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TREATMENT OF TEXTILE MATERIALS

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This invention relates to the treatment of filaments and yarns and relates more particularly to the conditioning of filaments or yarns made of organic derivatives of cellulose whereby the same are rendered more amenable to textile operations such as weaving or knitting. The invention also relates to fabrics which may be made from or contain organic derivative of cellulose yarns.

The principal object of the present invention is to condition filaments or yarns comprising organic derivatives of cellulose to improve their workability in textile operations such as spinning, twisting, coning, pirning, hanking, weaving, knitting and the like.

A further object of my invention is to treat yarns containing organic derivatives of cellulose with a conditioning fluid whereby they are rendered more pliable and therefore more adapted for use in textile operations such as knitting, wherein the yarns are subjected to sudden and frequent bends and turns.

A further object of the present invention is to treat organic derivative of cellulose yarns with a conditioning fluid containing different types of lubricants and softeners and other ingredients so that fabrics made from such yarns present a uniform appearance.

Still another object of the present invention is the preparation of a conditioning fluid for organic derivative of cellulose yarns which is stable, easily applied and does not deleteriously affect the yarn, even upon long standing. Other objects of my invention will appear from the following description and the appended claims.

Many substances such as vegetable and mineral oils, both normal and specially treated, have been employed for lubricating or conditioning yarns in order to render them more suitable for winding, twisting, weaving, knitting and the like. While these substances have resulted in some improvement in the yarns, they still left much to be desired and in addition presented problems of their own. Thus, the oils tend to gum or polymerize with time so that yarns lubricated or conditioned therewith, if not used promptly, do not run smoothly due to the hardening of the oil. Also such gumming or polymerization makes it difficult for the conditioning agent to be removed from the fabrics made with such yarns. The latter gives rise to streaks which are still further accentuated when the fabric is dyed. Also such compositions as were heretofore used would not always function evenly and smoothly due to uneven penetration into the yarns treated or difficulty in applying them uniformly.

I have found that these and other disadvantages arising out of the use of known conditioning fluids can be avoided by the use of conditioning fluids containing several ingredients, each possessing certain properties which render the combination highly useful in conditioning organic derivative of cellulose yarns. Yarns treated with such a composition behave much more satisfactorily in winding, twisting, weaving and knitting and like operations than do untreated yarns or yarns treated with known conditioning fluids. Moreover, I have found that yarns treated with my conditioning fluids are not deleteriously affected upon storage and in some cases may even be improved after being stored for a time. Other advantages are also imparted to the yarn by my conditioning fluid as will appear hereinafter.

In accordance with my invention I treat yarns containing organic derivatives of cellulose with a conditioning agent comprising substances which act as lubricants for yarn on yarn, as lubricants for yarn on metal or porcelain, agents to increase the penetrating and spreading power of the composition, substances which soften the fibers of the yarn, substances which aid in emulsifying the composition and also facilitate the removal of the same by scouring etc. after its work is done, for example, in the dyeing or finishing treatment of the fabric. Other materials may also be added to prevent or minimize the tendency for separation of the conditioning fluid when subjected to low temperatures, for example, in transportation, storage and the like.

The yarns to be treated in accordance with this invention may contain any suitable organic derivatives of cellulose such as organic esters of cellulose and cellulose ethers. Examples of organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate or mixed esters such as cellulose acetate butyrate or cellulose acetate propionate, while examples of cellulose ethers are ethyl cellulose, methyl cellulose and benzyl cellulose. However, I prefer to use cellulose acetate which may or may not be soluble in acetone. Specifically I prefer to use acetone-soluble cellulose acetate having an acetyl value of 52½% to 56%, preferably 54½% calculated as acetic acid.

This yarn need not consist wholly of yarns of organic derivatives of cellulose but may also contain fibers of other materials such as natural silk, artificial fibers of reconstituted cellulose, wool, cotton, etc. The yarns of organic derivatives of cellulose may be formed from continuous filaments or the same may be spun from short staples

or short lengths of such filaments and such spun yarn may also contain fibers of cotton, wool, etc.

This invention is applicable to the treatment of fine filaments, or a plurality of such fine filaments associated together in the form of yarn or larger filaments such as artificial bristles, horsehair, straw and the like, and also to fabrics or other articles formed therefrom. If desired, the yarns or other textile material made or treated in accordance with this invention may have finely divided pigment-like material, such as titanium dioxide, antimony trioxide, stannic oxide, starch, highly melting insoluble organic compounds and the like, incorporated therein, whereby they have a subdued luster. This lubricant is also satisfactory for yarns in which a transparent pigment has been added to alter the characteristics of the yarn without subduing the luster.

As pointed out above, my conditioning agent comprises a mixture of several ingredients. This mixture is highly lubricative not only as between the yarn and the metal or porcelain parts it may contact in the various operations but also as between yarn and yarn, thereby facilitating the various operations such as coning, hanking, twisting, winding, warping, reeling, weaving, knitting and other textile operations. Moreover, the composition of this mixture is such that it can be applied uniformly very easily with the conventional devices, and it wets or penetrates the yarns or fabrics very quickly. The yarn treated with this conditioning fluid is softened so that it can be easily processed with little or no static being developed. Furthermore, the conditioning agent is readily emulsifiable due to the amine soap formed therein, rendering it easily removable in the usual dyeing and scouring treatments to which fabrics are subjected.

My novel conditioning fluid comprises a mixture of white mineral oil, a sulphonated vegetable oil such as olive oil, an aryl phosphate such as tricresyl phosphate, a fatty acid and an alkylolamine. An animal oil lubricant such as sperm oil may also be present. White mineral oils, preferably those with a paraffin base, having a viscosity of 65 to 75 seconds (Saybolt Universal at 100° F.) have been found to give the best results in this mixture. The sulphonated vegetable oil serves to soften the yarn and the best results are obtained with an oil-soluble sulphonated olive oil. This may be replaced in whole or in part by sulphated alcohols or by oxidized oils of the type of oxidized sperm, olive and teaseed oils which have the same function and are referred to herein as softening agents for the fibers. The addition of sperm oil has been found to enhance the effects of both the mineral oil and the sulphonated vegetable oil, particularly in improving the yarn on yarn lubrication. With reference to the aryl phosphate, I have found that the best results are obtained by the use of tricresyl phosphate. This appears to have a beneficial effect on all of the individual ingredients of the conditioning agents, increasing the lubricative value of the oils, reducing the development of static, increasing the mutual solubility of the several constituents, lowering the viscosity of the conditioning fluid as a whole and improving the wetting power of the same. The emulsifiability of the conditioning fluid is improved by the presence of an amine soap which is preferably formed in the fluid itself by adding thereto a hydroxylated amine, such as triethanolamine, and a fatty acid such as oleic acid. The amine and the fatty acid are preferably added in stoichiometric proportions, so that no separation results on cooling. The presence of this soap also renders it unnecessary to add any anti-static agent even if the yarn is used for warping, and also increases the wetting out and penetration of a water soluble size prior to weaving.

The proportions of the several ingredients may be varied to some degree, depending somewhat on the use to which the yarn is to be put and the properties which it is desired to emphasize. Thus where it is desired to increase the spreading and wetting properties the amount of tricresyl phosphate may be increased. Where the hand of the yarn is of special importance the amount of sulphonated oil or softening agent should be increased. Also the amount of mineral oil can be varied from 50–75% depending on the lubricity desired, the mode of application and the like.

In order further to illustrate my invention but without being limited thereto, the following specific examples of suitable conditioning fluids are given.

Example I

	Parts by weight
White mineral oil, 60 to 75 seconds viscosity	70.0
Oil-soluble sulphonated olive oil	5.0
Sperm oil	2.5
Tricresyl phosphate	8.4
Oleic acid	9.2
Triethanolamine	4.9

Example II

	Parts by weight
White mineral oil, 50 seconds viscosity	64.3
Tricresyl phosphate	11.6
Oleic acid	10.9
Triethanolamine	5.7
Sulphonated olive oil	5.0
Sperm oil	2.5

Example III

	Parts by weight
White mineral oil, 60 to 70 seconds viscosity	62.5
Tricresyl phosphate	7.60
Oleic acid	8.30
Triethanolamine	4.35
Sperm oil	2.25
Technical oleyl alcohol	0.45
Oxidized olive, sperm or teaseed oil	14.5

Example IV

	Parts by weight
White mineral oil, 60 to 70 seconds viscosity	62.5
Oil-soluble sulphonated olive oil	4.5
Sperm oil	2.25
Tricresyl phosphate	7.60
Oleic acid	8.3
Triethanolamine	4.4
Oleyl alcohol	0.45
Oxidized olive, sperm or teaseed oil	10.00

Example V

	Parts by weight
White mineral oil, 65 to 75 seconds viscosity	71.8
Oil-soluble sulphonated olive oil	5.15
Tricresyl phosphate	8.60
Oleic acid	9.45
Triethanolamine	5.00

0.5% commercial oleyl, lauryl and similar alcohols may be added to the above formulae to decrease separation tendencies when subjected to low temperatures encountered in transportation and the like.

As stated above, it is preferred to balance the triethanolamine and oleic acid so that stoichio-

metric proportions are obtained. The excess of triethanolamine causes an undesirable increase in the viscosity of the conditioning fluid while an excess of oleic acid has a tendency to sensitize the yarn to delustering on storage. However, it is possible to decrease the triethanolamine to a considerable degree where it is desired to reduce the viscosity of the conditioning fluid and to lower the cloud point. This reduction in the amount of amine, however, renders the oil more difficultly emulsifiable. Where it is desired to obtain emulsification in order to facilitate application by emulsion methods or removal by simple washing, the viscosity of the conditioning fluid may be reduced by substituting a portion of the triethanolamine with a non-hydroxylated amine, as for instance, triamylamine, butyldiamylamine and other amines of high boiling point and low vapor pressure. The compatibility of the ingredients may be increased without seriously altering the lubricative qualities of the conditioning fluid by substituting naphthenic-base petroleum oils for the mineral oils.

The conditioning fluids preferably have a viscosity (Saybolt Universal, 100° F.) of 80 to 200 seconds. They may be applied by means of wicks, rollers, discs or other suitable furnishing devices to the cellulose acetate filaments immediately after leaving the dry spinning machine and prior to their being wound or twisted and wound, or they may be applied to the yarns during any subsequent textile operation. They are self-emulsifying in water and may be applied as such either with or without a cellulose acetate dyeing or tinting material. If the yarn is intended primarily for knitting purposes the amount of conditioning liquid applied will be from 1 to 10% of the weight of the yarn. If the yarn is intended primarily for weaving the amount of conditioning liquid applied may be only 1 to 5% of the weight of the yarn.

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

Yarns treated in accordance with this invention are very pliable and flexible and may be subjected to operations such as coning, pirning, 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 organic derivatives of cellulose, which comprises applying thereto a conditioning fluid comprising a mineral oil, a softening agent for the organic derivative of cellulose, an aryl phosphate, a higher fatty acid and an alkylolamine.

2. Method of conditioning textile materials containing organic derivatives of cellulose, which comprises applying thereto a conditioning fluid comprising a mineral oil, a sulphonated vegetable oil, an aryl phosphate, a higher fatty acid and an alkylolamine.

3. Method of conditioning textile materials containing organic derivatives of cellulose, which comprises applying thereto a conditioning fluid comprising a mineral oil, a sulphonated vegetable oil, and aryl phosphate, a higher fatty acid, an alkylolamine and oleyl alcohol.

4. Method of conditioning textile materials containing cellulose acetate, which comprises applying thereto a conditioning fluid comprising a mineral oil, a sulphonated vegetable oil, an aryl phosphate, a higher fatty acid and an alkylolamine.

5. Method of conditioning yarns containing organic derivatives of cellulose, which comprises applying thereto a conditioning fluid comprising a water-white mineral oil, a softening agent for the organic derivative of cellulose, sperm oil, a triaryl phosphate, a higher fatty acid and an alkylolamine.

6. Method of conditioning yarns containing cellulose acetate, which comprises applying thereto a conditioning fluid comprising a water-white mineral oil, a sulphated alcohol, sperm oil, a tricresyl phosphate, a higher fatty acid and an ethanolamine.

7. Method of conditioning yarns containing cellulose acetate, which comprises applying thereto a conditioning fluid comprising a water-white mineral oil, an oxidized oil of the type of oxidized sperm, olive and teaseed oils, sperm oil, a tricresyl phosphate, a higher fatty acid and an ethanolamine.

8. Method of conditioning yarns containing

cellulose acetate, which comprises applying thereto a conditioning fluid comprising 70 parts of water-white mineral oil having a viscosity of 60 to 75 seconds, 5.0 parts of oil-soluble sulphonated olive oil, 2.5 parts sperm oil, 8.4 parts of tricresyl phosphate, 9.2 parts of oleic acid and 4.9 parts of triethanolamine.

9. Method of conditioning yarns containing cellulose acetate, which comprises applying thereto a conditioning fluid comprising 69.5 parts of water-white mineral oil having a viscosity of 60 to 75 seconds, 5.0 parts of oil-soluble sulphonated olive oil, 2.5 parts sperm oil, 8.4 parts of tricresyl phosphate, 9.2 parts of oleic acid, 4.9 parts of triethanolamine and 0.5 part of oleyl alcohol.

10. Method of conditioning yarns containing cellulose acetate, which comprises applying thereto a conditioning fluid comprising 62.5 parts of water-white mineral oil having a viscosity of 60 to 70 seconds, 7.60 parts of tricresyl phosphate, 8.30 parts of oleic acid, 4.35 parts of triethanolamine, 2.25 parts of sperm oil, 0.45 part of technical oleyl alcohol and 14.5 parts of oxidized olive, sperm or teaseed oil.

11. Textile material comprising an organic derivative of cellulose having applied thereto a conditioning agent comprising a mineral oil, a softening agent for the organic derivative of cellulose, an aryl phosphate, a higher fatty acid and an alkylolamine.

12. Textile material comprising cellulose acetate having applied thereto a conditioning agent comprising a mineral oil, a softening agent for the cellulose acetate, an aryl phosphate, a higher fatty acid and an alkylolamine.

13. Yarn comprising an orangic derivative of cellulose having applied thereto a conditioning agent comprising a mineral oil, a sulphonated vegetable oil, an animal oil, an aryl phosphate, a higher fatty acid and an alkylolamine.

14. Yarn comprising an organic derivative of cellulose having applied thereto a conditioning agent comprising a mineral oil, an oxidized oil of the type of oxidized sperm, olive and teaseed oils, an animal oil, an aryl phosphate, a higher fatty acid and an alkylolamine.

15. Yarn comprising cellulose acetate having applied thereto a conditioning agent comprising a water-white mineral oil, an oxidized oil of the type of oxidized sperm, olive and teaseed oils, sperm oil, a tricresyl phosphate, a higher fatty acid and an ethanolamine.

16. Yarn comprising an organic derivative of cellulose having applied thereto a conditioning agent comprising a water-white mineral oil having a viscosity of 60 to 75 seconds, an oil-soluble sulphonated olive oil, sperm oil, tricresyl phosphate, oleic acid and an alkylolamine.

17. Yarn comprising an organic derivative of cellulose having applied thereto a conditioning agent comprising a water-white mineral oil having a viscosity of 60 to 75 seconds, an oil-soluble sulphonated olive oil, sperm oil, tricresyl phosphate, oleic acid, an alkylolamine and oleyl alcohol.

18. Yarn comprising cellulose acetate having applied thereto a conditioning agent comprising a water-white mineral oil having a viscosity of 60 to 75 seconds, an oil-soluble sulphonated olive oil, sperm oil, tricresyl phosphate, oleic acid and triethanolamine, the latter two ingredients being present in stoichiometric proportions to form a soap.

19. Yarn comprising an organic derivative of cellulose having applied thereto a conditioning agent comprising 70 parts of water-white mineral oil having a viscosity of 60 to 75 seconds, 5.0 parts of oil-soluble sulphonated olive oil, 2.5 parts sperm oil, 8.4 parts of tricresyl phosphate, 9.2 parts of oleic acid and 4.9 parts of triethanolamine.

20. Yarn comprising an organic derivative of cellulose having applied thereto a conditioning agent comprising 69.5 parts of water-white mineral oil having a viscosity of 60 to 75 seconds, 5.0 parts of oil-soluble sulphonated olive oil, 2.5 parts sperm oil, 8.4 parts of tricresyl phosphate, 9.2 parts of oleic acid, 4.9 parts of triethanolamine and 0.5 part of oleyl alcohol.

21. Yarn comprising cellulose acetate having applied thereto a conditioning agent comprising 62.5 parts of water-white mineral oil having a viscosity of 60 to 70 seconds, 7.60 parts of tricresyl phosphate, 8.30 parts of oleic acid, 4.35 parts of triethanolamine, 2.25 parts of sperm oil, 0.45 part of technical oleyl alcohol and 14.5 parts of oxidized olive, sperm or teaseed oil.

22. A conditioning agent for the treatment of textile materials containing an organic derivative of cellulose which comprises a mineral oil, a softening agent for the organic derivative of cellulose, an aryl phosphate, a higher fatty acid and an alkylolamine.

23. A conditioning agent for the treatment of textile materials containing an organic derivative of cellulose which comprises a mineral oil, a softening agent for the organic derivative of cellulose, an aryl phosphate, a higher fatty acid, an alkylolamine and a member selected from the group consisting of oleyl and lauryl alcohols.

24. A conditioning agent for the treatment of textile materials containing an organic derivative of cellulose which comprises a water-white mineral oil, a sulphonated vegetable oil, a triaryl phosphate, a higher fatty acid and an alkylolamine.

25. A conditioning agent for the treatment of textile materials containing an organic derivative of cellulose which comprises a water-white mineral oil, an oxidized oil of the type of oxidized sperm, olive and teaseed oils, sperm oil, a triaryl phosphate, a higher fatty acid and an alkylolamine.

26. A conditioning agent for the treatment of yarn containing an organic derivative of cellulose which comprises a water-white mineral oil, a partially sulphonated vegetable oil, sperm oil, a tricresyl phosphate, a higher fatty acid and an ethylolamine.

27. A conditioning agent for the treatment of yarn containing an organic derivative of cellulose which comprises a water-white mineral oil having a viscosity of 60 to 75 seconds, an oil-soluble sulphonated olive oil, sperm oil, tricresyl phosphate, oleic acid and an alkylolamine.

28. A conditioning agent for the treatment of yarn containing an organic derivative of cellulose which comprises a water-white mineral oil having a viscosity of 60 to 75 seconds, an oil-soluble sulphonated olive oil, sperm oil, tricresyl phosphate, oleic acid and triethanolamine, the latter two ingredients being present in stoichiometric proportions to form a soap.

29. A conditioning agent for the treatment of yarn containing an organic derivative of cellulose which comprises a water-white mineral oil having a viscosity of 60 to 75 seconds, an oil-soluble sulphonated olive oil, sperm oil, tricresyl phosphate, oleyl alcohol, oleic acid and triethanol-

amine, the latter two ingredients being present in stoichiometric proportions to form a soap.

30. A conditioning agent for the treatment of yarn containing an organic derivative of cellulose which comprises 70 parts of water-white mineral oil having a viscosity of 60 to 75 seconds, 5.0 parts of oil-soluble sulphonated olive oil, 2.5 parts sperm oil, 8.4 parts of tricresyl phosphate, 9.2 parts of oleic acid and 4.9 parts of triethanolamine.

31. A conditioning agent for the treatment of yarn containing an organic derivative of cellulose which comprises 62.5 parts of water-white mineral oil having a viscosity of 60 to 70 seconds, 7.60 parts of tricresyl phosphate, 8.30 parts of oleic acid, 4.35 parts of triethanolamine, 2.25 sperm oil, 0.45 part of technical oleyl alcohol and 14.5 parts of oxidized olive, sperm or teaseed oil.

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