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TREATMENT OF TEXTILE MATERIALS

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This invention relates to the treatment of textile materials and relates more particularly to an improved finish for continuous filament yarns, staple fibers and fabrics made of organic derivatives of cellulose.

An object of my invention is the preparation of an improved conditioning finish for continuous filament yarns, staple fibers and fabrics.

Another object of my invention is to condition continuous filament yarns and staple fibers to improve their workability in textile operations such as carding, combing, spinning, twisting, coning, pirning and weaving, and to give fabrics a soft, desirable hand by treating the yarns, staple fibers and fabrics with this improved finish.

Still another object of my invention is the preparation of an improved finish which will remain stable though exposed to atmospheric conditions and will not oxidize or otherwise undergo chemical changes.

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

Textile finishing compounds and lubricants for continuous filament yarns, staple fibers and fabrics are known. While many of these compounds impart desirable qualities to the yarns, fibers and fabrics to which they are applied, some of these compounds have the disadvantage of developing free acidity on ageing with a resulting deleterious effect on the yarns and the further processing thereof. Other compounds are prone to oxidative or hydrolytic changes which tend to make the compounds gummy and thus give the yarns and fibers to which they are applied a gummy or tacky surface. These effects make the further processing of the yarns and fibers difficult. In addition, such changes in the character of the finish make their removal difficult and in many instances their presence on the yarns, or on the fabrics made from these yarns, results in uneven and streaky dyeing. When the continuous filament yarns are cut into staple fibre and processed into spun yarns there is the added problem that the working of the short lengths of staple fiber and the rubbing of the fibers against one another generates a considerable amount of static electricity. Because of the static charge the fibers tend to stick to various parts of the machinery and to resist adherence to one another. The presence of the static electricity thus causes considerable difficulty. It has been attempted to overcome this by coating the fibers with various agents to make them conductors of electricity. However, many of those coating com-

positions were corrosive and/or imparted an undesirable scroopiness to the fibers which caused uneven sliver formation and uneven drafting with a resultant decrease in the uniformity and strength of the yarn produced.

I have now discovered that when yarns, staple fibers and fabrics are treated with an aqueous emulsion of a conditioning composition prepared by the reaction of several ingredients, each chosen for the specific effect it imparts to the composition and to the treated yarn, the difficulties experienced heretofore may be overcome. In accordance with my invention yarns and staple fibers of organic derivatives of cellulose are treated with a conditioning composition comprising substances which act as lubricating agents for the fibers in contact with one another and for the yarn in contact with metal and porcelain surfaces, substances which act to improve the electrical conductivity of the yarn so that static charges may be borne off, substances which increase the penetrating, spreading and emulsifying properties of the composition and substances which serve to blend and homogenize the finishing composition so that it is uniform throughout. When such compositions are employed, the resulting continuous filament yarns and staple fibers which are treated may be further processed and the treated staple fiber spun into yarn without the disadvantageous formation of gummy and tacky substances and without the generation of heavy charges of static electricity during the operations of mixing, carding, drawing, combing, spinning, and the like.

My invention is applicable to the treatment of both natural and artificial fibers and fabrics made therefrom. It may be used for treating such natural fibers as cotton or wool, or staple fibers cut from natural silk, and may also be used for the treatment of regenerated cellulose fibers made by the viscose, the cuprammonium or the nitrocellulose processes. My invention, however, is of especial importance in connection with yarns, staple fibers and fabrics made of organic derivatives of cellulose such as cellulose esters and cellulose ethers. Suitable cellulose esters are, for example, cellulose acetate, cellulose propionate, cellulose butyrate or mixed esters such as cellulose acetate-propionate, while examples of suitable ethers are ethyl cellulose, methyl cellulose and benzyl cellulose. My invention is also applicable in the treatment of yarns and mixtures of staple fibers comprising two or more of the above mentioned fibers. Such mixtures may, for example, comprise an organic derivative

of cellulose, such as cellulose acetate and wool, or cellulose acetate and silk. Other mixtures may likewise be so treated to advantage.

Likewise, my invention is applicable for the treatment of filaments of fine denier or a plurality of such filaments associated together in the form of yarn. The yarns or textile materials may also have various materials incorporated therein such as finely divided pigment-like materials as titanium oxide, antimony trioxide, stannic oxide, starch, high melting point insoluble organic compounds and the like to vary the luster thereof. Also yarns which have a transparent pigment incorporated therein to vary the characteristics of the yarn without changing the luster may be advantageously treated with the conditioning agents of my invention.

The novel and improved finishing composition of my invention comprises the reaction mixture of a long-chain aliphatic acid with sulfuric acid to which has been added a lubricant oil and a blending agent and in which the unreacted acid has then been neutralized by the addition of a compound of basic reaction to form neutral sulfates.

The sulfonated acids which are particularly suitable for use in accordance with my invention are the long-chain aliphatic acids. These acids may be saturated or unsaturated and preferably contain from about 12 to about 18 carbon atoms in the carbon chain. Such acids as oleic, lauric and palmitic acids are especially suitable for sulfonation in the preparation of the emulsifying agents of my finishing compositions. The sulfonation of these acids may be carried out in any suitable manner but preferably these acids are sulfonated by the use of oleum. The temperatures should preferably be kept low during sulfonation to inhibit undesirable side reactions and the formation of tars. Temperatures of from about 15° C. to 30° C. are suitable.

The lubricant employed in the finishing composition may be a suitable mineral oil preferably light in color and preferably saturated. The viscosity of the oil as well as the amount applied will vary depending on the type of fiber which is being treated and the particular operation to which it is to be subjected. Where staple fibers of organic derivatives of cellulose alone or mixed with wool or cotton are being subjected to carding, drafting and spinning, a mineral oil of about 50 to about 150 Saybolt viscosity at 100° F. is suitable. In addition to mineral oil such vegetable oils as olive oil, castor oil, teaseed oil, or cottonseed oil as well as oxidized vegetable oils such as oxidized olive oil, oxidized castor oil, etc., may be used.

In order that the composition may be blended to a homogeneous fluid, a blending agent compatible with the various components is preferably employed. Preferably, the blending agents should not possess too high a degree of volatility. Suitable blending agents are the higher alcohols such as oleyl, cetyl, lauryl and stearyl alcohol. In general the higher alcohols containing from about 12 to 18 carbon atoms in their carbon chains are suitable. Other blending agents such as polyethylene glycol ethers and esters may also be used.

To impart a proper degree of conductivity to the fibers so that the retention of undesirably heavy charges of static electricity is inhibited, an inorganic electrolyte should be present in the finishing composition. The electrolyte is preferably an inorganic salt and should be non-

corrosive. The electrolyte need not be added to the composition but may be formed in situ as by the neutralization of the unreacted acid in the sulfonation mixture. The unreacted sulfuric acid may be neutralized with potassium or sodium hydroxide with the formation of the corresponding sodium and potassium sulfates. While other inorganic electrolytic salts may be added, the presence of the sulfates formed in situ as mentioned, is generally sufficient to impart a proper anti-static quality to the finishing composition.

The finishing compositions may be applied to the yarns at any one or more of the various stages of their treatment. While these compositions may be applied in a fairly concentrated form, the yarns and fibers are preferably treated with the finishing composition when it is in the form of a dilute emulsion with water. The compositions may be applied to the yarns while they are still in continuous lengths and are conveniently applied by means of wicks, rollers or other furnishing devices while the yarns are in transit from one package to another, or they may be applied while the yarns are leaving the spinning meter in which they are formed. Likewise, the finishing compositions may be applied to the yarns as they approach a cutting device or they may be applied to the staple lengths of yarn after they have been cut by spraying the cut yarns with or by immersing them in the said finishing compositions. In addition, the finishing compositions may be applied at any intermediate stage of the spinning operation. It is preferable to apply the compositions prior to the lapping, carding, drawing or slubbing but they may be applied after any one of these operations.

Fabrics may be impregnated with such conditioning fluids or the fluid may be padded thereon in any suitable manner.

The concentration of the finishing composition aqueous emulsion may be varied depending upon the manner in which it is applied to the yarns or fibers and also to the operations to which the yarns or fibers are to be subjected. The amount of water present in the emulsion may vary from just enough to dissolve the inorganic electrolyte present, up to 99.5% based on the weight of the water-free composition. By varying the concentration of the aqueous emulsion and the manner in which it is applied, the amount of lubricant and anti-static finish placed on the yarn may be varied over a wide range. Generally, the amount of the emulsion applied to the yarns or fibers will vary from about 0.5% to about 2.0% of the substantially water-free emulsion based on the weight of the fibers.

The emulsion before being diluted with increased amounts of water for application to the yarn may contain about 40 to 60 parts by weight of the lubricant such as mineral oil, about 25 to 40 parts by weight of the sulfonated long-chain aliphatic acid emulsifying agent, about 2 to 6 parts of the inorganic electrolyte and 5 to 10 parts by weight of blending agent to make 100 parts on a water-free basis.

In the manufacture of certain fabrics such as carpets and blankets in which the yarns used are rather coarse it often may be desirable to give the fibers already treated with the emulsions heretofore mentioned a supplementary treatment with an additional finishing composition to augment the desirable characteristics heretofore imparted to the fibers. This is especially true when the yarns are spun from staple fibers of about 10

denier per filament and more and are spun on the woolen system. Staple fibers of these higher deniers do not possess sufficient surface friction for proper spinning into coarse yarns and to obtain the proper surface friction qualities, an additional treatment may be necessary. Such a treatment comprises spraying the staple fibers with a second aqueous emulsion comprising a trialkylamine resinate, glycerine and an aliphatic alcohol. The trialkylamine resinate improves the surface friction qualities of the staple while the aliphatic alcohol gives the staple a certain desirable crimp. The glycerine present serves to keep the treated fibers soft. This supplementary treatment for high denier per filament fibers is preferably applied subsequent to the application of the finishing composition but may be applied at any point prior to the spinning of the fiber.

A trialkylamine such as triethanolamine is suitable for the formation of the trialkylamine resinate by reaction with rosin. Methyl, ethyl or other lower aliphatic alcohol may be used for aiding the reaction and imparting the desirable crimp to the high denier per filament fibers.

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

Example I

77 parts by weight of oleic acid are sulfonated by the addition of 21 parts of 20% oleum. The oleum is added slowly and the mixture stirred vigorously during the addition so that the temperature does not rise above about 20-25° C. When the addition of the oleum is complete there are immediately added 77 parts of ice, 140 parts of mineral oil and 30 parts of oleyl alcohol. When these latter components have all been added, the unreacted acid is neutralized by the addition of an aqueous 50% solution of caustic soda until the final mixture has a pH of 7. The reaction of the caustic soda and sulfuric acid forms sodium sulfate which acts subsequently as an electrolytic agent. The resulting mixture is a clear oil containing about 30% of water. Finishing emulsions may be made by dispersing this oil in water in any desired concentration depending upon the particular use to which it is to be put.

2 parts by weight of this oil are emulsified with 98 parts of water and this emulsion is applied to a yarn of cellulose acetate of about 3 denier per filament when emerging from the metier, by means of a roller furnishing device, so that from 0.2% to about 0.6% of emulsion on the weight of the fiber is added. The yarn is then fed to a cutting device where it is cut into staple lengths of fiber of about 1.5 inches in length. This staple fiber is then sprayed with an additional amount of the emulsion sufficient to apply about 1.0% thereon, based on the weight of the fibers. When this staple fiber is processed it is found that it passes through all textile operations down to the final spun yarn with adequate lubrication and with very desirable anti-static qualities.

Example II

An emulsion formed by adding 1 part of the oil prepared in Example I to 99 parts of water is applied to a cellulose acetate creped fabric by means of quetch rolls in the usual finishing operation. The resulting fabric when dried contains about 1% by weight of the finishing composition and possesses an unusually soft and desirable hand.

By suitably varying the relative proportions of

mineral oil to the sulfonated acid, finishing compositions imparting various effects to the textile materials with which they are used may be prepared.

Example III

An emulsion suitable for the supplementary treatment of high denier per filament staple fibers may be prepared in the following manner.

A solution is formed by dissolving 2.2 parts by weight of a commercial grade of rosin in 10.5 parts by weight of methyl alcohol. To this solution is added 1 part by weight of triethanolamine and after the addition of the triethanolamine there are added 1.6 parts of glycerine. The resulting solution is poured into 25 parts by weight of water with vigorous agitation. The resulting emulsion may be sprayed on to the staple while it is running through an opener after the finishing composition has been applied at some prior point in the preparation of the fibers.

Yarns treated in accordance with this invention are very pliable and flexible and may be subjected to operations such as coning, pining, winding, hanking and the like or they may be knitted or woven to form knitted or woven materials, hosiery or other articles.

Yarns treated with my novel conditioning fluids have many more advantages. As pointed out above, they are flexible and pliable and they retain these properties even after storage for a long time. Thus the yarns regardless of their age, can be readily rewound from their original packages or subjected to any textile operations. The yarns treated in accordance with this invention take sizes very readily which obviously is a very important advantage.

Yarns treated as herein set out may be knitted on circular knitting machines or on warp knitting machines to produce fabrics of many wales and courses per unit length, which fabrics are substantially free of pin holes, distortions, tension lines, rowiness and the like. In fact yarns so treated may be commercially knitted on certain circular knitting machines on which similar untreated yarns or yarns treated with other conditioning fluids cannot be commercially utilized. Yarns treated in accordance with this invention produce woven fabrics that are substantially free of warp streaks or weft bars in contrast with yarn lubricated by prior methods. Fabrics produced from such yarn have less tendency to initial shrinkage thus giving greater flexibility in the final finished width without encountering subsequent shrinkage. Another important advantage possessed by yarns treated in accordance with the present invention is their eminent suitability for the production of crepe yarns wherein the crepe twist is inserted in the presence of steam.

Yarns or fabrics treated with my conditioning fluids dye very readily since the composition of the fluid is such as to permit rapid wetting out and penetration of the filaments or yarns due to their softened nature and to the high emulsifiability of the composition. Moreover, fabrics made of such yarn do not tend to develop wrinkles or creases when dyed, delustered, scoured or subjected to other finishing treatments. This is an important factor in the case of the dyeing or delustering of hosiery or other knitted wears and in the case of dyeing or delustering woven fabrics on a winch or similar apparatus where the material is treated in folded form.

It is to be understood that the foregoing detailed description is merely given by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

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

1. Method of conditioning textile materials containing relatively high denier per filament fibers of organic derivatives of cellulose, which comprises applying thereto a conditioning fluid comprising a mineral oil, an inorganic electrolyte, a long-chain aliphatic alcohol and a sulfonated long-chain aliphatic carboxylic acid and then applying a conditioning fluid comprising a trialkylamine resinate, a lower aliphatic alcohol and a hygroscopic organic agent.

2. Method of conditioning yarns containing relatively high denier per filament fibers of cellulose acetate which comprises applying thereto a conditioning fluid comprising a mineral oil, an inorganic electrolyte, a long-chain aliphatic alcohol and a sulfonated long-chain aliphatic carboxylic acid and then applying a conditioning fluid comprising a trialkylamine resinate, a lower aliphatic alcohol and a hygroscopic organic agent.

3. Yarn comprising an organic derivative of cellulose containing relatively high denier per filament fibers having applied thereto a conditioning agent comprising a mineral oil, an electrolyte, a long-chain aliphatic alcohol and a sulfonated long-chain aliphatic carboxylic acid and then applied thereto a conditioning fluid comprising a trialkylamine resinate, a lower aliphatic alcohol and a hygroscopic organic agent.

4. Yarn comprising cellulose acetate containing relatively high denier per filament fibers having applied thereto a conditioning agent compris-

ing a mineral oil, sodium sulfate, oleyl alcohol and sulfonated oleic acid, and then applied thereto a conditioning fluid comprising triethanolamine resinate, methyl alcohol and glycerine.

5. A conditioning agent for the treatment of yarn containing an organic derivative of cellulose which comprises a lubricant oil, an electrolyte, an organic blending agent, and a sulfonated long-chain aliphatic carboxylic acid containing a sulfonic acid group and a carboxylic acid group.

6. A conditioning agent for the treatment of yarn containing an organic derivative of cellulose which comprises a lubricant oil, an electrolyte, a long-chain aliphatic alcohol, and a sulfonated long-chain aliphatic carboxylic acid containing a sulfonic acid group and a carboxylic acid group.

7. A conditioning agent for the treatment of yarn containing an organic derivative of cellulose which comprises a mineral oil, an electrolyte, a long-chain aliphatic alcohol, and a sulfonated long-chain aliphatic carboxylic acid containing a sulfonic acid group and a carboxylic acid group.

8. A conditioning agent for treatment of yarn containing cellulose acetate which comprises a mineral oil, an inorganic electrolyte, oleyl alcohol and a sulfonated long-chain aliphatic carboxylic acid containing a sulfonic acid group and a carboxylic acid group.

9. A conditioning agent for treatment of yarn containing cellulose acetate which comprises a mineral oil, an inorganic electrolyte, a long chain aliphatic alcohol, and sulfonated oleic acid.

10. A conditioning agent for treatment of yarn containing cellulose acetate comprising a mineral oil, sodium sulfate, oleyl alcohol, and sulfonated oleic acid.

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