Patented Nov. 9, 1937 2,098,775

UNITED STATES PATENT OFFICE

2,098,775

METHOD OF TREATING CELLULOSIC MATERIALS

Denis de Goencz and Edmund C. Tarnuzzer, North Adams, Mass., assignors to Arnold Print Works, North Adams, Mass., a corporation of Massachusetts

No Drawing. Application December 9, 1933, Serial No. 701,730

8 Claims. (Cl. 8—20)

Our invention relates in general to the processing of materials composed of or containing cellulosic fibers such as cotton, jute, linen, ramie and wood. The materials to which the process may be most advantageously applied are woven fabrics, such as for example cotton cloth, and more particularly those of rather light weight, but the invention is not limited to the treatment of this particular kind of goods.

The treatment, according to our present invention, includes the preliminary application of an inactive cellulose solvent to the goods, and the subsequent treatment of the goods containing such solvent with an activating agent which enables the solvent to perform its function of modifying the character of the goods. Normally inactive cellulose solvents, capable of being activated in the manner contemplated by our present invention, are in general the cuprammonium salts such as obtained by dissolving a cupric or cuprous salt in an excess of strong ammonia water. Cuprammonium sulphate, obtained by the action of strong ammonia water upon copper sulphate, is typical of this class of solvents. Other salts which may be employed and which may be produced in an analogous manner are obtained from the action of strong ammonia water upon a chloride, nitrate, cyanide, chlorate, bichromate, formate, acetate, oxalate or citrate of copper. These and similar salts are therefore to be understood as normally inactive cellulose solvents for the purpose of the present invention.

The activating agent may be an aqueous solution of alkali metal hydroxide, of which caustic soda solution is in most respects the most suitable to use.

The effects produced upon the goods in accordance with the present invention are quite different from those which occur in the known process of applying an activating agent to the goods and then passing the goods containing such activating agent through an inactive cellulose solvent bath, such as obtained by dissolving copper sulphate in an excess of strong ammonia water. The new effects are somewhat more noticeable in lighter weight fabrics than in heavier goods, the "hand" or the feel of the treated fabric becoming wirier and stiffer with a peculiar springiness or elasticity which withstands wear and washing. The individual threads become semi-translucent, which renders the fabric transparent to a remarkable degree. Regularity of the warp and filling threads, as well as freedom from any unevenness due to weaving imperfections, which would show up before the treatment, are quite marked in the finished goods.

The effects above described are obtained to a fairly satisfactory degree by the use of the normally inactive cellulose solvent and the activating agent at ordinary room temperatures, but a particularly important embodiment of the invention comprises the cooling of the activating agent to temperatures which may be varied from room temperature to approximately 32° F., such cooling of the activating agent resulting in a considerable enhancement or increase in the effect. With reference to the cooling of the activating agent, it is to be noted that the reaction between the cuprammonium salts and the hydroxides of alkali metals is exothermic in nature, so that the continuous movement of a fabric containing the cuprammonium salt through a bath containing the hydroxide of an alkali metal would tend to raise the temperature of the alkali metal hydroxide bath and increase the loss of ammonia from the cuprammonium salt solution carried by the fabric. The cooling of this bath and the maintenance of temperatures below room temperature reduces the tendency of the ammonia to be driven off.

For the purposes of clearly illustrating the principles of the invention, we may refer to the treatment of thin cotton goods with inactive cuprammonium sulphate solution and caustic soda solution. For the production of the cuprammonium salt solution we may dissolve, for example, 45 pounds of crystallized copper sulphate in 10 gallons of water, and slowly mix 8 gallons of 29% commercial aqua ammonia into the solution to make 25 gallons of copper ammonia salt solution. The caustic soda solution may be made, for example, to 50° Twaddell, corresponding to about 29° Bé. at room temperature. The caustic soda solution is cooled by immersed cooling coils, or other approved means, to a temperature of, for example, 38° F. The cuprammonium salt solution may be operated at room temperature. The cloth is fed under slight tension from a roll, preferably pretentered to finished width, and passes

through the cuprammonium salt solution. In passing through the cuprammonium salt solution, the cloth may be immersed and withdrawn several times, but two dips, followed by a very slight squeeze between two rubber rolls, have been found sufficient. The cloth thus padded or saturated with cuprammonium salt solution then passes through the caustic soda solution. In the caustic soda solution, the cloth may dip several times, but twice is sufficient, and the cloth is thereafter squeezed out between pressure rolls, after which it passes on to the usual lateral stretching and tentering frame and from there into the souring and washing boxes or tanks.

The strength of the caustic soda solution may vary from about 15° Twaddell up to mercerizing strength of 54° Twaddell and over. The effect is the same in its nature, but the action increases in proportion to the strength of the caustic solution and inversely with the temperature.

The particular strength of the cuprammonium solution in the above example is not critical, but may be taken as typical of good and satisfactory commercial operation. Inactive cellulose solvent solutions, employing any of the other copper salts previously referred to, may be made up in an analogous manner to have equivalent copper content though, as stated, the particular strength of solution is not at all critical.

In the above example reference has been made to the padding of the goods with the cuprammonium solution, and the subsequent immersion of the goods in the caustic soda solution. The speed of travel of the cloth may be such as to represent, for example, 3 to 8 seconds' treatment in each of the solvent and solvent-activating baths. It is desirable to promptly deliver the padded cloth into the caustic soda bath to minimize the escape of ammonia after the initial padding.

Instead of applying the inactive solvent to the goods and treating the padded goods in the manner described, we may apply these reagents to the goods in other ways, as by spraying, transfer rolls, and the like. The effect upon the goods is indeed such that it offers particular advantages as a printing process, and may be employed to produce designs and figures due to the marked difference in appearance between the treated and untreated portions of the goods. For this purpose the goods may, for example, first be printed with a plain or colored resist and then subjected to the cuprammonium salt bath and caustic alkali bath. A still further important feature of the action of the cuprammonium salt solution and the caustic alkali solution upon the goods is the marked effect which it has on the action of dyes and printing pastes applied to the treated goods. After the treated goods have been soured and washed, subsequent dyeing or over-printing produces deeper shades on the treated parts than on untreated parts of the goods. Thus a great variety of effects can be obtained by the use of the treatment in conjunction with various types of printing and dyeing operations. Quite complex effects may be obtained, for instance, by printing the cloth with a resist or resists, either white or colored, and in the same operation applying suitable color or colors in a fitted pattern, after which the goods are run through the cuprammonium salt and caustic soda treatments described. The effects can be varied by placing the resist roller ahead of or after the other pattern rollers, or out of register, so that the color pattern is printed partly over the resist and hence washes out more or less to produce half-tone effects during the subsequent cuprammonium salt and caustic soda treatment. Any print color can be used for printing before the cuprammonium salt and caustic soda treatments, provided the color be fairly fast to caustic and copper solutions of such concentrations as mentioned, and also fast to such acid as encountered in the subsequent souring. The resist employed in any of the operations described may be selected at the discretion of the operator, egg albumen, casein and cellulose acetate being suitable examples.

We claim:—

1. A method of treating cellulosic material which comprises applying to the material a normally inactive cellulose solvent composed essentially of a cuprammonium salt in aqueous ammonia and thereafter treating the material containing such solvent with a solvent activating agent.

2. A method of treating cellulosic material which comprises applying to the material a normally inactive cellulose solvent composed essentially of a cuprammonium salt in aqueous ammonia and thereafter treating the material containing such solvent with a solvent activating agent at a temperature below room temperature.

3. A method of treating cellulosic material which comprises applying to the material a solution composed essentially of aqueous ammonia and cuprammonium sulphate and thereafter treating the fabric containing such solution with an alkali metal hydroxide solution at a temperature below room temperature, said first-mentioned solution normally incapable of dissolving cellulose but acquiring cellulose solvent properties in the presence of the alkali metal hydroxide.

4. A method of treating cellulosic material which comprises applying to the material a solution composed essentially of aqueous ammonia and cuprammonium sulphate and thereafter treating the fabric containing such solution with an alkali metal hydroxide solution at a temperature in the neighborhood of 38° F., said first-mentioned solution normally incapable of dissolving cellulose but acquiring cellulose solvent properties in the presence of the alkali metal hydroxide.

5. A method of processing woven fabrics of cellulosic material which comprises printing a resist and a color in matched patterns upon the fabric, thereafter applying to the resisted and color printed fabric a normally inactive cellulose solvent composed essentially of a solution of cuprammonium salt and aqueous ammonia, thereafter treating the fabric containing such solvent with a solvent activating agent, and subsequently souring and washing.

6. A method of treating cellulosic material which comprises applying to the material a solution normally incapable of dissolving cellulose and composed essentially of a cuprammonium salt and aqueous ammonia and thereafter treating the material containing the salt with an alkali metal hydroxide, to render the solution active as a cellulose solvent.

7. A method of treating cellulosic material which comprises applying to the material a solution normally incapable of dissolving cellulose and composed essentially of a cuprammonium salt and aqueous ammonia and thereafter treating the material containing the salt with an alkali metal hydroxide at a temperature below room temperature, to render the solution active as a cellulose solvent.

8. A method of processing woven fabrics of cellulosic material which comprises applying to the goods a solution composed essentially of a cuprammonium salt and aqueous ammonia, incapable of dissolving cellulose when not activated by alkali metal hydroxide, then applying to the solution remaining in the goods an alkali metal hydroxide to activate the solution, the action of the activated solution upon the goods being confined to limited areas to create a pattern or design, souring and washing the goods, and thereafter dyeing or over-printing with a dye.

DENIS DE GOENCZ.
EDMUND C. TARNUZZER.