METHOD OF TREATING YARN AND THE LIKE WITH FLUIDS

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1 Claim. (Cl. 8—155)

The present invention relates to a method of and package for treating natural and synthetic textile yarns and similar strand materials with fluids. The improved method and package of the invention may be used to advantage in bleaching, washing, mordanting and otherwise treating yarns and is particularly adapted for dyeing.

Yarn has heretofore been prepared for treatment with a dye-liquor or the like by winding it with an open cross-wind to form a package and then forcing the dye-liquor or other treating fluid outwardly through the yarn mass of the package under pressure. With this method certain commercial dyes will color the yarn uniformly throughout the package but with other dyes, particularly certain colors of the vat dye group, the yarn in the outer layers of the packages will be left with white or undyed spots at the junction of the crossed coils.

One of the objects of the present invention is to provide a method of treating packages of yarns with fluids to cause a uniform penetration of the fluid between the contacting portions of the crossed coils adjacent the periphery of the yarn mass.

Another object of the invention is to provide a method of winding packages of yarn for treatment with fluids whereby to effect resistance to the flow of the fluid at its point of egress from the package to cause it to penetrate between the crossings of the coils in the outer yarn mass.

Another object of the invention is to provide a textile package built up in a series of layers of open-spaced cross-wound coils with an outer spool-wound layer of parallel coils on its periphery.

Further objects of the invention are set forth in the following specification which describes a practical method of winding, a preferred form of yarn package produced thereby, and the method of treating the yarn in the package, all by way of example, as illustrated by the accompanying drawings in which:

Fig. 1 is a longitudinal sectional view of the improved form of package shown as wound on a hollow perforated shell or core and mounted on a perforated holder through which the treating fluid is forced;

Fig. 2 is a view showing the core or shell with the first turns of yarn wound thereon to illustrate the open cross-wind which constitutes the main body of the package; and

Fig. 3 is a view of the finished package with the outer spool-wound layer illustrated as partly broken away to show the cross-wound coils thereafter.

One feature of improvement in the present invention consists in providing a yarn package capable of resisting the flow of treating fluid at its point of egress from the package to cause it to penetrate between the contacting portions of the yarn at the crossings of the coils and to permeate the entire mass. As a result of study and experimentation to determine the cause of faulty dyeing it has been discovered that the white or undyed spots on the yarn occur only at the junction of the crossing coils in the outer layers of the package; and that the size or extent of the undyed sections varies directly with the size or denter of the yarn. It has further been discovered that the white or undyed spots result from the inability of particular dyes, either in solution or dispersion, to travel along the fibers or filaments of the yarn strands. Certain commercial dyes will travel along the filaments under any condition, due probably to absorption and capillary action, while other vat colors such as Indanthrene Blue BCS, Brown BR and Gray 3B do not have this characteristic. A textile yarn package regardless of the tension under which it is wound will absorb within its fibers an amount of water nearly equal to its dry weight with an equal amount held in suspension between the filaments and yarn strands. This absorption and suspension of water causes swelling of the yarn into a mass of substantially uniform density and porosity. When dye-liquor is forced through this mass under pressure it follows no selective path of travel since the resistance is uniform throughout the mass. At the outside or periphery of the package, however, the resistance becomes negligible so that the dye-liquor instead of seeping through the mass under pressure, exits freely through the voids or interstices between the yarn coils of the outer layers of the package. In other words, the pressure of the dye-liquor is released at the outer periphery of the package so that the liquor fails to penetrate between the crossings of the coils where they lie in contact to color the yarn at these junctions; unless the dye is of a type which will travel along the filaments of the yarn.

The present invention provides a package in which the flow of the dye-liquor or other treating fluid is resisted at the periphery of the yarn mass, that is, at the point of egress of the liquid, to cause back pressure and resultant penetration of the liquid between the crossed portions of the coils.

A practical application of the present method of and package for treating yarns with fluids consists in providing the porous yarn mass in the package with an outer layer of parallel, closely wound coils which form substantially a sheath capable of resisting the flow of the treating fluid; the yarn coils of this outer layer being disposed in parallel relationship to eliminate crossings. Preferably, the yarn is first wound in the usual manner to build up successive cross-wound layers forming the main body of a package. The pack-
age is then completed by winding on an outer layer with a spool-wind to form the enclosing sheath which covers the interstices or voids between the inner cross-wound coils. In this form of package there are no crossovers in the coils of the outer layer and consequently no points of juncture of the yarn liable to cause unduly portions or white spots. The outer spool-wound layer or enclosing sheath is considerably less porous than the inner cross-wound mass to resist the flow of fluid at its point of egress but, on the other hand, the liquor under pressure will penetrate through the yarn in this layer due to the resistance which it encounters at this point. It has been found by tests that when a package wound in this form is treated with the more troublesome vat dyes, the yarn is entirely free from white or undayed spots. On the other hand, cross-wound packages without the outer spool-wound layer when treated under the same conditions consistently have the undesirable white or undayed spots.

The improved results that flow from the present form of package are due to the fact that the outer spool-wound layer of yarn resists the flow of the fluid at its point of egress and causes it to penetrate between the strands at the crossings throughout the inner body of the wound mass.

In the present drawing a preferred form of package 2 is shown as comprising a yarn mass wound on a suitable hollow core such as a tube or shell 3 of waterproof fiber or the like. The core or tube 3 has a series of perforations 4 in its walls through which the treating liquor may be forced under pressure. The body portion 5 of the package is built up of successive layers of yarn coils helically disposed in spaced-apart relationship. The yarn may be wound on the tube 3 by any suitable type of machine, such as one employing a rotating drum for driving the package and guiding the yarn, or one having a positively rotated spindle and a reciprocating thread-guide. As illustrated by way of example in Fig. 3, the yarn may be wound with a ratio of traverse to package rotative speed to lay two and one-half turns on the core 3 from end to end of the package; or any other suitable number of winds may be employed. The package winding continues the coils are laid in parallel, openly-spaced relationship, crossing and recrossing each other at a multiplicity of points. After the package has been built up to the desired diameter an outer layer or sheath 6 is wound onto the body portion 5 with the coils disposed in closely-adjacent parallel relationship in the manner of a spool-wind. As will be noted by reference to Figs. 2 and 3, the coils of yarn in the main body portion 5 of the package form a porous mass with numerous interstices or voids 7 in the layers, while the outer spool-wound layer or sheath 6 encloses the porous mass and covers the interstices or voids.

The packages may be treated in any suitable apparatus and, as illustrated in Fig. 1, a series of hollow covers are usually telescopically mounted on a hollow, perforated holder 10 with spacer plates 12 between the ends thereof. Preferably, the perforated holder 10 is portable and is provided with a base flange 13 formed with an annular seat 14 adapted to cooperate with a nip 15 in the false bottom 16 of the dye-vat or kier. During the dyeing or other treating operation the seat 14 at the end of the holder 10 is held in seated engagement with the nipple 18 and the treating fluid is forced upwardly through the holder under pressure. Due to the pressure the treating fluid is caused to flow outwardly through the perforations in the holder 10 and dye-tube 3, and thence through the cross-wound portion 5 of the package and finally through the spool-wound sheath 6 overlying the yarn mass.

During this treatment the major part of the yarn mass in the package is of relatively high, uniform density so that the path of the fluid is non-selective. However, at the outer layers of the cross-wound mass are areas of contrasting high and low density, the high density area being at the points of crossing of the coils, while the voids between these points present areas of low density which would normally provide a course of free flow for the fluid. With the present improved form of package, however, by reason of the outer layer of closely-spaced spool-wound coils the area of high and low density is converted into one of uniform high density, while the outer layer itself becomes an area of high and low density. Therefore, the dye-liquor or other fluid penetrates uniformly through the whole yarn mass for as there are no crossovers in the coils of the outer spool-wound layer there will be no portions of the yarn which the fluid will not reach. In this way every portion of the material in the package is subjected to the flow of the fluid which consequently thoroughly penetrates thereto into effect an even and uniform treatment.

In dyeing rayon and other synthetic yarns which are normally less permeable to certain kinds of dyes the present improved form of package insures a thorough and complete penetration of the material even at the outer layers and thus more uniform and satisfactory results are obtained without undayed white spots in the yarn.

It will be observed from the foregoing that the present invention provides a particularly efficient method of treating packages of yarn and similar materials in dyeing and other processes to insure complete uniform treatment and coloring of the yarn in the whole package. The improved form of package may be produced on standard types of winding machines with the final layer wound by hand; or automatically-operated means may be provided for applying the last spool-wound layer, such means being outside of the scope of the present invention and to be made subject of a later application.

While the present specification describes by way of example a preferred method of winding the package and a preferable form of the same, it is to be understood that modifications may be made therein without departing from the spirit or scope of the invention. Therefore, without limiting myself in this respect, I claim:

The method of treating yarn with fluids which comprises winding a mass of the yarn on a hollow perforated core in layers of openly-spaced crossing coils, winding an outer layer on the mass with a spool-wind to cover the interstices of the open cross-wind, and passing a treating fluid outwardly through the perforated core and the surrounding yarn mass.