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TREATMENT OF FIBROUS MATERIAL

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Difficulties are associated with the use of viscose or cellulose solutions as an agent for dressing woven textile materials or sizing yarn, on account of the fact that the fabric or yarn which has been thus treated acquires a stiff, paper-like and cold feel, and moreover its extensibility is rather low. Fabrics which have been dressed by means of viscose have also the disadvantage that the cellulose regenerated from the viscose applied to the fabric frequently undergoes rupture when the material is stretched or pulled, owing to the difference between the coefficients of extensibility of the fabric and the coating, the result being that the coating exhibits numerous minute, or more or less coarse cracks. Even in textile printing, particularly in pigment printing with viscose, these defects are apparent to an undesirable degree, and the viscose layers printed on the textile have a stiff feel, and in many cases become torn on being stretched, especially when they are not very thin.

This invention relates to a process for treating textile fibrous material (whether in the form of woven fabrics or of yarn) by dressing, sizing, printing, weighting or the like, by means of cellulose in dissolved form (for example viscose or a solution of cellulose in cuprammonia) from which cellulose can be regenerated or precipitated respectively, whereby the foregoing disadvantages are minimized or remedied.

The invention consists in the application of the discovery that the properties of the dressing, sizing, printed layers or the like, which consist of, or contain cellulose regenerated from soluble derivatives of cellulose, for example from viscose or precipitated from a cellulose solution, for example in cuprammonia, which has been applied to the fibrous material are improved, especially in respect of feel and extensibility, if the dressing, sizing or coating contains hollow spaces or bubbles dispersed throughout it, or throughout at least a part of it. These hollows or small bubbles may be produced by dressing, sizing, or otherwise treating the material with a solution of a soluble modification of cellulose, for example viscose or

with a solution of cellulose, containing a quantity of a gas or of a substance capable of being caused to evolve a gas by a suitable treatment or containing both a gas and a substance capable of being caused to evolve a gas. Thus textile fabrics or yarns which have been dressed, sized or otherwise treated by means of viscose or a cellulose solution in accordance with the invention have a soft feel, even when the quantity of the dressing or the like is considerable. The dressing is much lighter, and more downy, and therefore resembles the natural fibre more closely than do the dressings produced in the usual manner from viscose or cellulose solution which is free from gas, or contains but little gas. Fabrics or yarns treated in accordance with the invention have also a warm feel, and owing to the hollows in the dressing sizing or the like, it is possible to produce even with small proportions of viscose or cellulose solution a very full, rich dressing or sizing. Material treated in accordance with the invention has a good capacity for extension, and fissures or cracks do not occur when the material is pulled or stretched.

The hollow spaces may contain the gas, for example air or carbon dioxide, or the gas may be removed, wholly or in part, from them, for example, by dissolution, or with the aid of an increased or reduced pressure.

In treating fibrous material in accordance with this invention a gas, for example air, hydrogen or nitrogen, may be emulsified in a solution of a soluble modification of cellulose, for example in crude or purified viscose or in a solution of cellulose, for example in cuprammonia, by known methods, such as by injection, blowing, beating, agitation or the like; or the gas may be dissolved in the viscose or other solution with the aid of pressure.

Another method of operating consists in incorporating with the viscose or solution of cellulose a substance, for example an alkali carbonate, an alkali sulphide or an alkali sulphite, which is capable of evolving a gas during the treatment for decomposing the viscose or precipitating the cellulose with an agent suitable for the regeneration of pre-

precipitation of the viscose respectively. The substance capable of evolving a gas must be present in sufficient concentration or amount as to yield enough gas to at least form fine bubbles or free gas in the viscose or cellulose solution. The viscose or cellulose solution containing a gas, or a substance capable of yielding a gas, or both a gas and a substance capable of yielding a gas, is then applied to or incorporated with a fabric or yarn, by hand or by means of a suitable machine. In order to cause the viscose or cellulose solution to penetrate more deeply into the fibre, this operation may, if desired, be conducted under reduced pressure, or under a raised pressure. There may be added to the viscose or cellulose solution another coating or sizing agent, for instance starch, dextrin, albumen or gelatine; a softening agent, for instance, glycerine, soap, Turkey-red oil, glucose, castor oil, or paraffin oil; a filling material, for instance, talc or china clay; a pigment, for instance, zinc white, soot, or powdered mica; or a dyestuff, or any two or more of these substances.

The cellulose may be regenerated from the viscose or precipitated from the cellulose solution in any known manner, by a suitable precipitating bath, or by other means, for instance, by heating, steaming, or merely by allowing the treated material to stand.

If it is desired to expel the gas, for example air, contained in the hollows in order to permit the walls of the hollows to collapse, the gas may be removed for example by boiling with water, or by treatment with water under pressure. If the gas contained in the spaces is carbon dioxide, it may be dissolved partly in the precipitating bath, and partly during the subsequent washing operation.

The following examples illustrate some methods by which the invention may be carried into effect, the parts being by weight:—

Example 1.—Air is injected into a viscose, made in any desired manner from matured or non-matured alkali-cellulose containing about 5–7 per cent of cellulose on analysis, so as to produce an emulsion. A cotton fabric is dressed in known manner in a back-filling machine with the emulsion so produced, and the dressed material is treated in the wet state or after drying, to cause reversion of the viscose to cellulose by any precipitating bath known in the viscose art, or by steaming, for example, for 3–15 minutes at 105–115° C. The material is then washed, dried and finished in the usual manner. If desired the washed and dried fabric may be steamed, for example, for 3–15 minutes at 105–115° C.

Example 2.—The procedure is as in Example 1, but with the exception that talc is added to the viscose in quantity amounting to about 1–3 parts for each part of cellulose as determined by analysis.

Example 3.—100 parts of sulphite-cellulose

containing 9–10 per cent of moisture, or 100 parts of linters containing 7–8 per cent of moisture are impregnated at 15° C. with 2,000 parts of a solution of caustic soda of 18 per cent strength. After 3 hours, the soda cellulose is expressed until its total weight is 300 parts in the case of sulphite-cellulose or 340 parts in the case of linters, and comminuted in a shredding machine for 2½ to 3 hours. Before the soda cellulose has undergone any maturing, 40–60 parts of carbon-disulphide are added, and the mixture is allowed to react for 8 hours at 15–18° C.; at the end of this period any excess of carbon-disulphide which may be present is removed by blowing through a current of air for about 15 minutes, and the cellulose xanthate obtained is dissolved with the aid of a quantity of water, caustic soda and sodium carbonate, such that the solution produced contains about 1,220 parts of water, about 107 parts of caustic soda and about 150 parts of sodium carbonate (reckoned as the anhydrous salt).

A suitable cotton fabric is dressed one or more times in a back-filling machine with the viscose produced in the manner just described, after it has been filtered or strained, and in the freshly prepared state, or after it has aged for 48–96 hours at 15° C. The dressed material is then immediately or after having been dried, introduced into sulphuric acid of 10 per cent strength or into any other acid precipitating bath known in the viscose industry, after which it is washed and dried. If desired, the dried fabric may be steamed, for example, for 3–15 minutes at 105–115° C. It will be understood that the material may be desulphurized or bleached in any known manner (for example by means of a solution of sodium sulphide) before or after it has been dried.

Example 4.—The procedure is as in Example 3, with the exception that the alkali cellulose is allowed to stand for a period of 48–70 hours at room temperature before being treated with carbon disulphide.

Example 5.—The procedure is as in Example 3 or Example 4, with the exception that talc is added to the viscose, for example, from 100 to 300 parts of the talc per 100 parts of cellulose.

Example 6.—The procedure is as in Example 1, Example 2, Example 3, Example 4, or Example 5, with the exception that there is added to the viscose about 1–2 per cent of its weight of paraffin oil or castor oil.

Example 7.—The procedure is as in any of the Examples 3–6, with the exception that the viscose has approximately the composition: 100 parts of parent cellulose, 1,260 parts of water, 67 parts of caustic soda, and 150 parts of sodium carbonate (reckoned as the anhydrous salt).

Example 8.—The procedure is as in any of the Examples 3–6, with the exception that

the viscose has approximately the composition: 100 parts of parent cellulose 1,285 parts of water, 43 parts of caustic soda and 150 parts of sodium carbonate (reckoned as anhydrous salt).

The viscose as used in any of Examples 3-8 contains about 6.5 to 6.7 per cent of cellulose which can be determined by analysis, sodium carbonate being neglected. There may, however, be used a viscose containing a smaller proportion of cellulose, for example, 4-5 per cent.

Example 9.—The procedure is as in any of the Examples 3-6, with the difference that the viscose has approximately the composition: 100 parts of parent cellulose, 1090 to 1,130 parts of water, 240 to 200 parts of caustic soda and 125 to 100 parts of sodium carbonate (reckoned as anhydrous salt).

Example 10.—100 parts of a viscose containing sodium carbonate as used in any of Examples 3-9 are intimately mixed with 5-8 parts of mica or with 10-15 parts of zinc white or 3 to 5 parts of soot. A cotton material is then printed with this mixture in a Rouleaux machine. The further treatment and finishing are conducted in the manner described in the preceding examples.

In the preceding Examples 3-10, after having been coated or impregnated or printed, before washing, the fabric in the wet or dried state, may be steamed, for instance for 3-15 minutes at 105-115° C. and thereafter treated with the acid bath as in Example 3, washed and dried.

Examples for sizing yarn follow from the foregoing examples.

In carrying out the invention, instead of viscose, there may be used a solution of cellulose from which cellulose may be precipitated, for example a solution of cellulose in a thiocyanate solution such as calcium thiocyanate solution, a solution of cellulose in ammoniacal copper oxide solution, a solution of cellulose in an aqueous solution of a caustic alkali containing urea, thiourea or guanidine.

It is to be understood that in the following claims the terms "dressing the fibrous material" includes any manner of application to the fibrous material, whether by manual or mechanical means customary for dressing, sizing, filling, impregnating, coating, weighting or printing a fibrous material, whether in the state of woven fabrics, or in the state of yarn.

The expression "textile fibrous material" in the specification and claims includes, wherever the context permits, any spun or woven fibrous material, whether animal or vegetable (for example, flax, linen, hemp, ramie, jute, wool and particularly cotton) in the form of pure fabrics, or in the form of mixed fabrics, or in the form of yarn in skeins, cops or warps.

The expression "cellulose" means in the description and claims: cellulose and its near conversion products, such as cellulose hydrate, hydrocellulose and oxycellulose.

The present application is a continuation in part of my copending application Serial Number 208,402 filed July 25, 1927, in which application I have claimed products produced by the processes described and claimed herein. In a copending application Serial No. 393,828 I have claimed the process herein described, of dissolving, dispersing or emulsifying the gas in the viscose solution, some of the claims of said application also being generic to that process and the process herein claimed.

Having described my invention what I claim is:

1. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose and containing a substance capable of evolving a gas, and thereafter treating the combination of textile fibrous material and solution to produce cellulose containing hollows from the latter.

2. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose and containing dispersed therein a substance capable of evolving a gas, and thereafter treating the solution dressed on the textile fibrous material to produce cellulose and to evolve gas whereby voids are formed in the cellulose produced.

3. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose and which solution contains a substance capable of evolving a gas, thereafter treating the solution dressed on the textile fibrous material with an agent to produce cellulose and to evolve gas whereby voids are formed in the cellulose produced, the said gas evolving substance and said agent being present in such an amount that sufficient quantities of free gas bubbles are liberated to form said voids.

4. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose by treatment with an acid, and which solution contains a carbonate, and thereafter treating with an acid the combination of textile fibrous material and solution.

5. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose and containing an alkali carbonate in sufficient amount to yield gaseous carbon dioxide upon treatment with acid and thereafter treating with an acid the combination of textile fibrous material and solution.

6. A treatment of textile fibrous material which comprises dressing the textile fibrous

material with an agent comprising viscose and sufficient of a substance capable of evolving a gas that free gas may be evolved from said substance, and thereafter treating the combination of textile fibrous material and agent to cause regeneration of cellulose from the viscose and to cause evolution of the free gas from the aforesaid substance.

7. A treatment of textile fibrous material which comprises dressing the textile fibrous material with an agent comprising viscose and a carbonate, and thereafter treating with an acid the combination of textile fibrous material and agent, the said carbonate and acid being present in sufficient amount to produce small bubbles of free gas in the cellulose regenerated by the said acid.

8. A treatment of textile fibrous material which comprises dressing the textile fibrous material with an agent comprising viscose and an alkali carbonate, and thereafter treating with an acid the combination of textile fibrous material and agent, the said alkali carbonate and acid being present in sufficient amount to produce small bubbles of gas in the regenerated cellulose.

9. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose and containing a substance capable of evolving a gas, thereafter treating the combination of textile fibrous material and solution to produce cellulose from the latter and to cause evolution of gas from the aforesaid substance also contained therein, the said substance being present in sufficient amount to produce small hollows in said cellulose, and treating the combination of textile fibrous material and cellulose so produced to remove gas at least in part from the hollows contained in the said combination.

10. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose by treatment with an acid, said solution containing a carbonate, thereafter treating with an acid the combination of textile fibrous material and solution, the said carbonate being present in sufficient amount to form bubbles of carbon dioxide in the cellulose freed by said acid, and treating the combination of textile fibrous material and insoluble product so produced to remove gas at least in part from the bubbles contained in the said combination.

11. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose by treatment with an acid, said solution containing an alkali carbonate, thereafter treating with an acid the combination of textile fibrous material and solution, the said alkali carbonate being present in sufficient amount to evolve carbon dioxide as a gas, and treating the combination of textile

fibrous material and cellulose so produced to remove gas at least in part from the hollows formed by said evolved carbon dioxide in the said combination.

12. A treatment of textile fibrous material which comprises dressing the textile fibrous material with an agent comprising viscose and a substance capable of evolving a gas, thereafter treating the combination of textile fibrous material and agent to cause regeneration of cellulose from the viscose and to cause evolution of a gas from the aforesaid substance, the said substance being present in sufficient amount to produce gas containing hollows in the regenerated cellulose, and treating the combination of textile fibrous material and regenerated cellulose so produced to remove gas at least in part from the hollows contained in the said combination.

13. A treatment of textile fibrous material which comprises dressing the textile fibrous material with an agent comprising viscose and a carbonate, thereafter treating with an acid the combination of textile fibrous material and agent, the said carbonate and acid being present in sufficient amount to form gas containing hollows in the cellulose regenerated by said acid, and treating the combination of textile fibrous material and regenerated cellulose so produced to remove gas at least in part from the hollows contained in the said combination.

14. A treatment of textile fibrous material which comprises dressing the textile fibrous material with an agent comprising viscose and an alkali carbonate, thereafter treating with an acid the combination of textile fibrous material and agent, the said alkali carbonate and acid being present in sufficient amount to form gas containing hollows in the cellulose regenerated by said acid, and treating the combination of textile fibrous material and regenerated cellulose so produced to remove gas at least in part from the hollows contained in the said combination.

15. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose and containing a substance capable of evolving a gas, thereafter treating the combination of textile fibrous material and solution to produce cellulose from the latter and to cause evolution of gas from the aforesaid substance also contained therein, the said substance being present in sufficient amount to form gas containing hollows in said cellulose, and treating the combination of textile fibrous material and cellulose so produced with a solvent for the said gas to remove gas at least in part from the hollows contained in the said combination.

16. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding

cellulose by treatment with an acid and containing a carbonate, thereafter treating with an acid the combination of textile fibrous material and solution, the said carbonate being present in sufficient amount to form carbon dioxide containing hollows in the cellulose liberated by said acid, and finally treating the combination of textile fibrous material and cellulose so produced with a solvent for carbon dioxide to remove gas at least in part from the hollows contained in the said combination.

lose regenerated by said acid, and treating the combination of textile fibrous material and regenerated cellulose so produced with a solvent for carbon dioxide to remove gas at least in part from the hollows contained in the said combination. 70

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17. A treatment of textile fibrous material which comprises dressing the textile fibrous material with a solution capable of yielding cellulose by treatment with an acid, said solution containing an alkali carbonate, thereafter treating with an acid the combination of textile fibrous material and solution, the said carbonate and acid being present in sufficient amount to produce carbon dioxide containing hollows in the cellulose liberated by the said acid, and treating the combination of textile fibrous material and cellulose so produced with a solvent for carbon dioxide to remove gas at least in part from the hollows contained in the said combination.

18. A treatment of textile fibrous material which comprises dressing the textile fibrous material with an agent comprising viscose and a substance capable of evolving a gas, thereafter treating the combination of textile fibrous material and agent to cause regeneration of cellulose from the viscose and to cause evolution of gas from the aforesaid substance, the said substance being present in sufficient amount to form gas containing hollows in the regenerated cellulose, and treating the combination of textile fibrous material and regenerated cellulose so produced with a solvent for the said gas to remove gas at least in part from the hollows contained in the said combination.

19. A treatment of textile fibrous material which comprises dressing the textile fibrous material with an agent comprising viscose and a carbonate, thereafter treating with an acid the combination of textile fibrous material and agent, the said carbonate and acid being present in sufficient amount to form gas containing hollows in the cellulose regenerated by said acid, and treating the combination of textile fibrous material and regenerated cellulose so produced with a solvent for carbon dioxide to remove gas at least in part from the hollows contained in the said combination.

20. A treatment of textile fibrous material which comprises dressing the textile fibrous material with an agent comprising viscose and an alkali carbonate, thereafter treating with an acid the combination of textile fibrous material and agent, the said alkali carbonate acid being present in sufficient amount to form gas containing hollows in the cellulose regenerated by said acid, and treating the combination of textile fibrous material and regenerated cellulose so produced with a solvent for carbon dioxide to remove gas at least in part from the hollows contained in the said combination.

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