object of our invention is to provide a process to produce a core yarn with a bulk appearance.

Another object of our invention is to provide a process to produce a core yarn by the method of electrostatically surfacing fibers peripherally onto a coring element.

Another object of our invention is to provide a process to produce a core yarn by the method of electrostatically surfacing fibers permanently onto a coring element.

Still another object of our invention is to provide a process to produce a core yarn by the method of electrostatically surfacing fibers uniformly onto a coring element which has been treated with a crosslinking resin and subsequently curing to produce a permanent yarn configuration.

Still another object of our invention is to provide a process for producing a core yarn by the method of electrostatically plating fibers peripherally onto a coring element of a thermostetting material and subsequently applying heat to permanently adhere the plating fibers to the core.

These and additional objects and advantages of our invention will be apparent from the following drawings, specifications, and claims set forth herein.

FIG. 1 is a schematic view of a process for electrostatically producing a core yarn.

FIG. 2 is a pictorial view of one embodiment of a twisting element.

FIG. 3 is a pictorial view of a second embodiment of a twisting element.

FIG. 4 is a schematic view of a second embodiment of a process for electrostatically, chemically and physically producing a core yarn.

FIG. 5 is a schematic view of another embodiment of a process for electrostatically and physically producing a core yarn.

FIG. 6 illustrates the modified apparatus of copending patent application Ser. No. 132,953 filed Apr. 12, 1971.

Referring to our drawings, FIG. 1 is the embodiment of our invention showing any type power supply such as supply 10 capable of, for example, up to 120 kv at 2 milliamps which is connected by leads 11 and 12 to the electrodes 13 and 14 of electrostatic fiber collecting and yarn spinning apparatus 15 of copending Patent Application, Ser. No. 132,953 filed Apr. 12, 1971.

A coring element 16 of any type staple fiber or filament of supply package 17 on spindle 18 is rotatably mounted on any conventional braking means such as friction brake 19. Coring element 16 is fed past rotatably mounted guide roll 20 in bearings not shown into electrostatic fiber collecting and yarn spinning apparatus 15. Said element 16 passes through axis of rotation of electrode 14 of unit 15. It is to be understood that conical electrode and twisting element of unit 15 of copending Patent Application Ser. No. 132,953 filed Apr. 12, 1971 is to be modified by relocation of drive to permit coring element 16 to pass through center of rotation of conical electrode and twisting element. Individual fibers 21 from any conventional source not shown are fed from duct 22 into the electric field 23 of unit 15. Said fibers 21 migrate to region of highest field intensity which is also region of closest proximity of electrodes 13 and 14 of unit 15. Individual fibers 21 contact the twisting element 24 of unit 15 and because of the rotation of electrode 14 and twisting element 24, said fibers 21 twist around coring element 16 and completely and uniformly cover the peripheral surface of said coring element 16 to produce a uniform core yarn 25. Said core yarn 25 passes rotatably mounted guide rolls 26 and 27 in bearing not shown and wound on any type package common to the art such as cone 28. Said cone 28 is driven by any conventional variable speed drive such as variable speed motor 29.

Another embodiment of invention uses a twisted coring element 16 fed to twisting element 24 such that rotation of said twisting element 24 will effect a false untwist to partially or completely untwist coring element 16 prior to attachment of peripheral surface fibers 21. Once false untwist is released, the normal twist of coring element 16 will tightly hold said surface fibers 21, due to interlocking of the fibers within the coring element, to produce a permanent core yarn 25 having said fibers interlocked within the coring element.

Twisting element 24 of unit 15, FIG. 1, may be of any desired shape to produce any specific core yarn configuration. Referring to FIG. 2, essentially round twisting element 40 with a longitudinal hole 41 along axis and any type smooth convoluted surface at discharge end 42 will produce a core yarn with a bulked appearance resembling an angora wool yarn.

Another embodiment, FIG. 3, of twisting element 45 is cylindrical in shape with an entrance hole 46 on axis of element 45. Said hole 46 follows a smooth angular path terminating at 47 at periphery of element 45. Discharge end of element follows a reverse configuration to entrance. Hole 48 starts at periphery of element 45 180° opposite to opening 47 and proceeds angularly toward center discharge post 49. Core yarn made with said element 45 will produce a core yarn with a smooth uniform peripheral surface of fibers on the coring yarn.

Other designs of twisting elements to produce specific core yarn configurations will be obvious to those skilled in the art.

Another embodiment of our invention to produce permanent type core element is shown in FIG. 4. A coring yarn 50 from supply package 51 on spindle 52 rotatably mounted on any type braking means such as friction brake 53, passes rotatably mounted guide rolls 54, 55, and 56 in bearings not shown. Said coring element 50 enters any type treating vessel such as tank 57,
containing any desired crosslinking agent 58 such as 5 percent to 20 percent dimethyl ethyleneurea (DMEU) or dimethyl dehydroxyethyleneurea (DMDHEU) and is maintained at a relatively constant temperature and volume by conventional methods not shown. Coring element 50 is held immersed in crosslinking resin 58 by rotatably mounted immersion roll 59 in bearings not shown. Element 50 proceeds over rotatable squeeze rolls 60 and 61 in bearings not shown to remove excess solution. Roll 60 is positively driven by any conventional variable speed drive such as variable speed motor 62, pulleys 63 and 64 and belt 65. Roll 61 is weighted by any conventional means such as coil spring 66. Element 50 with crosslinking resin enters electrostatic fiber collecting and yarn spinning apparatus 67 of Copending Patent Application Ser. No. 132,953 filed Apr. 12, 1971. Individualized fibers from any conventional source not shown are fed into unit 67 by duct 68. Peripheral fiber surfacing onto coring element 50 is accomplished within unit 67 in same manner as described in embodiment, FIG. 1. Core yarn 69 from unit 67 proceeds over rotatably mounted guide roll 70 in bearings not shown to any type curing stage common to the as such as radiant heater 71 wherein the resin treated core yarn 69 is cured and set. This curing of the resin permanently sets the peripheral fibers to the coring element so that it can be knitted, woven, and otherwise handled without losing its configuration and characteristics. The core yarn 69 passes through rotatable mounted guide rolls 72 and 73 in bearings not shown and is wound on any type package such as cone 74 which is driven by any variable speed means common to the art such as variable speed motor 75. Motors 62 and 75 are synchronously controlled by output of conventional control 76 through leads 77 and 78.

In addition to providing the resin formulation for permanently fixing the core yarn 69, tank 57 can contain other chemicals to impart other desirable properties. For example, bath 58 can be formulated to contain dimethyl ethyleneurea (DMEU) for permanent setting, carboxymethyl cellulose for anti-soiling, copper naphthenate for mildew proofing of tetrakis (hydroxy methyl) phosphonium chloride for flame resistance. Other possibilities for multipurpose treatment will be obvious to those skilled in the art of textile finishing.

In another embodiment of our invention, FIG. 5, coring element 100 is constructed of any type thermo-setting material common to the art such as a nylon filament. Said coring element 100 from supply package 101 on spindle 102 mounted on any type braking means such as friction brake 103 is fed past rotatably mounted guide roll 104 in bearings not shown into electrostatic fiber collecting and yarn spinning apparatus 105 of Copending Patent Application Ser. No. 132,953 filed Apr. 12, 1971. Individualized fibers from any conventional source not shown are fed into unit 105 from duct 106. Peripheral fiber surfacing onto coring element 100 is accomplished within unit 105 in same manner as described in embodiment, FIG. 1. Core yarn 107 from unit 105 proceeds over rotatably mounted guide roll 108 in bearings not shown to any type setting stage common to the art such as radiant heater 109 wherein the peripheral fibers are permanently set onto the coring element 100. The core yarn 107 passes through rotatably mounted guide rolls 110 and 111 in bearings not shown and is wound on any type package such as cone 112 which is driven by any variable speed means common to the art such as variable speed motor 113.

Referring to FIG. 6, the apparatus is comprised of conic electrode 14, rotatably mounted, axially and radially supported by hollow spindle 114 through bearings 115 and 116. Hollow spindle 114 is independently driven by variable speed motor 117, through motor shaft 118, pulleys 119 and 146 and nonconducting belt 120. Motor 117 is connected to and supported by support member 135. Hollow spindle 114 is also rotatably mounted, independently driven by any type driving means such as highspeed motor 121, through motor shaft 123, pulleys 122 and 147 and nonconducting belt 133. Hollow spindle 114 is axially and radially supported by nonconducting support member 137 through bearing 136. Motor 121 is connected to and supported by support member 138.

Conic electrode 14 is supported by means of protruding bearing surfaces 124 and 125 of hollow spindle 114. Conic electrode 14 is energized, for example, by a standard DC power supply with 10 kilovolts to 60 kilovolts at 2 milliamperes maximum current through conventional wire and slide contacting means.

Hollow spindle 114 is constructed with a conducting cylindrically shaped knife-edge ring 126, extending axially there-through opening 127 and terminating slightly above surface of conic electrode 14.

Attached to and extending axially from hollow spindle 114 is a hollow nonconducting twisting element 24.

Referring to FIGS. 1 and 6, to provide an adequate electrostatic field for complete removal of individual fibers 21, from the airstream, flat plate electrode 13 is constructed sufficiently large to extend beyond periphery of conic electrode 14, and flat plate electrode 13 is provided with opening 29 extending there-through axially aligned with hollow twisting element 24. Flat-plate electrode 13 is adjustable mounted by means of movable clamp 142 (in partial view) and it is electrically grounded through conventional wire and standard connections.

Coring element 16 is guided into hollow spindle 114 by guide roll 20, which is rotatably mounted onto stubshaft 143, by means of bearing 144. Stubshaft 143 is attached to support members 145. Coring element 16 passes through center of rotation of hollow spindle 114 and hollow twisting element 24. As coring element 16 leaves hollow twisting element 24, fibers 21 are spun there-around, mechanically bonding said fibers 21 to said element 16, forming core yarn 25. The coring element 16 encapsulated with spun fibers 21 in the electrostatic field 23, emerging as core yarn 25, passes through opening 29 of stationary flat plate electrode 13 through guide rolls 26 and 27 to winding means such as cone 28 attached to motor 29.

Other spindle element configuration and variations thereof may be successfully utilized, for example a conic fiber twisting component with a centrally located circular passage beginning at its base, extending there-through and terminating axially at its apex.

Although all embodiments of this invention have been discussed in terms of producing core yarn on a coring element it is also understood that it is feasible to produce core yarn from other coring textile strands such as roving.

We claim:
1. A mechanically locked core yarn with peripherally spun fibers about a coring element, said fibers tightly held by the coring element and interlocked therewith, said interlocking effected by feeding a twisted coring element to a twisting element, rotating said twisting element in a direction to effect a false twist to at least partially untwist said coring element, attaching said peripheral fibers, releasing said false untwist to cause the normal twist of said coring element to tightly hold and interlock with said peripheral fibers.

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