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FLUID TREATING YARN CAKES BY RADIAL LIQUID FLOW

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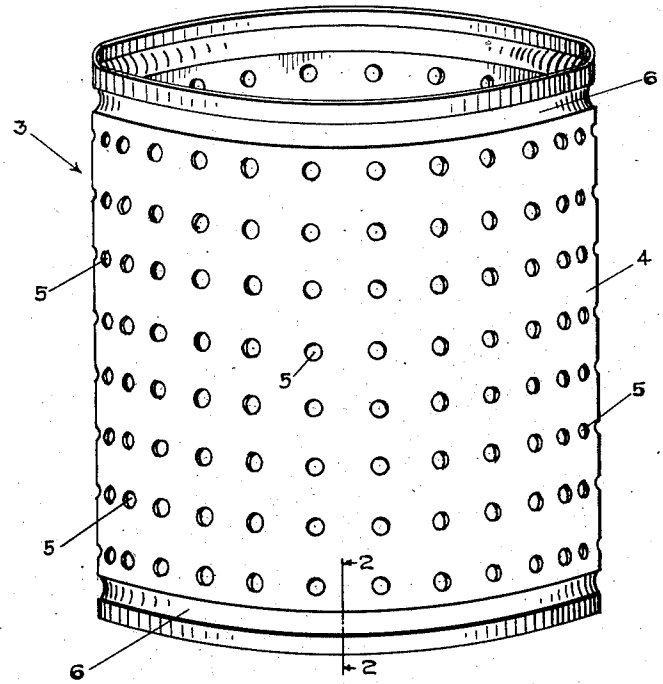


Fig. 1

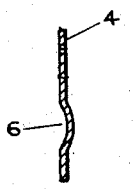


Fig. 2

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FLUID TREATING YARN CAKES BY RADIAL LIQUID FLOW

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1 Claim. (Cl. 8—155.1)

1

This invention relates to yarn supports, and relates more particularly to a yarn support for holding thereon a cake of yarn which is to be subjected to fluid treatment.

While the yarn support of our invention may be employed wherever yarn in cake form is to be subjected to fluid processing, it has been found to be particularly satisfactory for use in the saponification of cellulose ester yarn and will, therefore, be described in connection therewith.

In the production of high tenacity regenerated cellulose yarn by the saponification of stretched or unstretched yarn having a basis of cellulose acetate or other organic acid ester of cellulose, the yarns are usually saponified in package form, that is in the form of a cake wound on a bobbin or other suitable support. These supports are normally flangeless, perforated tubes, preferably made of stainless steel. The perforated tubes, having yarn wound thereon in cake form, are placed in a closed vessel and a suitable saponifying liquid is fed into the vessel. The yarn-filled tubes are maintained in contact with the saponifying liquid in the vessel for a length of time sufficient to saponify the yarns completely or to the desired degree.

Since the yarn on the tube undergoes a substantial decrease in denier as the result of the action of the saponifying medium, which acts to split off combined acetyl groups, the yarn cake of regenerated cellulose yarn which is produced becomes quite loose and soft, and tends to slip off the tube entirely. Moreover, during the saponifying liquid induction period, a large portion of liquid tends to gush out from the ends of the yarn cake adjacent to the tube. This action causes the cutting of by-pass channels, thus preventing the desired uniform diffusion of the saponifying medium throughout the yarn cake. This channelling required the extending of the time of processing to permit the slow places or the by-passed voids to catch up. However, even with the extension of processing time, many unprocessed spots were present in the yarn cake when removed from the saponifying vessel.

It is, accordingly, an important object of our invention to provide an improved yarn support which will hold the yarn package thereon before, during and after processing, and in such a manner that by-passed channels are not formed during processing.

Another object of this invention is the provision in a yarn support of grooves for the purpose of receiving some yarn of the yarn cake.

Still another object of this invention is to provide an improved method of winding a yarn cake on a yarn support whereby a portion of the yarn cake forms an effective trap for the liquid employed in subsequent liquid processing and the shifting of the yarn cake on the yarn support is prevented.

2

Other objects of this invention will appear from the following detailed description.

In the drawings, wherein the preferred embodiment of our invention is shown,

Fig. 1 is a perspective view of our improved yarn support, and

Fig. 2 is a cross-sectional view taken on line 2—2 in Fig. 1 in the direction of the arrows.

Like reference numerals indicate like parts throughout both views of the drawing.

In the drawing, there is shown a yarn support, generally indicated by reference numeral 3, comprising a tube 4, preferably made of stainless steel, provided with a plurality of perforations 5. Formed adjacent each end of the tube is a circumferential groove 6.

In forming the yarn cake on the yarn support 3, some yarn is wound into the middle of each of the grooves 6 by means of a suitable adjustment to the winding device employed in the winding of the yarn in cake form on the tube. The yarn windings in the grooves 6 form a very effective trap for the liquid and in the treatment with the saponifying medium the traps prevent the gushing out of the liquid from the ends of the yarn cake adjacent to the tube, causing a uniform diffusion of the saponifying medium throughout the yarn cake without channelling the same. Moreover, no shifting of the yarn cake on the tube occurs before, during or after processing. Furthermore, structurally these grooves provide excellent rigidity to the tube.

Usually the yarn support of the present invention is employed with a covering. Thus, the yarn support is covered, prior to the winding of the yarn thereon, with a sock made of any suitable woven or knitted fabric, such as cotton, regenerated cellulose or other material, which would not be harmed by the saponifying medium employed, and the ends of the sock tucked inside the tube. After the winding of the yarn on the yarn support has been completed, the ends of the sock are withdrawn from the interior of the tube and are folded over the yarn cake to protect the same during processing, as is well understood in the art.

By employing our improved yarn support, complete and uniform saponification of the yarn cake is effected in a very short time without any chan-

nelling of the liquid saponifying medium through the yarn windings. The cake of high tenacity regenerated cellulose yarns produced is in the form of a firm, dense, compact cake with the continuity of the original wind substantially wholly retained. The retention of the original continuity of the wind and the compact form in which the yarn cake is produced enables the latter to be handled with ease, and washings, lubricating, back-winding, coning or other processing operations may be carried out rapidly and efficiently. This efficient handling is further enhanced by the fact that no difficulty is encountered due to the slippage of the yarn cake from the tube.

The saponifying medium forced through the yarn cake may be an aqueous, alcoholic or aqueous/alcoholic solution of any suitable basic saponifying agent. The saponifying agent may be inorganic in nature such as, for example, sodium hydroxide, potassium hydroxide, sodium silicate, ammonium hydroxide, sodium carbonate or other inorganic basic agent. Organic saponifying agents may also be employed, such as, for example, methyl amine, ethylene diamine, triethanolamine or other organic bases. The temperature of the solution of the saponifying agent applied to the yarn may vary, with temperatures of from 20 to 100° C. being satisfactory. Preferably, in saponifying stretched cellulose acetate yarns, we employ aqueous solutions of sodium hydroxide as the saponifying agent and in concentrations of 0.1 to 5% by weight, the solution being applied to the yarns undergoing saponification at a temperature of from 20 to 90° C. Optimum results are achieved employing an 0.2 to 2% aqueous solution of sodium hydroxide as the saponifying agent, the solution being maintained at about 80° C. during saponification. Preferably, the solution should also contain from about 5 to 20% by weight of sodium acetate or sodium sulfate.

When saponifying said cellulose acetate yarns in the form of a cake of 1 to 3 pounds in weight, the flow of saponifying solution through the yarn windings may be at a rate of ½ to 10 gallons per minute, the pressure on the yarn cake being such as to cause the liquid flowing through the yarn cake to be maintained at a back pressure of 2 up to 20 pounds per square inch. Complete saponification of the cake of stretched cellulose acetate yarn may be affected under these conditions in from 20 to 60 minutes. After saponification is completed, the cake of high tenacity regenerated cellulose yarns obtained may be washed neutral with water, lubricated and dried.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

In a method of treating a package of yarn with a liquid medium, the steps which comprise winding yarn onto a holder having a pair of circumferential grooves extending inwardly toward the axis of the holder, one groove being adjacent each end of said holder, and having a relatively smooth perforated portion between said grooves, winding a plurality of layers of yarn onto said holder to form a cake, and into each of said grooves, the winding in said grooves forming a liquor trap, and treating the yarn package thus formed by forcing a liquid medium radially outward through the perforations in said holder and through said cake.

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