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MANUFACTURE OF IMPREGNATED FIBER ARTICLES

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After cellulose fiber articles have been fabricated, it is sometimes desirable to impregnate them with materials which impart water-repellency and other valuable characteristics thereto. For instance, it may be desired to impregnate them with heat-fusible, solid, waterproofing agents, such as asphalt, waxes, resins, or the like. A convenient and economical way to impregnate fiber articles in a porous state with such agents is to treat them with water dispersions of these agents, and then to dry them under conditions to fuse the dispersed particles.

In accordance with the present invention, we associate regenerated cellulose, as well as a solid, heat-fused, waterproofing agent, with the fiber article. The regenerated cellulose may be associated with the fiber article while largely preserving its porosity before the article is subjected to impregnation with the aqueous medium containing the dispersed, fusible waterproofing agent. On the other hand, the article may be impregnated with a mixture of viscose and dispersed, fusible waterproofing agent. When the article is then dried, it may be subjected to a sufficiently elevated drying temperature to fuse the dispersed particles and thus to produce a continuous water-repellent phase enveloping the regenerated cellulose phase. Because of the inertness of the regenerated cellulose phase, it is not affected by the fusion and flow of the solid waterproofing material. Fiber articles, such as papers or felts, thus made are characterized by being doubly reinforced against being ruptured or disintegrated in the presence of water. Thus, should the phase of water-repellent material become cracked, abraded, or otherwise injured so as to permit water to enter into the article, the phase of regenerated cellulose, which is also water-insoluble and which is not so readily disrupted or broken as the first-named phase, lends sufficient reinforcement to the fiber article to keep it intact even under considerable stress and despite the entrance of water thereinto and/or the presence of water thereabout. The fact is, that papers made in accordance with our invention can be soaked in water for days and yet be preserved intact and of high strength.

Inasmuch as there are various ways of associating regenerated cellulose with fiber articles, the present application is intended to cover broadly the association of regenerated cellulose with fiber articles, followed by the impregnation of such articles with the aqueous media containing the dispersed, fusible waterproofing agents, irrespective of the cellulose derivative used as the source of the regenerated cellulose or of the formation of the regenerated cellulose in the bulk fiber or pulp from which the article is to be fabricated or in the already-fabricated fiber article. While it is possible to employ nitrocellulose or other cellulose derivatives and to regenerate cellulose therefrom by the use of suitable cellulose-regenerating agents, the most attractive cellulose derivative from the standpoint of both low cost and ease of regenerating cellulose therefrom is the xanthate. The xanthate in the form of an aqueous solution may be incorporated into the pulp from which the articles are to be formed, and then precipitated on the pulp fibers by the use of a suitable cellulose-regenerating agent, such as acetic acid, alum, or the like. Or the article may first be formed, then impregnated with a solution of viscose, and then treated with the cellulose-regenerating agent. It is of advantage, however, to proceed as described in patent applications Serial No. 494,185, filed November 7, 1930, by George A. Richter and Milton O. Schur (now Patent No. 1,856,114, dated May 3, 1932), and Serial No. 494,207, filed November 7, 1930, by Milton O. Schur (now Patent No. 1,880,286, dated October 4, 1932), as those procedures have been found to be economical and to lead to excellent results. According to the first-mentioned application, the cellulose-regenerating agent is applied to the article before it is treated with the viscose solution, as it has been found that the cellulose is regenerated as a more or less continuous phase throughout the fibrous structure. In the case of a paper, it is desirable to add a cellulose-regenerating agent, such as alum, to the paper stock in the beater engine, to the head-box of the paper machine, or to the web while it is in its course on the paper machine or after it has come off the paper machine, and to treat the paper containing the cellulose-regenerating agent with the viscose after it has come off the paper machine, as such a procedure avoids corrosion of the wire or cylinder mould of the paper machine by the sulphide impurities always present in viscose, as well as deterioration of the felts and drier cloth of the paper machine by the free alkali present in the viscose. According to the second-mentioned application, the alkali content of the viscose is largely or completely neutralized, whereupon it is applied to the pulp from which the fiber article is to be fabricated or to the fabricated fiber article, and the article then dried and/or heated to liberate regenerated cellulose. The volatile sulphur compounds resulting from neutralization of alkali in the viscose are preferably removed by aeration, as disclosed in the second-mentioned application before use of the viscose, thereby reducing the likelihood of ill-smelling compounds appearing in the fiber articles.

In applying the principles of the present invention, a waterleaf sheet of paper or web of pulp containing but a very small quantity of regenerated cellulose can be drawn through a bath of water-dispersed asphalt, waxes, resins, or

mixtures of such heat-fusible, solid water-proofing agents to produce a uniformly impregnated sheet which, when dried at elevated temperature, acquires high water-repellency on account of the fusion and coalescence of the dispersed particles. The impregnated sheet may be dried in any suitable way, for instance, as by passing over the usual steam-heated drier drums, which should be maintained at a temperature above the fusing point of the dispersed particles of waterproofing agent. A waterleaf web of fibers containing but a very small quantity of regenerated cellulose is transformed by impregnation with dispersed wax or the like and subsequent drying at elevated temperature into a product having many of the characteristics of parchment paper. Our novel papers have an important advantage over parchment papers in that they do not take up water as readily and are hence to be preferred for such uses as fabrication into bags or sacks, designed to hold wet or moist materials, such as coal.

The fibrous structure of the articles of the present invention is characterized by the individual fibers carrying thin coatings of regenerated cellulose which keep the fibers strongly bonded together, especially when the cellulose is regenerated as a more or less continuous phase. The regenerated cellulose, being present in small amount, for instance about 1% based on fiber, does not completely fill the pores of interstices in the fibrous structure, so that the article is still capable of taking up considerable quantities of dispersed waterproofing agent from the aqueous medium, for instance, considerably more dispersed waterproofing agent than its content of regenerated cellulose. The amount of waterproofing agent present in the final product will depend upon the density of the original web. In some instances, however, we may advantageously impregnate the fiber article with a mixture of viscose and dispersed, fusible waterproofing material, as hereinbefore indicated. For instance, as disclosed in our application Serial No. 631,497, filed Sept. 2, 1932 (now Patent No. 1,971,274, dated August 21, 1934), a paper may advantageously be impregnated with a composition comprising viscose and an aqueous paraffin wax emulsion. If desired, the mixed composition may contain another sizing agent, such as rosin size or other soap. The rosin size or other soap may, in fact, constitute the dispersing or stabilizing ingredient for the aqueous paraffin wax emulsion. The impregnated paper may be dried in the usual manner on steam-heated drier drums, which serve additionally to cause more or less fluxing and coalescence of the dispersed wax particles. The mixture of viscose and wax emulsion may, if desired, be added to the bulk papermaking stock in the beater engine and undergo precipitation and fixation on the fibers through the action thereupon of alum or equivalent acid salt or other acid reagent, before the stock is delivered to the papermaking machine. The mixed composition may, in fact, be applied to the stock at any suitable stage of papermaking, beginning with the bulk stock in the beater engine, or to a prefabricated paper sheet. Dispersions of fusible waterproofing material, including waxes other than paraffin, asphalt, and the like, may be similarly commingled with viscose and applied to paper at any suitable stage of its manufacture, or to a prefabricated paper sheet. There are instances when such a mixed composition may be used to advantage in fiber articles other than paper. For instance, fiber tubes are sometimes made my convoluting a wet web of paper or paper pulp on a mandrel until the desired wall thickness has been reached, removing the tube from the mandrel, and drying it at elevated temperature. The application of a mixture of viscose and water-dispersed asphalt or similar fusible waterproofing material might well be made to the fibrous web before it is convoluted into tubular form, whereupon the tube may be dried at a sufficiently elevated temperature to fuse the asphalt particles or similar waterproofing material. In such case, too, the aqueous dispersion of asphalt may be stabilized by soap, colloidal clay, or other hydrophilic colloids well known to those skilled in the art.

By the expression "impregnating with an aqueous medium containing a dispersed, heat-fusible, waterproofing agent" as used in the appended claims, we mean to include not only procedures which result in the agent being carried clear through the porous fiber article by the aqueous medium, but also procedures by which only partial or surface penetration of the article is accomplished or by which the aqueous medium is caused to pass through the article while the agent is deposited or filtered out on the surface as a coating with little penetration into the body of the article.

We claim:

1. A process which comprises introducing regenerated cellulose throughout a porous fiber article while substantially preserving its porosity, impregnating the article throughout with an aqueous dispersion of heat-fusible, solid waterproofing material, and drying the impregnated article at a sufficiently elevated temperature to fuse the dispersed particles of waterproofing material.

2. A process which comprises introducing regenerated cellulose throughout a waterleaf web of paper while substantially preserving its porosity, impregnating the paper throughout with an aqueous dispersion of heat-fusible, solid waterproofing material, drying the impregnated article, and fusing the dispersed particles of waterproofing material therein.

3. A process which comprises introducing regenerated cellulose throughout a porous fiber article while substantially preserving its porosity, submersing the article in a bath of water-dispersed, heat-fusible, solid waterproofing agent to impregnate said article with said dispersed particles, and drying the impregnated article at a sufficiently elevated temperature to fuse the dispersed particles.

4. A process which comprises introducing not more than about 1% regenerated cellulose throughout a waterleaf web of paper, thereby substantially preserving its porosity, submersing the paper in a bath of water-dispersed, heat-fusible, solid waterproofing agent to impregnate said paper with said dispersed particles, and drying the impregnated paper at a sufficiently elevated temperature to fuse the dispersed particles.

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