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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 objects 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.

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.

Another object of this invention is the provision of a conditioning fluid for filaments or yarns which will be non-toxic to the system and non-irritating to the skin of the workers handling the same.

Still another object of this invention is the provision of an improved textile material made of or containing organic derivative of cellulose yarns having applied thereto a conditioning fluid of the present invention.

Other objects of our invention will appear from the following detailed 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 improvements 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.

We 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, we have found that yarns treated with our conditioning fluids are not deleteriously affected upon storage and in some cases may even be improved after being stored for a time. Furthermore, the conditioning fluid of our invention is not only non-toxic to the system of the worker but also does not cause dermatitis. Other advantages are also imparted to the yarn by our conditioning fluid as will appear hereinafter.

In accordance with our invention we 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 act as anti-oxidants for the lubricants and which may 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 propionate and cellulose butyrate or mixed esters such as cellulose acetate-butyrate or cellulose acetate-propionate, while examples of cellulose ethers are ethyl cellulose and benzyl cellu-

lose. However, we prefer to use cellulose acetate which may or may not be soluble in acetone. Specifically we 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, high-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, our 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. The conditioning fluid of this invention applied to yarn also prevents the formation of static electricity thereon in any textile operation to which said yarn is subjected. 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.

Our novel conditioning fluid comprises a mixture of a white mineral oil, a modified vegetable oil, an alkylated phenol or other wetting agent, a fatty acid and an alkylolamine. A blending agent such as oleyl alcohol may also be present. The replacement in the mixture of a part or all of the alkylated phenol by an acylated vegetable oil has been found advantageous where the yarns treated have a basis of an ester of cellulose.

The white mineral oil employed in the conditioning fluid of our invention may be one having a paraffinic or naphthenic base and a viscosity of 50 to 75 seconds. This viscosity and those given hereinafter are Saybolt Universal at 100° F. However, the viscosity of the mineral oil employed is determined by the over-all viscosity desired in the conditioning fluid or, in other words, the limit of viscosity of the mineral oil is set by the over-all viscosity of the conditioning fluid which can be handled in application. This over-all viscosity may be on the order of 80 to 200 seconds and preferably about 150 seconds. In the mixture comprising our novel conditioning fluid, optimum results are obtained using a mineral oil having a paraffinic base and a viscosity of 50 seconds.

The modified vegetable oil serves to soften the yarn and the best results are obtained with oxidized peanut oil. This oil may be replaced in whole or in part by sulphonated olive oil, sulphated alcohols or by oxidized sperm, olive or teaseed oils, all of which have the same function and are referred to herein as softening agents for the yarn.

The alkylated phenol employed in the present conditioning fluid has a beneficial effect on all of the individual ingredients thereof. This ingredient increases lubricating value of the oils, reduces the development of static, increases the mutual solubility of the several constituents, lowers the viscosity of the conditioning fluid as a whole and improves the wetting power of the same. While we prefer to employ diamyl phenol in our conditioning fluid, other alkylated phenols such as dibutyl and diamyl derivatives of cresols and xylenols are also usable alkylated phenols in accordance with our invention. These dibutyl and diamyl derivatives may be prepared from any of the individual pure cresols and xylenols or from technical grades of mixed cresols and cresylic acids. The dibutyl and diamyl derivatives of any of the mono-chlorophenols are also usable in our novel conditioning fluid.

The alkylated phenol not only acts as an antioxidant but also governs the penetration and spread of the conditioning fluid in and on the yarn and stabilizes the conditioning fluid. The alkylated phenol, moreover, differs from the phenol compounds heretofore employed in that it does not cause dermatitis among the workers handling the yarn. The alkylated phenols normally have a compatibility with cellulose derivatives of 1 to 50%, diamyl phenol having a compatibility of about 20%. The compatibility of phenol derivatives and of acylated vegetable oils with cellulose derivatives is determined by preparing films of the cellulose derivative and the material or compound whose compatibility is being tested. The films are prepared from solutions of the cellulose derivative and the phenol or vegetable oil derivative in a suitable volatile solvent such as acetone by pouring said solutions on a glass or metal plate. After the solvent has evaporated, the film remaining will be clear if the limit of compatibility has not been exceeded. The maximum percentage by weight of the phenol or vegetable oil derivative present in a clear film is the compatibility.

As stated above, the presence of an organic ester of vegetable oil in the conditioning fluid is highly desirable, particularly when the yarn being treated is one having a basis of an organic ester of cellulose. Examples of such vegetable oil organic esters are the formyl, acetyl, propionyl and butyryl esters of castor oil or castor oil derivatives, specific examples being acetylated castor oil and butyl acetyl ricinoleate. The acetylated vegetable oils have a greatly increased degree of compatibility with the yarn over the unacylated vegetable oils, thereby enhancing the spreading power and wetting out action of the conditioning fluid or dressing. The acetylated vegetable oils may be employed in amounts of from 1 to 10% by weight of the conditioning fluid.

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 if it is desired to increase the spreading and wetting properties the amount of alkyl phenol, etc., 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 to 75% depending on the lubricity desired, the mode of application and the like.

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

Example I

	Per cent
Paraffin base white mineral oil (50 seconds vis.)	55.6
Oxidized peanut oil (110 vis.)	18.5
Oleic acid	10.7
Diamyl phenol	9.7
Triethanolamine	4.98
Olelyl alcohol	0.55

The foregoing mixture results in a conditioning fluid having a viscosity of 165 seconds.

Example II

	Per cent
Paraffin base white mineral oil (50 seconds vis.)	56
Oxidized peanut oil (100 vis.)	19
Oleic acid	10
Diamyl phenol	9.25
Triethanolamine	4.75
Oleyl alcohol	1

The foregoing mixture results in a conditioning fluid having a viscosity of 149 seconds.

Example III

	Per cent
Paraffin base white mineral oil (50 seconds vis.)	52
Oxidized peanut oil (100 vis.)	22
Butyl acetyl ricinoleate	10
Oleic acid	10
Triethanolamine	5
Oleyl alcohol	1

The foregoing mixture results in a conditioning fluid having a viscosity of 146 seconds.

Example IV

	Per cent
Paraffin base white mineral oil (50 seconds vis.)	54.5
Oxidized peanut oil (100 vis.)	20
Oleic acid	10.25
Butyl acetyl ricinoleate	5
Diamyl phenol	4.5
Triethanolamine	4.75
Oleyl alcohol	1

The foregoing mixture results in a conditioning fluid having a viscosity of 146 seconds.

Example V

	Per cent
Paraffin base white mineral oil (50 seconds vis.)	55.05
Oxidized peanut oil (100 vis.)	20.2
Oleic acid	10.35
Triethanolamine	4.80
Butyl acetyl ricinoleate	5.05
Diamyl phenol	4.55

The foregoing mixture results in a conditioning fluid having a viscosity of 150 seconds.

Example VI

	Per cent
Paraffin base white mineral oil (50 seconds vis.)	53.75
Oxidized peanut oil (100 vis.)	19.75
Oleic acid	10
Butyl acetyl ricinoleate	5
Diamyl phenol	4.5
Triethanolamine	3
Octadecenyl amine	3
Oleyl alcohol	1

The foregoing mixture results in a conditioning fluid having a viscosity of 135 seconds.

Example VII

	Per cent
Paraffin base white mineral oil (50 seconds vis.)	56
Oxidized peanut oil (100 vis.)	21
Oleic acid	5
Cocoanut oil diethanolamide	5
Acetylated castor oil	5
Diamyl phenol	4.5
Triethanolamine	1.5
Octadecenyl amine	1
Oleyl alcohol	1

The foregoing mixture results in a conditioning fluid having a viscosity of 130 seconds.

Example VIII

	Per cent
Twitchell oil	70
Oxidized peanut oil (100 vis.)	20
Butyl acetyl ricinoleate	5
Diamyl phenol	5

The foregoing mixture results in a conditioning fluid having a viscosity of 130 seconds.

Example IX

	Per cent
Twitchell oil	80
Oxidized peanut oil (100 vis.)	12½
Diamyl phenol	5
Acetylated castor oil	2½

The foregoing mixture results in a conditioning fluid having a viscosity of 142 seconds.

The Twitchell oil employed in Examples VIII and IX above consists of a paraffin base mineral oil, sulphonated oil, vegetable oils and soap. More specifically the Twitchell oil employed contains 76% of mineral oil, 13% of a saponifiable oil, such as synthetic trioleic acid ester of glycerol, natural vegetable oil, or glycerol diester, 9% of soap and 2% of sulphonated mineral oil.

In those of the foregoing examples which contain triethanolamine, the amount of the triethanolamine may be decreased 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 conditioning fluids 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 our 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 on or 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 our 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 our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. Yarn having a basis of cellulose acetate having applied thereto a conditioning agent comprising a paraffin base white mineral oil having a viscosity of about 50 seconds Saybolt Universal at 100° F., an oxidized peanut oil, diamyl phenol, butyl acetyl ricinoleate, oleic acid and triethanolamine.

2. A conditioning fluid for the treatment of textile materials comprising a mineral oil, an oxidized vegetable oil, a compound selected from the group consisting of dibutyl and diamyl derivatives of phenols, an acyl derivative of an ester of a hydroxylated higher fatty acid in which the acyl radicle is derived from a lower fatty acid, oleic acid, triethanolamine and oleyl alcohol.

3. A conditioning fluid for the treatment of textile materials comprising a mineral oil, an oxidized vegetable oil, a compound selected from the group consisting of dibutyl and diamyl derivatives of phenols acetylated castor oil, oleic acid, triethanolamine and oleyl alcohol.

4. A conditioning fluid for the treatment of textile materials comprising a mineral oil, an oxidized vegetable oil, a compound selected from the group consisting of dibutyl and diamyl derivatives of phenols, dibutyl acetyl ricinoleate, oleic acid, triethanolamine and oleyl alcohol.

5. A conditioning fluid for the treatment of textile materials comprising a mineral oil, an oxidized vegetable oil, a compound selected from the group consisting of dibutyl and diamyl derivatives of phenols, oleic acid, triethanolamine and oleyl alcohol.

6. A conditioning fluid for the treatment of textile materials comprising a mineral oil, an oxidized vegetable oil, an acyl derivative of an ester of a hydroxylated higher fatty acid in which the acyl radicle is derivative from a lower fatty acid, oleic acid, triethanolamine and oleyl alcohol.

7. A conditioning fluid for the treatment of textile materials having a basis of an organic derivative of cellulose, said conditioning fluid comprising a white mineral oil, an oxidized vegetable oil, a compound selected from the group consisting of dibutyl and diamyl derivatives of phenols, an acetylated vegetable oil, a higher fatty acid, an alkylolamine and oleyl alcohol.

8. A conditioning fluid for the treatment of yarn having a basis of an organic derivative of cellulose, said conditioning fluid comprising a paraffin base white mineral oil having a viscosity of about 50 seconds Saybolt Universal at 100° F., an oxidized peanut oil, diamyl phenol, butyl acetyl ricinoleate, oleic acid, triethanolamine and oleyl alcohol.

GEORGE W. SEYMOUR.
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CERTIFICATE OF CORRECTION.

Patent No. 2,385,423. September 25, 1945.

GEORGE W. SEYMOUR, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 9, for "objects" read --object--; page 3, first column, line 75, for "156 seconds" read --148 seconds--; page 4, second column, line 51, claim 6, for "derivative" read --derived--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of December, A. D. 1945.

Leslie Frazer

(Seal) First Assistant Commissioner of Patents.