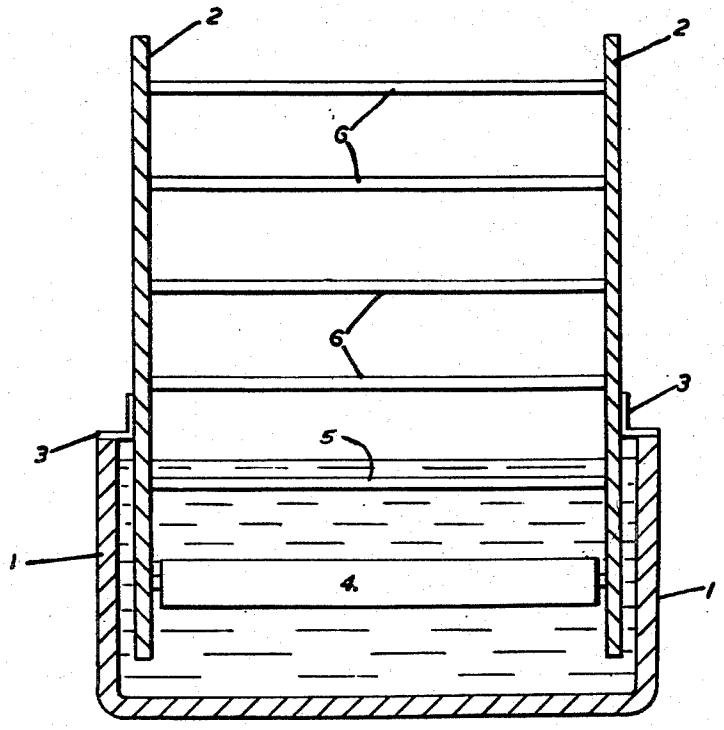
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TREATMENT OF TEXTILE FABRICS WITH POLYVINYL COMPOUND

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TREATMENT OF TEXTILE FABRICS WITH POLYVINYL COMPOUND

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This invention relates to the treatment of woven, knitted and netted textile fabrics to reduce their liability to slipping, fraying, laddering or the like.

In accordance with the invention there is applied to woven, knitted or netted textile fabrics a composition comprising an acetone-insoluble polyvinyl chloride or a co-polymer of vinyl chloride and vinyl acetate with a vinyl chloride content of 80–95%, and preferably also a plasticiser for the polyvinyl compound, in amount insufficient to close the interstices of the fabric. The expression "polyvinyl composition" is employed hereinafter to denote compositions comprising the polyvinyl compound, whether or not they also comprise a plasticiser.

The amount of the polyvinyl composition applied to the fabric is preferably small, especially between about 0.25 and 7.0% of the weight of the fabric.

In the preferred method of putting the invention into practice the fabric is impregnated with a dope comprising the polyvinyl compound and preferably a plasticiser dissolved in a suitable liquid solvent medium, and the solvent medium is then removed by evaporation, leaving the polyvinyl composition on the fabric.

The choice of a suitable solvent medium is a matter of importance. It must, of course, be capable of dissolving the polyvinyl compound and the plasticiser if one is employed. (Either a true solution or a colloidal dispersion of the polyvinyl compound and/or the plasticiser may be formed, and the term "solution" is used hereinafter to include both kinds of composition.) It must not exert any undesired action on the material of which the fabric is composed. For example it must not dissolve the material. Moreover, I have found that a very much better product results if the solvent medium is one which on evaporation is capable of depositing the polyvinyl compound in the form of a film.

Examples of liquids which fulfil this last condition are certain aliphatic ketones, especially methyl ethyl ketone; certain aliphatic dihalides, in particular propylene dichloride; and dioxane and tetrahydrofurane. Since methyl ethyl ketone, propylene dichloride, dioxane and tetrahydrofurane are substantially without action on cellulose, fabrics made of cellulose yarns, e. g. viscose or cuprammonium cellulose yarns or yarns made by saponifying stretched cellulose acetate yarns, may advantageously be treated with a solution of the polyvinyl compound and a plasticiser in one of these solvents. Solutions

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of the polyvinyl compound and plasticiser in propylene dichloride can also be used for the treatment of fabrics made of yarns having a basis of an organic derivative of cellulose, for example cellulose acetate. Methyl ethyl ketone, dioxane and tetrahydrofurane however, are solvents or strong swelling agents for cellulose acetate and are not suitable by themselves for treating fabrics containing cellulose acetate. I have found that mixtures of these solvents, and especially of methyl ethyl ketone, with aliphatic ketones containing at least 5 carbon atoms, for example di-isopropyl ketone, and especially methyl alkyl ketones such as methyl iso-butyl ketone and methyl n-amyl ketone, can be used very satisfactorily. These higher aliphatic ketones can, if desired, be employed alone, but this is less satisfactory, since, except from very dilute solutions, they tend to deposit the polyvinyl compound in a continuous or granular form rather than as a film. Propylene dichloride, on the other hand, can be used satisfactorily either alone or in admixture with methyl ethyl ketone. Examples of suitable mixtures which may be used at temperatures of about 20° C. are: 70 parts of methyl ethyl ketone with 30 parts of methyl isobutyl ketone or methyl n-amyl ketone: 75 parts of methyl ethyl ketone with 25 parts of di-isopropyl ketone; 55 parts of methyl ethyl ketone with 45 parts of propylene dichloride; as well as similar mixtures containing a lower proportion of methyl ethyl ketone, e. g. down to about 20% in the case of the mixtures with higher ketones. Mixtures of methyl ethyl ketone with hydrocarbons, especially mononuclear aromatic hydrocarbons, instead of with the higher ketones or with propylene dichloride, can also be used, though less advantageously. Examples of such mixtures are 60 parts or less of methyl ethyl ketone with 40 parts or more of benzene or a xylene. In all cases the parts given are by volume.

The concentration of the polyvinyl compound in the solvent medium is preferably between about 1% and 12%. The precise concentration which will give the best results in any instance will depend on the construction of the fabric to be treated, the degree of softness desired in the product, and the method by which the dope is to be applied to the fabric; concentrations between 3 and 9% are usually preferred. Preferably the dope is applied to the fabric at a temperature of about 15–30° C.

As the plasticiser for the polyvinyl compound there should, of course, be used a substance

which has no deleterious effect upon the material of which the fabric is composed and does not impart undesirable properties to the fabric. The plasticisers which it is preferred to employ are organic phosphates, e. g. tricresyl phosphate and other triaryl phosphates and tributyl phosphate; phthalate plasticisers, e. g. dibutyl phthalate, dioctyl phthalate and dilauryl phthalate; dibutyl and dioctyl sebacate, dibutyl adipate, tributyl citrate, tetra-hydrofuryl oleate and methyl cyclohexanol oxalate. The amount of the plasticiser may be between 25% and 200% of the weight of the polyvinyl compound, but is preferably between about 50% and 140%, especially about 100%.

If desired the polyvinyl composition may also contain a heat or light-stabiliser, e. g. lead stearate or other heavy metal salt, diphenyl thiourea, alpha-phenyl indole or adipic acid dihydrazide.

As already indicated, the polyvinyl compositions can be applied with good results to fabrics made of very different materials. For example, they can be applied to fabrics having a basis of natural cellulose, e. g. cotton, or of a regenerated cellulose staple fibre. The treatment is, however, of particular advantage in connection with fabrics made of continuous filaments, either of regenerated cellulose, e. g. viscose and more especially regenerated cellulose filaments made by first stretching and then saponifying cellulose acetate filaments, or of an ester or ether of cellulose, in particular cellulose acetate or cellulose propionate. Fabrics comprising continuous filaments or staple fibres of purely synthetic polymeric materials, e. g. polyamides of the nylon type or polyurethanes, may also be treated in accordance with the invention.

Not only should the amount of the polyvinyl composition applied to the fabric be small, but for most purposes it is important that the composition should be evenly distributed on the fabric. While it is possible to apply the composition in pre-determined amount by passing the fabric through the dope and removing excess dope by means of one or more doctor blades, the following device has been found to be particularly effective, especially for the treatment of woven fabrics.

The device comprises means for wetting the fabric with the dope in combination with a number of fixed bars, e. g. straight cylindrical bars, parallel to one another and spaced in such a way that a fabric passed successively between each pair of adjacent bars and held under tension presses against each bar. The effect of the bars is to distribute the dope evenly over and throughout the fabric and to remove dope in excess of the amount desired on the fabric. The fabric may be wetted with the dope in any convenient way, for example by passing the fabric through a bath of the dope immediately before passing it through the series of bars as described.

One such device comprises a free-running or driven roller immersed in a bath of the dope and, situated above the rollers, a series of fixed, cylindrical, steel bars each parallel to the roller. There may, for example, be 4, 6 or 8 of these bars, and preferably at least one of them is situated below the level of the surface of the dope, while the majority are above the surface level. For example the device may comprise a roller and one bar below the surface level of the dope and four or five bars above the surface level. Preferably the axes of the bars lie in a single plane, which may either be vertical or inclined at an angle to the vertical.

The accompanying drawing is a sectional view of a device of this kind, comprising a vessel 1 for the dope to be applied to the fabric and two vertical members 2 mounted on brackets 3 attached to the sides of the vessel 1. A free-running roller 4 is mounted in bearings near the lower end of the members 2 and above it, but below the level to which the vessel 1 can be filled with liquid, is mounted a fixed cylindrical steel bar 5. Above this bar, and equally spaced therefrom and from each other, are fixed further similar bars 6.

In operation, the fabric to be treated is caused to travel through the bath and under the roller 4 and then in a zigzag manner between adjacent bars 5 and 6. For example, it may be drawn through the device by a pair of nip rollers (not shown in the drawing). By adjusting the tension on the fabric, and thus the pressure of the fabric against the bars, it is possible very closely to control the amount of dope remaining on the fabric. It has been found that this device has the further advantage of eliminating troubles due to bubbles in the dope and of distributing the polyvinyl composition evenly over the fabric even when the concentration of the polyvinyl composition in the dope is high, e. g. up to 200 grammes of the composition per litre of dope.

For applying to knitted or netted fabrics the relatively small quantities of liquid required for the treatment above described, it is preferred to employ a padding device, for example a device in which the fabric is fed between two rollers together with and above an endless thick woollen blanket, the lower bight of which passes through the bath containing the dope. The amount of the dope remaining on the fabric may be controlled by varying the pressure exerted by the rollers on the fabric and blanket. If desired, a padding device can also be used for applying the dope to woven fabrics.

The removal of the liquid component or components of the dope from the impregnated fabric by evaporation may, for example, be effected by passing the impregnated fabric through a chamber through which passes a current of heated air or other gas. The air or other gas, after passing through the chamber, may be freed from the vapours of the liquid component or components of the dope, e. g. by condensation or by adsorption on charcoal, activated alumina or silica gel, and may then be recirculated through the chamber. The separated liquid or liquids may be employed in the production of further quantities of dope.

It has been found that fabrics which have been subjected to the treatment described can be dyed in an even and satisfactory manner by the same general methods and using the same dyestuffs as if they had not been so treated. For example cotton fabrics and fabrics of regenerated cellulose may be dyed by the standard methods with direct cotton dyes, for example Chlorantine Fast Blue 4GL or Durazol Yellow 6G; cellulose acetate fabrics can be dyed by the standard methods using aqueous dispersions of substantially water-insoluble dyes. Moreover, a pleasing effect can be produced by incorporating a dyestuff in the polyvinyl composition; thus the composition may be applied in the form of a dope containing the dyestuff, preferably a water-insoluble dye soluble in the dope or a coloured pigment, for example in amount 0.01–1% by weight of the polyvinyl compound. If a high degree of covering power is required, the dope may also contain a white filler, e. g. titanium dioxide, zinc oxide, or another

white pigment, for example in amount up to 10% of the weight of the polyvinyl compound.

The new process is of value in the treatment of woven, knitted and netted fabrics of various types and of textile articles made therefrom. For example, it is of great value in the treatment of hosiery, especially hosiery comprising regenerated cellulose yarns made by stretching and then saponifying cellulose acetate yarns, in order to reduce their liability to ladder.

The invention is illustrated by the following example:

Example

Sufficient methyl ethyl ketone is added to an emulsion-polymerised, spray-dried polyvinyl chloride to form a gelatinous mass, which is then finely broken up. Tricresyl phosphate is added in amount equal to the weight of the polyvinyl chloride and further methyl ethyl ketone is added with agitation until a dope consisting of a solution of the polyvinyl chloride and tricresyl phosphate is obtained, the concentration of polyvinyl chloride in the dope being about 5%. The vessel 1 of the device illustrated in the drawings is filled with the dope, which is kept at a temperature of 20° C.

A light-weight woven fabric of regenerated cellulose (made by weaving yarns produced by stretching and saponifying cellulose acetate yarns) is drawn through the dope under the roller 4 and in a zigzag path between the series of bars 5, 6. The tension on the fabric is such that the fabric retains 25–35% of its weight of the dope.

The fabric carrying the dope is then passed through a drying chamber in which it meets a current of heated air whereby the methyl ethyl ketone is substantially completely evaporated.

When a cellulose acetate fabric is treated the amount of methyl ethyl ketone used is reduced by 30%; the solution so obtained is diluted with methyl isobutyl ketone or methyl n-amyl ketone in amount sufficient to bring it to the same concentration of polyvinyl chloride as before.

The treated fabrics have a greater resistance to slipping than untreated similar fabrics and can be evenly dyed—the regenerated cellulose fabric with direct cotton dyes and the cellulose acetate fabric with an aqueous dispersion of a water-insoluble dye.

If, instead of using the device described in the drawing for applying the dope to the fabric, the dope is applied by a padding method, it may contain 7.5 parts each of the polyvinyl chloride and tricresyl phosphate in 100 parts of the ketone or mixture of ketones used. Such a solution is also used in the treatment of knitted fabrics and articles by the padding method.

Having described my invention, what I desire to secure by Letters Patent is:

1. Process for the treatment of woven, knitted and netted fabrics comprising continuous filament yarns of organic derivatives of cellulose, which comprises depositing on the fabric from a solution of 3%–9% concentration a composition comprising a polyvinyl compound selected from the group which consists of copolymers of vinyl chloride and vinyl acetate having a vinyl chloride content of 80%–95% and acetone-insoluble polyvinyl chloride, dissolved in a mixture consisting essentially of 20 to 75% of methyl ethyl ketone the remainder being a methyl alkyl ketone containing at least 5 carbon atoms, the amount of the said composition deposited on the fabric being insufficient to close the interstices of the fabric.

2. Process according to claim 1, wherein the amount of plasticizer in the composition is 25%–200% of the weight of the polyvinyl compound.

3. Process for the treatment of woven, knitted and netted fabrics comprising continuous filament yarns of organic derivatives of cellulose, which comprises depositing on the fabric from a solution of 3%–9% concentration a composition comprising a polyvinyl compound selected from the group which consists of copolymers of vinyl chloride and vinyl acetate having a vinyl chloride content of 80%–95% and acetone-insoluble polyvinyl chloride, dissolved in a mixture consisting essentially of 20 to 75% of methyl ethyl ketone the remainder being a methyl alkyl ketone containing at least 5 carbon atoms, the amount of the said composition deposited on the fabric being insufficient to close the interstices of the fabric, and between 0.25% and 7% of the weight of the fabric.

4. Process for the treatment of woven, knitted and netted fabrics comprising continuous filaments yarns of organic derivatives of cellulose, which comprises depositing on the fabric from a solution of 3%–9% concentration a composition comprising a polyvinyl compound and a plasticizer therefore, said polyvinyl compound being selected from the group which consists of copolymers of vinyl chloride and vinyl acetate having a vinyl chloride content of 80%–95% and acetone-insoluble polyvinyl chloride, dissolved in a mixture consisting essentially of 20 to 75% of methyl ethyl ketone the remainder being a methyl alkyl ketone containing at least 5 carbon atoms, the amount of the said composition deposited on the fabric being insufficient to close the interstices of the fabric.

5. Process for the treatment of woven, knitted and netted fabrics comprising continuous filament yarns of organic derivatives of cellulose, which comprises depositing on the fabric from a solution of 3%–9% concentration a composition comprising a polyvinyl compound and a plasticizer therefore, said polyvinyl compound being selected from the group which consists of copolymers of vinyl chloride and vinyl acetate having a vinyl chloride content of 80%–95% and acetone-insoluble polyvinyl chloride, dissolved in a mixture consisting essentially of 20 to 75% of methyl ethyl ketone the remainder being a methyl alkyl ketone containing at least 5 carbon atoms, the amount of the said composition deposited on the fabric being insufficient to close the interstices of the fabric, and between 0.25% and 7% of the weight of the fabric.

6. Process for the treatment of woven, knitted and netted fabrics comprising continuous filament yarns of organic derivatives of cellulose, which comprises depositing on the fabric at a temperature of 15° to 30° C. from a solution of 3%–9% concentration a composition comprising a polyvinyl compound selected from the group which consists of copolymers of vinyl chloride and vinyl acetate having a vinyl chloride content of 80%–95% and acetone-insoluble polyvinyl chloride, dissolved in a mixture consisting essentially of 20 to 75% of methyl ethyl ketone the remainder being a methyl alkyl ketone containing at least 5 carbon atoms, the amount of the said composition deposited on the fabric being insufficient to close the interstices of the fabric,

and between 0.25% and 7% of the weight of the fabric.

7. Process for the treatment of woven, knitted and netted fabrics comprising continuous filament yarns of organic derivatives of cellulose, which comprises depositing on the fabric at a temperature of 15° to 30° C. from a solution of 3%–9% concentration a polyvinyl compound and a plasticizer therefore, said polyvinyl compound being selected from the group which consists of copolymers of vinyl chloride and vinyl acetate having a vinyl chloride content of 80%–95% and acetone-insoluble polyvinyl chloride, dissolved in a mixture consisting essentially of 20 to 75% of methyl ethyl ketone the remainder being a methyl alkyl ketone containing at least 5 carbon atoms, the amount of the said composition deposited on the fabric being insufficient to close the interstices of the fabric, and between 0.25% and 7% of the weight of the fabric.

8. Process for the treatment of woven fabrics made from continuous filament yarns of an organic derivative of cellulose, which comprises passing the fabric through a 3%–9% solution of a composition comprising a polyvinyl compound and a plasticizer therefore, said polyvinyl compound being selected from the group which consists of copolymers of vinyl chloride and vinyl acetate having a vinyl chloride content of 80%–95% and acetone-insoluble polyvinyl chloride, in a solvent medium comprising methyl ethyl ketone in admixture with a methyl alkyl ketone containing at least 5 carbon atoms, then subjecting the fabric to repeated substantially uniform pressure and friction on its two sides alternately until the solution remaining on the fabric contains an amount of the composition insufficient to close the interstices of the fabric and between 0.25% and 7% of the weight of the fabric, and subsequently evaporating the solvent medium.

HENRY EWING.

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Certificate of Correction

Patent No. 2,517,646 August 8, 1950

HENRY EWING

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 7, line 8, after the word "concentration" insert *a composition comprising*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of November, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.