PROCESS AND APPARATUS FOR MAKING FIBER PACKAGES

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Robert C. Wilkie
Inventor

by
This invention relates to a process and apparatus for setting fibers such as those used in the textile industry by means of compression, steam and vacuum extraction. Its chief object is to reduce a very large, bulky package of fibers to a small dense one which is easily handled and more than doubles the storing and shipping capacity of a given space. Another object is to reduce the inherent springiness of the fibers, thereby greatly assisting the subsequent drawing and spinning operations, without the need for long storage periods commonly used for "ageing" fibers, and consequently producing yarn of increased tensile strength. Still another object is to provide means for introducing identification media in the form of steam sublimated or distilled dyes, tracing agents, radioactive chemicals or fluorescent dyes. A further object, in the case of wool, is to eliminate the need of backwashing preparatory to combing.

Therefore, for instance, one practice has been to form combed wool sliver in tightly wound balls weighing approximately twelve pounds. The balls were wrapped in paper and stored for as long a period as possible, depending on the economic policies of the user. This storing period resulted in the fibers becoming more dormant due to the tension and compression of the wind causing the fibers to assume their tensioned form to a more or less permanent degree, depending on the ageing period. The loss of springiness in the fiber is insured in a greater degree of control in subsequent drawing operations, and hence better operating efficiency and quality reflected by more uniform and stronger yarn. However, these latter advantages cannot be fully gained due to the excessive cost and risk of having large quantities of valuable material in storage for many months.

For example, the wool package produced by the apparatus described in U. S. Patent No. 2,478,960 is particularly well adapted to the present process. The package containing up to 60 pounds of fiber in the form of sliver is symmetrically and uniformly wound from bottom to top in coils laid spirally about the center and has a central hole through its full length.

In the drawings, Fig. 1 is a side view of a preferred form of apparatus for carrying out my process together with a diagrammatic representation of the means controlling the steam and vacuum extraction. Fig. 2 is a plan view of the cylinders in which the packages of fibers are processed. Fig. 3 is a plan view of a package. Figs. 4 and 5 are side views of the apparatus of Fig. 1, in different stages of operation.

The apparatus may be described briefly with reference to Fig. 1 as follows: two platforms 11a and 11b are mounted on movable carriage 10 by means of springs 13 surrounding the upper portions of hollow sleeves 13c which pass through holes in the carriage 10. Beneath the latter is a hydraulic device 15 capable of moving the carriage 10 back and forth over pipes 13b leading down to solenoid operated valves 20, 20 hereinafter described. The platforms 11a and 11b are capable of supporting a set of cylinders 12a and 12b, respectively, above which and in line with the pipes 13b are four rams 16, 16 operated by hydraulic devices 17, 17.

In operation, the carriage 10 is positioned to the left as shown in Fig. 1. (It may of course be positioned to the right as shown in Fig. 5.) In Fig. 1, a set of four cylinders 12a have first been placed on the platform 11a and have then been filled with fibers in the form of uncompressed packages 14 each of which has a central hole 19, Fig. 3, extending its entire length. The cylinders 12b on the platform 11b are directly under the retracted rams 16 and contain packages 18 which have been subjected to the process of this invention hereinafter described.

In Fig. 4, the carriage 10, carrying therewith the platforms 11a and 11b and the cylinders 12a and 12b and the contents thereof, has been moved to the right into a position where the cylinders 12a are each directly under each of the rams 16. The latter have been forced down by means of the hydraulic devices 17 thereby compressing the fibers into the form of compressed packages 18 and bringing into sealed engagement the mouths of the sleeves 13a and the mouths of the pipes 13b by forcing down the platform 11a against the pressure of the springs 13. The cylinders 12b have been removed leaving the original, compressed packages 18 on the platform 11b.

The rams having entered the cylinders 12a and compressed the packages to a desired height, solenoid operated valves 20, Fig. 1, open to force a supply of steam 27 up through the pipes 13b and sleeves 13a and into the central holes 19 of the packages. Then, inasmuch as each ram head effects a seal at the top of each package, the steam escapes radially through the packages and out through the perforations 21 in the lower portion of the walls of the cylinders. The steaming operation may last from half a minute to two minutes, at the end of which time the valves 20 close, and solenoid air valve 22 opens to connect the pipe from the packages to vacuum pump 23. Air at room temperature is drawn from the outside through the perforations in the cylinder and through the packages for three to five minutes, cools the fibers and removes the moisture. This operation of steaming followed by cooling and drying of the fibers while they are under compression sets the fibers and reduces the inherent springiness thereof. The valve 22 then automatically closes.

If it is desired to apply a fugitive identification dye, such as a steam sublimated or distilled dye, a tracing agent, a radioactive chemical or a fluorescent dye, to the fibers, a supply of said dye 25 is intermingled with the steam by opening valve 24 for a predetermined period during the steaming operation to deposit the dye along the sides of the center holes 19 and carry said dye radially to a depth of about one inch into the packages. In subsequent operations when the fibers are unwound, the spots of dye appear at intervals and later, after doubling and drafting, provide sufficient color distribution to give the required identification.

In Fig. 5, the valve 22 having been closed, the rams 16 have been withdrawn, the compressed packages 18 on platform 11b have been removed, and the cylinders 12b have been replaced upon the platform 11b and filled with uncompressed packages 14. From this position which is similar to that of Fig. 1, the apparatus will be run through the process again as heretofore described.

The starting, running and stopping of the above hydraulic devices and valves may all be operated and synchronized by automatic, electrical timing means. The lowering and raising of the cylinders and the lowering of the rams may be accomplished by overhead hoists or the like. The removal of the compressed packages is normally done by hand in conjunction with a pallet.
3. In the worsted system the process may be substituted for backwashing before combing in which case the fibers are dried after carding to effect parallelization thereof. As described, the fibers are introduced in coiled uncompressed packages for use in the process by means of which the fibers are set by the steaming in a condition suitable for combing.

One of the advantages of this process is that the compression and steaming of the fibers reduces the inherent springiness of the fibers to such an extent that ageing is no longer required and, thereby, the expense in warehousing and storage formerly required for ageing are eliminated.

It has been found that the process works equally well on any known textile fiber, either natural or synthetic. The amount of material in the uncompressed state may be varied, or the amount of compression may be varied, or both, depending upon the use to which the product will be put. Certain physical characteristics of the fiber, such as specific gravity and modulus of elasticity, have a bearing on volume to weight ratio in both the uncompressed and finished package.

The dyeing and liquid treating processes disclosed herein are claimed in my continuation-in-part application Serial No. 359,602 filed June 4, 1953. The compressed package disclosed herein is claimed in application Serial No. 423,986 filed April 19, 1954 as a division of said application Serial No. 359,602.

I claim:

1. An apparatus for compressing textile fibers and setting the fibers in compressed condition comprising a base member, a carriage horizontally movable thereon, a conduit on said carriage movable therewith, another conduit disposed lower than said first-mentioned conduit, said carriage being movable horizontally to and from a working position in which said first-mentioned conduit is vertically aligned with said lower conduit, conduits being relatively movable axially into and out of communication with each other, a vertically movable ram positioned above the conduit on said carriage when said carriage is in said working position for applying a compressive force to textile fibers on said conduit, and means for selectively connecting a source of steam under pressure and a source of vacuum to said lower conduit.

2. An apparatus for compressing textile fibers and setting the fibers in compressed condition comprising a horizontally movable carriage, a plurality of vertically movable platforms supported on said carriage, means for urging each platform upwardly with respect to said carriage while permitting downward movement with respect to said carriage, a conduit on each platform movable vertically therewith, another conduit disposed lower than said movable conduits, means for moving said carriage between a position in which a conduit on one platform is vertically aligned with said lower conduit and another position in which a conduit on another platform is aligned with said lower conduit, a vertically movable ram positioned above said lower conduit and above said platform for applying a compressive force to textile fibers on said conduit, and means for selectively connecting a source of steam under pressure and a source of vacuum to said lower conduit, whereby each platform may be unloaded and reloaded while the other is in working position.

3. The apparatus of claim 2 wherein each platform has a plurality of conduits thereon and wherein there are a corresponding plurality of lower conduits positioned to be engaged simultaneously by all of the conduits on a platform.

4. An apparatus for compressing textile fibers and setting the fibers in compressed condition comprising a base, a horizontally movable carriage on said base, a plurality of vertically movable platforms supported on said carriage, means for urging each platform upwardly with respect to said carriage while permitting downward movement with respect to said carriage, a conduit on each platform movable vertically therewith and opening into the upper surface of the platform, another conduit disposed lower than said movable conduits, means for moving said carriage between a position in which a conduit on one of said platforms is vertically aligned with said lower conduit and a position in which a conduit on another of said platforms is vertically aligned with said lower conduit, a vertically movable ram, positioned above said lower conduit and above said platforms, for applying a compressive force to textile fibers on the platform the conduit of which is in vertical alignment with said lower conduit, whereby when said force is applied said aligned conduit is moved downwardly with its platform into communication with said lower conduit, values for selectively connecting a source of steam under pressure and a source of vacuum to said lower conduit, means for moving said carriage between said two positions, and means for operating said valves and ram in timed sequence.

5. The apparatus of claim 4 wherein each platform has a plurality of conduits thereon and wherein there are a corresponding plurality of lower conduits positioned to be engaged simultaneously by all of the conduits on a platform.

6. An apparatus for compressing textile fibers and setting the fibers in compressed condition comprising a base, a carriage supported on said base for horizontal reciprocating movement thereon, a plurality of platforms supported on said carriage for vertical movement with respect thereto, means for urging each of said platforms upwardly with respect to said carriage, a conduit on each of said platforms vertically movable therewith, and opening into the upper surface of the platform and extending downwardly therefrom through said carriage, a lower conduit on said base having an upwardly facing opening at a lower level than said movable conduits, means for reciprocating said carriage on said base and in vertical alignment in which one of said platform conduits is in vertical alignment with said lower conduit and another position in which another platform conduit is in vertical alignment with said lower conduit, open-ended cylindrical cans having perforated walls and removable spouts on said platforms with the interior of each can in communication with one of said platform conduits, valves for selectively connecting a source of steam under pressure and a source of vacuum to said lower conduit, a vertically movable ram disposed above said lower conduit and including said conduits and conduits of said platform, means for moving said carriage back and forth on the platform between said two positions, and means for operating said valves and ram in timed sequence.

7. The process for preparing textile fibers for textile operations such as liquid treating, drafting and spinning which comprises compressing the fibers into a small dense package having the shape of a right circular cylinder with flat ends at right angles to its axis and an axial passageway therethrough, and of a reduced volume less than two-fifths the volume of the uncompressed fibers, confining the mass of compressed fibers in its reduced size, subjecting the fibers while so confined to a beating treatment by flowing hot fluid radially through the confined mass of fibers, thereafter, while said fibers re-
main so confined, cooling said fibers by flowing a fluid radially through said mass of fibers to set said mass of fibers in its reduced size and form, and thereafter releasing the confining pressure, the compressed completed package retaining substantially its said reduced form and size upon said release of pressure.

8. The process for preparing textile fibers for textile operations such as liquid treating, drafting and spinning which comprises compressing the fibers into a small dense package having the shape of a right circular cylinder with flat ends at right angles to its axis and an axial passageway therethrough, and of a reduced volume less than two-fifths the volume of the uncompressed fibers, confining the mass of compressed fibers under pressure to its reduced form and size, flowing steam at low pressure radially through the confined mass of fibers for from about 1/2 to about 2 minutes, thereafter, while said fibers remain so confined, cooling said fibers by flowing air radially through said mass of fibers for from about 3 to 5 minutes to set said mass of fibers in its reduced size and form, and thereafter releasing the confining pressure, the compressed completed package retaining substantially its said reduced form and size upon said release of pressure.

9. The process for preparing textile fibers for textile operations such as liquid treating, drafting and spinning which comprises compressing the fibers into a small dense package having the shape of a right circular cylinder with flat ends at right angles to its axis and an axial passageway therethrough, and of a reduced volume less than two-fifths the volume of the uncompressed fibers, confining the mass of compressed fibers under pressure to its reduced form and size, subjecting the fibers while so confined to a heating treatment by flowing a hot fluid into said axial passageway and radially outwardly through the confined mass of fibers, thereafter, while said fibers remain so confined, cooling said fibers by flowing a fluid radially inwardly through said mass of fibers and into said axial passageway, to set said mass of fibers in its reduced size and form, and thereafter releasing the confining pressure, the compressed completed package retaining substantially its said reduced form and size upon said release of pressure.

10. The process according to claim 9 wherein the fibers to be treated are in the form of sliver.

11. The process for preparing textile fibers for textile operations such as liquid treating, drafting and spinning which comprises compressing the fibers into a small dense package having the shape of a right circular cylinder with flat ends at right angles to its axis and an axial passageway therethrough, and of a reduced volume less than two-fifths the volume of the uncompressed fibers, confining the mass of compressed fibers under pressure to its reduced form and size, flowing steam at low pressure into said axial passageway and radially outwardly through the confined mass of fibers for from about 1/2 to about 2 minutes, thereafter, while said fibers remain so confined, cooling said fibers by flowing air radially inwardly through said mass of fibers and into said axial passageway, for from about 3 to about 5 minutes to set said mass of fibers in its reduced size and form, and thereafter releasing the confining pressure, the compressed completed package retaining substantially its said reduced form and size upon said release of pressure.

12. The process according to claim 11 wherein the fibers to be treated are in the form of sliver.

13. The process according to claim 7 wherein the fibers to be treated are in the form of sliver.

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