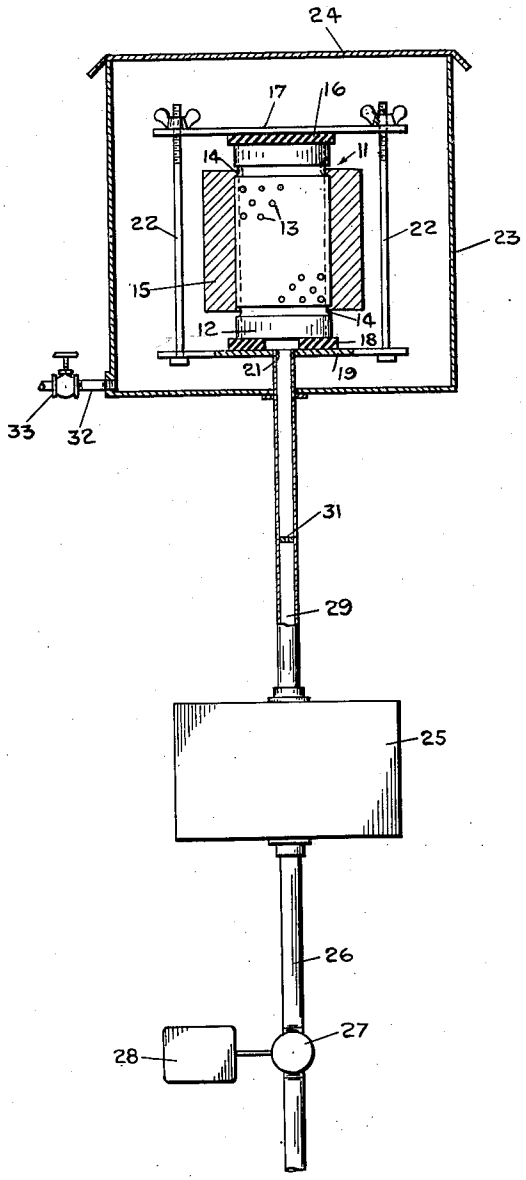
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TREATMENT OF TEXTILE MATERIAL

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TREATMENT OF TEXTILE MATERIAL

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This invention relates to a process and apparatus for treating textile materials, and relates more particularly to a process and apparatus for saponifying packages of textile materials having a basis of a cellulose ester.

In the textile art involving the use of artificial filamentary materials, it is often necessary to saponify textile materials having a basis of a cellulose ester to convert the cellulose ester to regenerated cellulose. For example, in producing high tenacity regenerated cellulose textile materials from textile materials having a basis of a cellulose ester, the textile materials first are stretched while in a softened or plasticized condition, and the cellulose ester is then converted to regenerated cellulose by treatment of the textile materials with saponifying agents. To obtain textile materials having uniform properties, it is necessary that the saponification be substantially uniform and complete. One manner in which the saponification has heretofore been carried out is to apply the saponifying agents to the textile materials as they pass from one point to another, but this method of treatment is uneconomical since it requires a considerable amount of equipment and a great deal of handling of the textile material.

To eliminate the equipment and handling required for the saponification of textile materials that are moving from point to point, it has been suggested that the saponification be carried out by forcing the saponifying agents through packages of said textile materials. However, when saponification is carried out in this manner a long period of time is required to obtain a complete and uniform saponification of all the textile material in the packages being treated. Hitherto, in processes for the saponification of textile materials in package form, the initial flow of the saponifying agent through the package was limited to a small number of channels therein, and only those turns of the textile material which were adjacent to said channels came into contact with the streams of saponifying agent.

Since the saponification of textile materials decreases, their cross-sectional area by about 35%, the channels tend to increase in size during the saponification. For a given flow of the saponifying agent, this increase in the size of the channels will tend to reduce the total number of channels thereby reducing still further the turns of textile material which come into direct contact with the streams of saponifying agent. The saponifying agent reaches the remainder of the textile material, which is spaced from the channels through which the saponifying agent flows, only by the slow process of diffusion. Therefore, although some of the textile material in a package is saponified within a short time after the flow of the saponifying agent therethrough begins, a greatly extended period of time is required to saponify all the textile material.

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It is an important object of this invention to provide a process and apparatus for saponifying packages of textile material which will overcome the foregoing and other disadvantages of the prior art processes and apparatus employed for this purpose, and which will be especially efficient in operation and simple in construction.

A further object of this invention is to provide a process and apparatus for saponifying packages of textile material which will effect a substantially uniform and complete saponification of the textile material in a shorter period of time than has hitherto been necessary.

Another object of this invention is the provision of a process and apparatus for saponifying packages of textile material in which the flow of saponifying agent through the package is interrupted periodically during the saponification period.

Other objects of this invention, together with certain details of construction and combinations of parts, will be apparent from the following detailed description and claims.

We have now discovered that a substantially uniform and complete saponification of packages of textile material may be effected in a shorter period of time than has hitherto been necessary by periodically interrupting the flow of saponifying agent through the package. When the flow of saponifying agent is interrupted, the textile material fills the channels through which the saponifying agent has been flowing, and, when the flow of saponifying agent is resumed, new channels are opened in the packages and new turns of textile material are brought into direct contact with the streams of saponifying agent flowing through the package. By carrying out the saponification of packages of textile materials in this manner, the time necessary for saponification may be reduced to one-half, or even less, of that previously necessary.

The interruption in the flow of saponifying agent through the packages of textile material is preferably complete but may be partial. When partial, the flow should be reduced sufficiently so that at least the majority of the channels are emptied of the saponifying agent and filled by the textile material. In general this condition

may be achieved by reducing the flow by at least about 98%. The interval of time between successive interruptions of the flow of saponifying agent will depend upon the total time necessary for complete saponification, which will in turn depend on a large number of variables such as, for example, the concentration, temperature and rate of flow of the saponifying agent, the size and density of the packages, and the particular cellulose ester being treated. However, there is ordinarily no advantage in interrupting the flow of saponifying agent at intervals of less than about 10 seconds whereas if the interval of time between successive interruptions of the flow of saponifying agent exceeds about 10 minutes, the total time necessary for saponification will be increased by a corresponding amount. The interruption in the flow of saponifying agent should be long enough to empty the channels through which it has been flowing or a minimum of about 10 seconds. During the interruption in the flow, the packages retain a sufficient quantity of saponifying agent at the proper temperature to permit saponification of the textile material to proceed unchecked.

The desired interruptions in the flow of the saponifying agent may be obtained by employing any one of a large number of expedients. For example, the pump employed to force the saponifying agent through the packages of textile material may be cut off periodically. On the other hand, a valve between said pump and the supply of saponifying agent or between said pump and the packages being treated may be closed periodically, or a valve in a bypass around said pump may be opened periodically. While the interruptions in the flow of saponifying agent may be effected manually, it is preferred to employ for this purpose suitable automatic means.

The saponifying agent may be forced radially through the package of textile material either from or towards the center with no substantial difference in the results obtained. However, it is somewhat less desirable to force the saponifying agent through the textile package toward the center since it is necessary in this case to enclose the packages in a pressure chamber to obtain the desired flow of saponifying agent. On the other hand, when the saponifying agent flows through the packages from the center no such pressure chamber is necessary, it being necessary merely to force the saponifying agent into the core of the package.

The textile materials which may be saponified in accordance with this invention include, for example, filaments, yarns, tow, sliver, roving or the like, having a basis of any ester of cellulose such as, for example, cellulose acetate, cellulose propionate, cellulose acetate-butyrate, cellulose acetate-propionate, or the benzoic acid ester of cellulose; and the textile materials may or may not be stretched before saponification. The textile materials may be packaged as, for example, cakes, balls, bobbins, cheeses, cones, pirns or the like. In those cases where the package includes a package support, the support should be provided with means, such as perforations, to permit the flow of saponifying agent therethrough, and should be constructed of a material chemically inert to the saponifying agent.

Among the saponifying agents which may be employed are aqueous solutions of alkaline materials such as, for example, sodium hydroxide, sodium carbonate or ammonium hydroxide. The solutions may also include buffering agents such as, for example, sodium acetate, sodium citrate or sodium sulfate. The saponifying agents may be employed at room temperatures or at elevated temperatures to increase the rapidity with which they act.

A preferred embodiment of this invention is illustrated in the accompanying drawing in which the figure is a diagrammatic view, partly in section, of an apparatus for saponifying packages of textile materials.

Referring now to the drawing, a package of textile material is indicated generally by the reference numeral 11. The package 11 comprises a tubular package support 12 of stainless steel having a plurality of perforations 13 therein, and provided with peripheral grooves 14 adjacent its upper and lower ends. A textile material 15 is wound on the package support 12; the grooves 14 preventing the textile material from moving longitudinally of the support during the saponification; and preventing an excessive flow of saponifying agent along the package support 12.

The package support 12 is mounted between a rubber disk 16 fastened to a plate 17, and an annular rubber gasket 18 fastened to a plate 19, which plate is provided with an aperture 21 extending therethrough to admit the saponifying agent. Tie rods 22 serve to draw the plates 17 and 19 toward each other producing a liquid tight seal between the disk 16, the gasket 18 and the package support 12. The entire assembly including the package 11 is positioned within a chamber 23 which is closed by means of a loosely fitting cover 24.

The saponifying agent is forced through the textile material 15 by means of a pump 25 which draws the saponifying agent from any suitable source of supply (not shown) through a conduit 26. A valve 27, which is periodically closed by means of an automatic timer 28 of any suitable design, is mounted in the conduit 26 to interrupt the flow of saponifying agent periodically. After passing through the pump 25, the saponifying agent flows under pressure through a conduit 29, containing a metering orifice 31 therein, to the interior of the package 11, and then flows outwardly through the apertures 13 and the textile material 15. A conduit 32 provided with a valve 33 permits the saponifying agent to be drained from the chamber 23, and returned to the source of supply after replenishment. By adjusting the valve 33, the level of the saponifying agent in the chamber 23 may be controlled, permitting the saponification to be carried on either with the package 11 completely or partially submerged, or with the package 11 standing above the level of the saponifying agent.

The following example is given to illustrate the invention further.

Example

A package of textile material containing 4 pounds of cellulose acetate yarn is mounted in the apparatus shown in the accompanying drawing, and a stream of saponifying agent containing 0.6% sodium hydroxide and 6–8% sodium acetate maintained at a temperature of 80° C. forced through said package. The flow of saponifying agent is interrupted every 3 minutes for a period of 30 seconds. At the end of 30 minutes all the yarn is uniformly and completely saponified.

If the package of textile material is saponified without periodically interrupting the flow of saponifying agent therethrough, at least 60

minutes is required to obtain a uniform and complete saponification of the yarn.

While the process and apparatus of this invention have been described with particular reference to the saponification of textile materials having a basis of a cellulose ester in package form, they may also be employed for other purposes wherein a fluid treating agent is passed through a package of textile material.

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:

1. In a process for saponifying organic acid ester of cellulose yarns in package form, employing a liquid saponifying medium which is passed through the windings of the yarn package, the steps which comprise interrupting the flow of the liquid saponifying medium through the windings of the yarn package at intervals of at least about 10 seconds, permitting the yarn in the package to settle under the action of gravity on the yarn alone, restarting the flow of the liquid saponifying medium through the windings of the yarn package after an interval of at least about 10 seconds and alternating said steps until complete and uniform saponification of the yarn is attained.

2. In a process for saponifying cellulose acetate in package form, employing a liquid saponifying medium which is passed through the windings of the yarn package, the steps which comprise interrupting the flow of the liquid saponifying medium through the windings of the yarn package at intervals of at least about 10 seconds, permitting the yarn in the package to settle under the action of gravity on the yarn alone, restarting the flow of the liquid saponifying medium through the windings of the yarn package after an interval of at least about 10 seconds and alternating said steps until complete and uniform saponification of the yarn is attained.

3. In a process for saponifying cellulose acetate yarns in package form, employing a liquid saponifying medium which is passed through the windings of the yarn package, the steps which comprise interrupting the flow of the liquid saponifying medium through the windings of the yarn package at intervals of about 3 minutes, permitting the yarn in the package to settle under the action of gravity on the yarn alone, restarting the flow of the liquid saponifying medium through the windings of the yarn package after an interval of about 30 seconds and alternating said steps until complete and uniform saponification of the yarn is attained.

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