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TREATING TEXTILE FABRIC

Floyd E. Bartell, Ann Arbor, Mich., assignor to
Copeman Laboratories Company, Flint, Mich.,
a corporation of Michigan

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This invention relates to processes of treating textile fabrics, and more particularly to the improvement and reinforcement of textile fibers by treatment applicable to the assembled fabric and especially applicable to woven cloth of textile materials to be used for wearing apparel and for other purposes in which the fibers are to be fabricated into materials which will be subject to wear; such wear being caused by the mutual friction of the yarns within, and the wear against itself or other surfaces to which the outer surfaces of the fabric is exposed.

To better understand and clarify the present invention, it may be said that my process is a specific improvement over the process disclosed in the patent to Tully No. 1,417,587 of May 30, 1922, and that the product resulting from my process is essentially the product described and claimed in the patent to Tully. In fact, the various objects and products resulting from my new process may be said to be very well described by page 1 of said Tully patent and up to line 63 of page 2.

Heretofore, in the carrying out of the Tully process, while the desired product was invariably obtained, difficulties have been encountered in the application of the process due mainly to the necessity of expensive mechanical equipment. In carrying out the Tully process, the water insoluble colloidal material has been dissolved in a volatile organic liquid. The application of this liquid by the vapor spray method suggested by Tully has proven effective as far as the final product is concerned, but such spray method has always offered certain mechanical difficulties and, furthermore, made it difficult to control the fumes set up during the spraying operation; breathing of these fumes by an operator was harmful. Equally good results have been obtained in some cases by immersing the fabric directly into the organic solution and then causing the organic liquid to vaporize leaving the colloidal coating material upon the fibers; however, this dipping method required a large volume of organic liquid in order to completely treat the cloth, and the evaporation of this large quantity of organic liquid resulted in a relatively great over-all loss, unless the liquid was condensed and recovered; condensation and recovery was difficult and costly. Furthermore, the dipping of some colored fabrics into the organic solution resulted in dissolving out some of the dye substance, slightly affecting the color of the finished material.

Since Tully, various modifications and proc-

esses have been developed in the application of resinous material to the individual fibers of textile materials, one of such methods being disclosed in the patent to Bradley No. 1,780,375 and another in the patent to Foulds No. 1,734,516. There has been some question in the application of resins to individual fibers as to whether the penetration is within the fiber or in a thin layer around the fiber but, regardless of this, the majority of processes have embodied the idea of using a water soluble substance, in solution with water, for treating fabric, and to then use a subsequent step in the process to produce a new substance by chemical reaction which forms on the fibers of the fabric and which is, by reason of such chemical reaction, insoluble in water. In addition to the necessary chemical reaction to render the water soluble substances insoluble, most of such processes are open to the objection that they remove something from the cloth.

I have discovered that instead of following the general trend as disclosed by many recent patents in the process of applying coatings to the individual threads, that especially good and efficient results may be obtained by using essentially the same materials used by Tully but in changing the process of bringing the materials on to the fabric. I still prefer to use insoluble resins and the like dissolved in an organic solvent, but instead of using such an organic solution reduced to fine particles by spraying and thus brought into contact with the fabric, I use a very small amount of organic solvent and reduce the same to a high degree of dispersion in a relatively large body of an aqueous medium, and then bring this aqueous medium into contact with the fabric.

A recommended procedure consists in the immersion of the fabric into a bath of treating solution, preferably consisting of a water insoluble gum, a natural or synthetic resin, finely dispersed in an aqueous medium so that the resulting liquid is in a thin or comparatively weak colloidal solution adapted to deposit a film, usually a thin film, the consistency of the solution being so regulated that the flowing power is such that the liquid will enter the capillary spaces of the fabric. Further, the physical characteristics of the dispersed gummy or resinous material must be such as to result in a relatively great lowering of interfacial tension between the aqueous solution and the fiber and a high degree of adsorption or adhesion against the solid fibrous material.

Different methods may be adopted for the high

degree of dispersion of the water insoluble gum or resin in the aqueous medium. Typical of the water insoluble gums or resins and substances of the non-crystalline or colloidal type suitable for use are gum shellac, polymerized oils as polymerized tung oil, polymerized vinyl compounds such as polymerized vinyl acetate, or almost any one of the many synthetic resins now on the market as "Amberol", "Lewisol", "Glyptol resin" or "Ester resin."

In carrying out the present process of treating textile materials, it is found that satisfactory results can be obtained as follows:

(1) Dissolve the water insoluble colloid (elastic, horny) substance in an excess of organic solvent.

(2) Disperse the solution containing the colloid substance and organic solvent, in a finely divided condition in water; this being accomplished by adding a dispersing agent such as ammonia stearate.

(3) Treat the fabric by drawing it through the solution containing the colloid substance in the finely divided solvent drops.

(4) Next dry the fabric.

(5) Then heat the fabric which softens the artificial integument and makes it fast to the fiber. The individual fibers and threads which form the fabric are thus coated with a thin layer of dry colloid horny and elastic material which will coat and at the same time tend to join the fibers together. The dry colloid material is insoluble in water, is resistant to acids, and forms a resistance on the threads of the fabric which serves to resist wear and abrasion. The colloid material by binding the fibers together at their points of contact gives a stronger thread and results in a higher tensile strength for the fabric.

Example 1.—As one typical example of the mode of carrying out my process, it has been found satisfactory to use as a colloid material a product consisting of 2 parts of ester gum, 2 parts polymerized linseed oil and 1 part oleic acid. Ordinary linseed oil is heated to a temperature of about 220° C. and is held at this temperature for about four hours until gelation begins. Ester gum which has been heated to the liquid condition is then added, after which the oleic acid is added. Upon cooling the material sets to a firm hard mass; this is put into solution by adding 8 parts of organic solvent consisting of equal volume of benzine and carbon tetrachloride. To prepare the final processing solution, the organic liquid solution described is added, slowly and with constant stirring, to 88 (or more) parts of water to which has previously been added 1½ parts by volume of 26° aqua ammonia. There is thus obtained a white solution (emulsion) containing the colloidal resins dissolved in droplets of organic solvent which are highly dispersed throughout an aqueous medium.

As examples of other methods suitable for producing a high degree of dispersion of the water insoluble gum or resin in an aqueous medium, the following methods are described:

Example 2.—A preferred solution may be prepared by adding eighty parts of commercial alcohol preferably containing not more than 10% of water, denaturing or other impurities, to 18 parts of a rich varnish of gum shellac, such as the shellac in alcohol of commerce, consisting of a viscous solution in alcohol of orange or white gum shellac. To the above ingredients I prefer to add two parts of castor oil, more or less for the purpose of somewhat decreasing the stiffness and resiliency

of the colloid coating resulting when the volatile ingredients have been evaporated, and especially somewhat to lessen the effect of stiffness after pressing with heat.

10 cc. of this, the above, solution is added with constant and vigorous stirring to 90 cc. of water. This gives a white fluid of milky appearance containing the fine particles of water insoluble shellac in a high degree of dispersion in the aqueous medium. The liquid is now ready for use.

Example 3.—10 grams ester gum are dissolved in 90 cc. of acetone. Plasticizing or softening agents such as 2 cc. of castor oil are added at this stage. This solution is poured slowly into water with vigorous stirring. A white liquid of milky appearance containing the fine particles of insoluble ester gum highly dispersed (in colloidal solution) is obtained. This liquid is ready for use as will subsequently be described.

Example 4.—50 grams of "Amberol" (synthetic resin), heat to melt at temperature of approximately 150° C. Add 2 cc. butyl stearate or 2 cc. castor oil. Cool to room temperature. Add 250 cc. of carbon tetrachloride which will give a viscous solution. Add this solution with vigorous stirring to 500 cc. of water. This gives a white fluid of milky appearance containing the synthetic resin and organic solvent droplets in a high degree of dispersion. The liquid is now ready for use.

The treating liquid is applied to the textile or porous material as follows: The liquid is placed in a tank such as is used in a regular "padding machine". The textile or porous material is drawn through this liquid and run through regular padding rolls under tension which serve to squeeze the liquid into the capillaries formed by the fibers of the textile or porous material, also serve to remove the excess of liquid from the material being treated. The treated material is then dried as by passing over heated cans such as are used in the textile industry. Water and any other volatile liquids which may be present are thus removed and the material is left in an essentially dry condition. The material is next heated under pressure as by passing between the heated rolls of a calender such as is used in the textile industry. This step is desirable but not necessary.

It will thus be seen that I have provided an extremely simple and inexpensive method of getting the water insoluble resins or similar coating material particles onto the fibers. Only a small amount of organic solvent is required, the amount being so small as to make it unnecessary to utilize any recovering machinery. No chemical reaction is necessary because the fine dispersed resins or similar materials are already in a water insoluble form. There are no appreciable toxic vapors to contend with. The original color of the original dye and hence the color of the treated fabric material is not affected nor changed in any way.

Regardless of the method in which my coating material is prepared, the essential point is that the water insoluble resins or similar materials are held in fine droplets of organic liquid or otherwise are highly dispersed in the aqueous solution. Thus, in Examples 2 and 3, the particles of resin dispersion are brought down very small and fine, but not down to molecular size. In other words, in the type of solution set forth in Examples 2 and 3, I obtain a colloidal suspension or a relatively fine suspension which gives a relatively great surface area and results in highly adhesive properties. In the emulsions as set forth in Ex-

amples 1 and 4 the water insoluble resins are dissolved in a relatively small amount of organic liquid, but this organic liquid instead of being dissolved in the water is dispersed in the water in the form of very small droplets. Thus, in all preferred processes of mixing the coating liquid, only a very small amount of organic liquid is used and the resins or similar materials are highly dispersed in the aqueous solution as water insoluble resins, which may be directly applied to the goods without subsequent treatment of any kind. In one case the organic liquid is dissolved in the water and the fine particles of resin are directly held in suspension in the aqueous solution; in the other case, the resin is dissolved in the organic liquid and the organic liquid exists in the form of very fine droplets (in which the resins are dissolved) highly dispersed in the aqueous solution; in the first case the resins are thrown into colloidal suspension by what I call a grinding method, and in the second case by a water soluble organic solvent method.

A further important feature of my process has to do with the retaining of the organic solvent in solution during the time that the fabric is dipped in or treated with the solution. Emulsions for non-analogous processes have heretofore been prepared by dissolving water insoluble bodies in organic solvents and dispersing the same in water, but in such cases it has been customary to remove the solvent in preparing the final emulsion. I obtain a decided beneficial effect by retaining the organic solvent in that I obtain a much more effective application of the coating material and a desired thin coating of the discrete fibers. By leaving the organic solvent as a part of the aqueous dispersion of resin I have discovered that the small fine droplets in suspension consisting of resin and organic liquid have a preferential adsorption for fibers; in other words, by leaving the small amount of organic liquid droplets containing the dissolved resin in suspension, such droplets will have a preferential adsorption or preferential adhesion to the fibers. It will be obvious that this preferential adsorption materially assists in obtaining a coating for each thread or fiber so thin as not to appreciably change the appearance of the fabric. When the fabric to be treated is drawn through the emulsion consisting of very fine droplets of organic liquid containing the dissolved (water insoluble) resin, the organic liquid in the form of the very fine droplets has a high affinity for the textile material and is absorbed by it. In this way the extremely fine particles or molecules of resin are drawn to the fibers and tend to cover each fiber. When the fabric is removed from the solution or emulsion it is allowed to dry and in the drying process both the water and the organic liquid which surrounds the fibers escape leaving the resin in contact with the fibers. Subsequent heat-

ing and ironing or calendering tend to further dry out and set the resin.

What I claim is:

1. The art of treating textile fabrics which comprises dissolving water insoluble bodies and an emulsifying agent in a volatile organic solvent, incorporating in such solution water to produce a relatively fine dispersion of the water insoluble bodies and organic solvent in the form of very fine droplets, the consistency of the solution being such that the liquid will enter the capillary spaces of the fabric, subjecting the fabric to said aqueous dispersion whereby the droplets of organic liquid containing dissolved water insoluble bodies are adsorbed by the textile material due to the high affinity of the organic liquid for the textile material, and then evaporating the organic liquid to leave the water insoluble bodies as a thin coating around the fibers.

2. The art of treating textile fabrics having interstices comprising as a step, applying to discrete fibers of the structural yarns of the fabric an aqueous dispersion of water insoluble resin and water insoluble organic solvent for the resin, the consistency of the dispersion being so thin as to leave said interstices open, the organic solvent being of a nature as to carry the dispersed resins into the capillary spaces of the fabric, and drying the fabric to leave a thin coating of resin around the fibers while they remain in their original relative open position and without appreciably changing the appearance of the fabric.

3. The art of treating textile fabrics having interstices comprising as a step, applying to discrete fibers of the structural yarns of the fabric an aqueous dispersion of water insoluble resin and water soluble organic solvent for the resin, the consistency of the dispersion being so thin as to leave said interstices open, the organic solvent being of such a nature as to carry the dispersed resins into the capillary spaces of the fabric, and drying the fabric to leave a thin coating of resin around the fibers while they remain in their original relative open position and without appreciably changing the appearance of the fabric.

4. The art of treating textile fabrics having interstices comprising as a step, applying to discrete fibers of the structural yarns of the fabric an aqueous dispersion of water insoluble resins containing a relatively small amount of solvent, the consistency of the dispersion being so thin as to leave said interstices open, the solvent being of such a nature as to carry the dispersed resins into the capillary spaces of the fabric, and evaporating the solvent and drying the fabric while the coated fibers remain in their original relative position and without appreciably changing the appearance thereof.

FLOYD E. BARTELL.