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GEORGE A. RICHTER AND MILTON O. SCHUR, OF BERLIN, NEW HAMPSHIRE, ASSIGNORS TO BROWN COMPANY, OF BERLIN, NEW HAMPSHIRE, A CORPORATION OF MAINE

MANUFACTURE OF FIBER ARTICLES CONTAINING REGENERATED CELLULOSE

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This invention relates to the manufacture of fiber articles which contain regenerated cellulose as an ingredient imparting desired properties thereto. Viscose is an attractive source of regenerated cellulose, as it is not only an inexpensive cellulose derivative syrup preparable from wood pulp, but undergoes ready decomposition with various cellulose-regenerating agents to form the solid, regenerated cellulose.

We have found that it is distinctly advantageous to impart the cellulose-regenerating agent to the fiber article and then to apply the viscose to the article containing the cellulose-regenerating agent, as the cellulose is regenerated under conditions leading to a degree of continuity in the regenerated cellulose phase. By imparting a cellulose-regenerating agent to the article, we mean to include applying the agent to the fibers while in bulk, dry form or while suspended in water as a pulp, as well as to the particular article fabricated from the dry fibers or from the aqueous pulp suspension. After the article has been treated with viscose to produce regenerated cellulose therein, it may be dried; and it may be desirable to effect a washing of the article before or after the drying operation to accomplish the removal of water-soluble side-reaction products. While the principles of our invention are applicable to a wide variety of fiber articles, including moulded or pressed pulp articles and fabrics, their application in the manufacture of papers containing regenerated cellulose is attended with marked benefits. It is of advantage to produce papers containing regenerated cellulose, particularly when they are to be used as towelling, for the presence of only a small quantity of regenerated cellulose in papers enormously increases their wet strength and hardly affects their absorbency. The manufacture of paper towelling of this kind is disclosed in U. S. Patent No. 1,745,557, issued February 4, 1930, to George A. Richter, Milton O. Schur and Royal H. Rasch.

There are several factors to be considered in the manufacture of papers containing regenerated cellulose. If the viscose is added to the paper stock in the beaters, a closed-white-water cycle must be used; else the loss of viscose in the white water leaving the cycle is excessive. In order to realize a closed-cycle, it is necessary to use comparatively large filters or settling basins to obtain sufficient clear water from the white water to feed the showers which clean the wire and the felts of the paper machine. Again, the sulphide impurities always present in the viscose cause serious corrosion of the Fourdrinier or cylinder machine and the free alkali content of the viscose gives rise to rapid deterioration of the expensive felts and drier clothing of the paper machine. If it be attempted to avoid these difficulties by precipitating the regenerated cellulose on the paper stock in the beaters, it is found that the results obtained are inferior to those obtained when the cellulose is regenerated as a more or less continuous phase in the paper.

In accordance with the present invention, the cellulose-regenerating agent may be incorporated into the stock, or while the paper is in the course of manufacture, or after the sheet has been fully made, whereas the viscose is applied after the sheet is fully made and has already incorporated therein the cellulose-regenerating agent. For instance, a cellulose-regenerating agent, such as alum, may be added in the beater, at the head-box, before the first press-roll, between the press-rolls, along the drier, or to the dry sheet; and the viscose may be added to the fully fabricated sheet containing the alum to produce regenerated cellulose in the desired condition in the sheet. By adding a cellulose-regenerating agent before the viscose as above described, not only are eminently satisfactory results obtained, but corrosion of the wire or cylinder moulds is avoided, as is also rotting of the felts and drier clothing of the paper machine. An important advantage of our process is that it lends itself nicely to high-speed production on a paper machine, which, when already provided with a sizing tub and an auxiliary bank of driers, requires no additional expensive equipment.

We may cite the following procedure falling within the purview of the present invention, as an example which has been found to

give excellent results in actual practice on a Fourdrinier paper machine running at about 500 feet per minute and equipped with a sizing tub and an auxiliary bank of driers. A solution of alum of ¾% strength was sprayed on a waterleaf paper web between the dandy roll and the first press, whereupon the web was permitted to proceed through the machine as usual. The continuous sheet of paper coming from the dry end of the machine was then passed through the sizing tub so as to dip into a viscose solution containing ¾% cellulose combined as xanthate, which was circulated through the tub. The sheet issuing from the bath of viscose was passed between squeeze rolls to remove excess viscose, and thence over the auxiliary bank of driers to evaporate its aqueous content. The dry sheet was found to contain about 0.9% to 1% regenerated cellulose, which increased its wet strength six to ten-fold and with but very little change in its absorbency. The regenerated cellulose is believed to exist in the waterleaf paper sheet as a more or less continuous medium, which coats the fibers without plugging the pores between them.

While the example given may be deviated from without departing from our invention, there are features of advantage in adding a water-soluble, cellulose-regenerating agent, such as alum, to the paper stock or fiber web before the drying operation has been completed, and applying the viscose to the dried web, for the viscose penetrates easily into the pores of the dry web without displacing the regenerating agent therefrom. The alum dissolves in the viscose solution in the pores of the web and under the influence of the heat of the drier rolls regenerates the cellulose. When the drying of the web is accomplished before the application of the viscose, as is preferably the case, it is essential that the cellulose-regenerating agent be one which does not volatilize under the temperature conditions of drying. Alum answers these requirements, as do other water-soluble salts or acid salts which are well known in the art as being capable of regenerating cellulose from viscose. The spraying of the solution of the cellulose-regenerating agent onto the wet, nascent web of fibers is a simple, convenient, and inexpensive mode of accomplishing a uniform incorporation of the agent throughout the sheet, as a waterleaf web permits substantially instantaneous diffusion of the solution therethroughout, especially if the solution is added above a suction box.

We claim:

1. In the manufacture of fiber articles containing regenerated cellulose, those steps which comprise first imparting a cellulose-regenerating agent to the article and then treating the article with viscose.

2. In the manufacture of fiber articles containing regenerated cellulose, those steps which comprise first imparting a cellulose-regenerating agent to the article, then treating the article with viscose, and drying.

3. In the manufacture of fiber articles containing regenerated cellulose, those steps which comprise first imparting a cellulose-regenerating agent to the article, then treating the article with viscose, washing, and drying.

4. In the manufacture of paper containing regenerated cellulose, those steps which comprise first imparting to the paper a cellulose-regenerating agent, and then treating the paper with viscose.

5. In the manufacture of paper containing regenerated cellulose on a paper machine equipped with a dry end, those steps which comprise incorporating a cellulose-regenerating agent into the paper stock before it leaves the dry end of the machine, then treating the dry paper with viscose, and again drying.

6. In the manufacture of paper containing regenerated cellulose on a paper machine equipped with elevated temperature drying means, those steps which comprise incorporating into the paper an aqueous solution of a non-volatile cellulose-regenerating agent before the paper leaves the drying means, then treating the dry paper with viscose, and again drying the paper.

7. In the manufacture of paper containing regenerated cellulose on a paper machine equipped with a dry end, those steps which comprise adding a solution of a cellulose-regenerating agent to the paper stock before it leaves the dry end of the machine, passing the continuous sheet of paper leaving the dry end of the machine through a bath of viscose, and drying the sheet.

8. In the manufacture of paper containing regenerated cellulose on a paper machine equipped with a dry end, those steps which comprise spraying an aqueous solution of a cellulose-regenerating agent on the nascent, wet web of fibers, treating the continuous sheet of paper leaving the dry end of the machine with viscose, and drying the sheet.

9. In the manufacture of paper containing regenerated cellulose on a paper machine equipped with a high-temperature dry end, those steps which comprise spraying an aqueous solution of alum on the web of fibers while still wet, passing the continuous sheet of paper leaving the dry end of the machine through a bath of viscose, and drying the sheet.

In testimony whereof we have affixed our signatures.

GEORGE A. RICHTER.
MILTON O. SCHUR.