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METHOD OF STABILIZING TEXTILE GOODS

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No Drawing. Filed May 25, 1964, Ser. No. 370,054
5 Claims. (Cl. 28-76)

This invention relates generally to a method of fabric stabilization which produces a fabric with a minimum of progressive shrinkage. All fabrics after manufacture have a tendency to shrink when wetted. Many reasons have been advanced to explain this physical occurrence and many techniques have been employed to prevent or limit this. It has been found that fabrics usually shrink more in the warp than in the filling direction. An explanation for this physical fact has been given that the warp yarns are pulled and strained more during finishing and desire to revert to original dimension.

Among the techniques employed to limit progressive shrinkage is the known technique of utilizing a resination process to achieve a moderate degree of stabilization and non-shrinkage of a cellulose fiber fabric. In the standard resination technique as exemplified by United States Patent 2,121,005, the fabric is impregnated in a resin solution containing a catalyst which is released at a predetermined temperature to allow the resin to react (polymerization). In this process the resinated cloth must be cured for a relatively long period of time in order to obtain satisfactory curing of the resin which is of the thermosetting type.

With the resination technique the residual and progressive shrinking of the fabric cannot predictably and consistently be reduced to less than 1%.

It is also known in the prior art that mechanical stabilization or compressive shrinking techniques can be utilized to reduce progressive or residual shrinking. In these well known procedures the fabric undergoes a finishing procedure which includes impregnation in starch, which may under certain circumstances include resin and a catalyst. The fabric is then dried on a tenter, subjected to humidification and then subjected to compressive shrinking. In one technique the fabric is held and confined between an extended rubber blanket and a cylindrical drum. When the tension on the rubber blanket is released, it retracts to a shorter length. The confined fabric must accommodate itself to the new configuration, and hence is compressively shrunk. It is noted that the shrinkage inflicted upon the fabric is applied in the direction of the warp yarns. Whereas this process may achieve a minimization of initial shrinking of approximately 1% it does not reduce or minimize progressive shrinkage to a satisfactory extent.

It is the object of this invention to provide an improved method of stabilizing textile goods which will result in a fabric which will exhibit less than 1/2% initial shrinkage with little or no progressive shrinkage on repeated washings. The method essentially provides for impregnating the fabric with a thermosetting resin on a padder, bringing the fabric to width on the tenter and delivering the fabric from the tenter damp to a compressive shrinking device and applying a high degree of heat as the compressive shrinking occurs and thereby effecting cure during the actual moment of the compressive shrinkage act.

In the practice of this method when the cloth is treated with the thermosetting resin and taken from the tenter damp only the initial stage of coreaction between the resin and the fabric has taken place. At this point, the fabric has not been immobilized (as it would be if it had been brought off the tenter dry, and coreaction allowed to proceed to the intermediate stage) and therefore collapses on the compressive shrinking machine in

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the presence of the high degree of heat which is the heat required for polymerization, which heat carries the resin fabric reaction toward the intermediate stage and the short period of curing thereafter completes the chemical reaction to its end point.

A specific example of the method which is the subject of this invention will now be given in which a cellulose fiber fabric such as a cotton interlining for use in shirts is treated in accordance with the invention. As a first step in the method the fabric is desized, bleached and dried in the usual manner. It is essential that a good and complete bleach be achieved so that no foreign matter remains in the cotton to interfere with the absorption of the cellulose reactant or with the later performance of the cellulose reactant. Any system of desizing and bleaching which produces a cloth that is uniformly absorbent, generally white and neutral would be satisfactory for this purpose. Special desizing and bleaching procedures, such as the use of enzymes, acids, caustic soda, hypochlorite, hydrogen peroxide, sodium chlorite, are best dictated by local conditions and suitably selected in accordance with the standard procedures in the art. After bleaching the fabric was not dried completely, that is, it was not made "bone dry" or "hard dry" since drying fabric to that extent prior to resination has been found not to give the best results because it physically stiffens the cloth making it more resistant to penetration by the finishing chemicals. Additionally, the presence of a small amount of moisture in the goods acts as a lubricant to aid the penetration of the finishing chemicals.

The fabric was then resinated. Impregnation of the cloth with the finishing chemicals was performed on a two-bowl, rubber roll, padder mounted in tandem with a small stack of dry cans and an enclosed clip tenter frame. Such equipment is well known in the art and commonly used.

Because of the many chemicals involved in the formulation of the resinate very careful attention was given to the actual mixing of the chemicals.

The formulation of the finishing chemical used for resinating is as follows:

1/8%	3 lbs.	polyglycol nonionic wetting agent such as a product sold by Rohm & Haas under the trademark Triton X-100
5 1/2%	135 lbs.	polyvinyl alcohol resins such as that sold by Shawinigan Resins Corp. under the trademark Gelvatol 1-90
15%	360 lbs.	uronic melamine thermosetting reactant
1%	24 lbs.	textile softener or finishing agent such as that sold by American Cyanamid Co. under the trademark Cyanatex TSI
1/2%	12 lbs.	polyglycol nonionic rewetting agent such as that sold by Rohm & Haas under the trademark Triton GR-5
2%	48 lbs.	inorganic salt solution such as zinc fluoborate solution
	300 gal.	at 90° F.

The polyvinyl alcohol resin (Gelvatol 1-90) is first made up to an 11% stock solution. This solution is prepared by adding the polyvinyl alcohol resins (Gelvatol 1-90) with agitation to cold water in which 1 lb. of polyglycol nonionic wetting agent (Triton X-100) and 1 lb. of a mixture of N-ethyl-ortho- and para-toluenesulfonamides (such as is sold under the trademark Santicizer 8 which is a product of Monsanto Chemical Co.) has already been added. The solution is slowly brought up to 200° F. and maintained at that temperature for two hours with agitation. The solution is then allowed to cool to at least 100° F. before using.

After padding and some drying on the tenter the fabric which emerges with a uniform dampness of about 20% is delivered to a rubber belt type compressive shrinker such as the type made available by Cluett, Peabody & Co., Inc. under the trademark Sanforizer, with a collapse of approximately 1 3/4 inches obtained. While subjected to the compressive shrinking the cloth is subjected to heat at a temperature such as the heat of 120 lbs. pressure

steam. Thereafter the partially cured cloth is carried through to a final cure at 340° for two minutes.

It has been found that such a process gives the fabric stabilization of under 0.5% in both warp and fill and actually holds progressive or residual shrinking after repeated washings to an amount less than 3/10%.

It has also been found that the high burst of heat given off by the above referred to Sanforizing machine is sufficient to effect polymerization without the application of additional heat and the period of application of heat must be concurrent with the application of the compressive shrinking forces.

In other words, in the subject invention it is essential that the polymerization occur or at least definitely begin during the compressive shrinking. If the polymerization occurs before or after the compressive shrinking the results will not be achieved and the method is outside of the scope of the claimed invention. It is noted also that the two minute curing time after compressive shrinking is quite short in comparison with the practice in the art. In fact, complete curing is effected under the invention on the Sanforizer where a duplex range is used.

Thus, among others, the object in the invention as specifically aforementioned is achieved. Obviously numerous changes in technique might be resorted to and numerous changes in specific formulations might be utilized without departing from the spirit of the invention as defined by the claims.

I claim:

1. A method of stabilizing cellulose fiber fabric comprising thoroughly impregnating the fabric with a solution containing a resin cellulose reactant and a catalyst capable of effecting at least a partial reaction between the resin and the cellulose fiber at a predetermined temperature, applying compressive shrinking forces to the fabric in the direction of the warp yarns while the fabric is damp with the impregnated solution, applying predetermined heat sufficient to effect reaction between the resin and the cellulose fiber while the fabric is undergoing compressive shrinking forces and thereafter curing the fabric for a limited period.

2. A method of stabilizing fabric comprising thoroughly impregnating the fabric with a solution containing a thermosetting plastic and a catalyst capable of releasing said plastic for polymerization at a predetermined temperature, applying compressive shrinking forces to the fabric in the direction of the warp yarns while the fabric is damp with the impregnated solution, applying predetermined heat above the setting heat of the plastic while the fabric is undergoing compressive shrinking forces and thereafter curing the fabric for a limited period.

3. A method of stabilizing cellulose fiber fabric comprising impregnating the fabric with a solution containing: polyglycol nonionic wetting agent; polyvinyl alcohol resins; uronic melamine thermosetting reactant; textile softener or finishing agent; polyglycol nonionic rewetting agent; inorganic salt such as zinc fluoborate; then applying compressive shrinking forces to the fabric in the direction of the warp yarns while the fabric is damp with the impregnated solution, applying predetermined heat sufficient to effect polymerization while the fabric is undergoing compressive shrinking forces, and thereafter curing the fabric for a limited period.

4. A method of stabilizing cellulose fiber fabric comprising impregnating the fabric with a solution containing: 1/8%—3# polyglycol nonionic wetting agent; 5 1/2%—135# polyvinyl alcohol resins; 15%—360# uronic melamine thermosetting reactant; 1%—24# textile softener or finishing agent; 1/2%—12# polyglycol nonionic rewetting agent; 2%—48# inorganic salt such as zinc fluoborate; then applying compressive shrinking forces to the fabric in the direction of the warp yarns while the fabric is damp with the impregnated solution, applying predetermined heat sufficient to effect polymerization while the fabric is undergoing compressive shrinking forces, and thereafter curing the fabric for a limited period.

5. The method in accordance with claim 4 in which the polyvinyl alcohol resin is first made up to an 11% stock solution by adding the polyvinyl alcohol resins with agitation to cold water in which 1 lb. of polyglycol nonionic wetting agent and 1 lb. of a mixture of N-ethyl-ortho- and para-toluenesulfonamides has already been added and the solution is slowly brought up to 200° F. and maintained at that temperature for two hours with agitation and allowed to cool to at least 100° F. before using.

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