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FLAMEPROOFING TEXTILE MATERIALS

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This invention relates to the treatment of textile materials and relates more particularly to processes for the treatment of textile materials containing cellulose acetate or other organic derivative of cellulose to render said materials flameproof.

An object of this invention is to provide a novel process for rendering cellulose acetate or other organic derivative of cellulose textile materials flameproof.

Another object of this invention is to provide a novel process for rendering cellulose acetate or other organic derivative of cellulose textile materials flameproof without imparting a harsh hand to the materials.

A further object of this invention is the preparation of flameproofed textile materials having a basis of cellulose acetate or other organic derivative of cellulose.

Other objects of this invention will appear from the following detailed description.

Various treatments have been provided for rendering textile materials having a basis of cotton, or other non-thermoplastic material, flameproof. These processes comprise depositing certain inorganic salts on the non-thermoplastic material, which materials substantially raise the ignition temperature of the latter. While these processes yield satisfactory results on non-thermoplastic materials, they are without any appreciable utility whatever when applied to textile materials made of or containing cellulose acetate or other organic derivative of cellulose. Since the latter materials are thermoplastic, they tend to melt away from the flameproofing agents deposited on the thermoplastic material and the molten material, free of the flameproofing agent, ignites as it falls away. The flaming drops of molten cellulose acetate coming in contact with other inflammable materials, will, of course, cause the latter to ignite. Accordingly, processes specifically adapted for rendering cellulose acetate materials flameproof must be employed.

We have now discovered that cellulose acetate or other organic derivative of cellulose textile materials in the form of yarns, fabrics, staple fiber, etc. may be rendered flameproof if said materials are treated with a solution of thiourea in a suitable solvent medium, and the solvent medium is removed. When the solvent medium is removed, as by any convenient drying process, the thiourea is deposited upon the cellulose acetate material and imparts a very satisfactory degree of flameproofing thereto without disadvantageously affecting the hand or draping qualities of the material. While we do not wish to be

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bound by any theoretical considerations, it appears that the thiourea lowers the viscosity of molten cellulose acetate material to the extent that when cellulose acetate material, treated with thiourea in the above manner, comes in contact with an open flame of a sufficiently high temperature to melt the cellulose acetate, the molten cellulose acetate drips away from the flame so rapidly that the flame is unable to raise the molten cellulose acetate to its ignition temperature.

Other agents may be employed in conjunction with thiourea to improve the characteristics of the flameproofed material. Such other agents may be ammonium salts as, for example, ammonium bromide, ammonium chloride, ammonium borate and diammonium phosphate. When these ammonium salts are employed, we have found that an excellent hand may be imparted to the cellulose acetate fabrics if an alkyl substituted diammonium phosphate is also present in the solution employed for treating the fabric. Examples of suitable diammonium alkyl phosphates are diammonium methyl phosphate, diammonium ethyl phosphate, diammonium amyl phosphate and diammonium octyl phosphate.

The concentration of the solution may vary depending, of course, upon the amount of the agent desired on the flameproofed textile material. Solutions containing thiourea in amounts of from 5 to 20% by weight, and preferably from 10 to 12%, are satisfactory for treating the cellulose acetate materials. Where ammonium salts are employed in conjunction with the thiourea, they may be present in amounts of from 2 to 20% by weight, while the diammonium alkyl phosphates yield effective results when employed in the solution in amounts of from 5 to 20%.

As solvents for the thiourea, we may employ aqueous or aqueous-alcoholic solutions. When ethyl alcohol is employed as the solvent in the form of an aqueous solution, it may comprise from 10 to 60% by weight of the solvent.

The quantity of the flameproofing agent or agents applied to the textile material may vary depending upon the textile material being treated and the degree of flameproofing desired. We have found that satisfactory results are obtained when the weight of the textile is increased from about 10 to 15% by treatment with aqueous or aqueous-alcoholic solutions of thiourea. Where ammonium salts alone or together with a diammonium alkyl phosphate are employed in addition to the thiourea, a desirable degree of flameproofing may be effected when the weight of the textile materials is increased from about 10 to 25% by our novel treatment. To attain the de-

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sired weight increase, the flameproofing solution may be applied to the textile materials by a padding or immersion treatment and the treatment may be carried out one or more times to effect the desired weight increase.

After treatment, the textile materials may be dried in any convenient manner. In the case of fabrics, a hot tower or a tenter frame is preferably employed for drying.

In order further to illustrate our invention but without being limited thereto, the following examples are given:

Example I

An aqueous solution comprising 10% by weight of thiourea is padded on to a cellulose acetate fabric and the latter is dried in a hot tower. The fabric is increased in weight 12% by this treatment. When tested for its flameproof qualities by being placed in the open luminous flames of a Bunsen burner, the fabric does not ignite but melts away rapidly from the flame.

Example II

A cellulose acetate fabric is padded with an aqueous solution containing 10% by weight of thiourea and 10% by weight of ammonium bromide. The fabric is dried in a hot tower and a weight increase of 20% is effected. The fabric is rendered flameproof by this treatment and does not ignite on contact with an open flame.

Example III

A cellulose acetate fabric is padded with an aqueous solution containing 10% by weight of thiourea, 10% by weight of ammonium bromide and 5% by weight of diammonium methyl phosphate. The fabric is dried with heated air and the treatment effects a weight increase of 25%. On being exposed to an open flame, the fabric is found to be flameproof, and drips away from the open flame without igniting.

The flameproofing solutions of the above examples may also be employed for treating staple fibers having a basis of cellulose acetate and, by effecting a weight increase of 10 to 25%, flameproof staple fiber may be obtained. The fiber may then be processed into yarn by suitable spinning operations.

While our invention has been more particularly described in connection with the treatment of textile materials having a basis of cellulose acetate, textile materials made of or containing other organic derivatives of cellulose may also be rendered flameproof in like manner by this novel treatment. Examples of other organic derivatives of cellulose are cellulose esters, such as cellulose propionate and cellulose butyrate, mixed esters such as cellulose acetate-propionate and cellulose acetate-butyrate, and cellulose ethers, such as methyl cellulose and benzyl cellulose.

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:

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1. Flameproof textile materials containing cellulose acetate which drip away rapidly when melted by contact with an open flame, characterized by having present thereon from 5 to 20% of thiourea, from 5 to 20% of a diammonium alkyl phosphate and from 2 to 20% of an ammonium salt, the amounts being based upon the weight of the textile materials.

2. Flameproof textile materials containing cellulose acetate which drip away rapidly when melted by contact with an open flame, characterized by having present thereon 10% of thiourea, 10% of ammonium bromide and 5% of diammonium methyl phosphate, the amounts being based upon the weight of the textile materials.

3. Process for the treatment of textile materials to cause the same to drip away rapidly when melted by contact with an open flame, which comprises applying to a textile material containing cellulose acetate a solution containing 5 to 20% by weight of thiourea, 5 to 20% by weight of a diammonium alkyl phosphate and 2 to 20% by weight of an ammonium salt, and removing the solvent medium.

4. Process for the treatment of textile materials to cause the same to drip away rapidly when melted by contact with an open flame, which comprises applying to a textile material containing cellulose acetate a solution in an aqueous-alcoholic medium containing 5 to 20% by weight of thiourea, 5 to 20% by weight of a diammonium alkyl phosphate and 2 to 20% by weight of an ammonium salt, and removing the solvent medium.

5. Process for the treatment of textile materials to cause the same to drip away rapidly when melted by contact with an open flame, which comprises applying to a textile material containing cellulose acetate an aqueous-alcoholic solution containing 10% by weight of thiourea, 5% by weight of diammonium methyl phosphate and 10% by weight of ammonium bromide, and removing the solvent medium.

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