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FIBER TREATING COMPOSITIONS

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This invention relates to the lubrication and conditioning of textile yarns and filaments. More particularly this invention concerns method and treating composition particularly applicable to cellulose ester yarns and filaments for rendering such filaments amenable to a variety of textile operations such as warping, weaving, knitting, spinning, carding and the like.

As is well-known in the manufacture of most types of yarns, it is necessary to treat the yarn in order to reduce the tendency of the yarn toward breakage of the individual filaments or fibers when they are subjected to various mechanical strains. It is necessary to lubricate the yarn in order to facilitate the handling of the yarn in operations as aforementioned, such as spinning, twisting, winding and various other operations.

The treatment of yarns is a complex problem and a diversity of materials has been suggeted to meet the demands of such treatment. There are numerous different types of yarns, which yarns vary not only in their physical make-up, but there is considerable variance in their chemical composition. While certain treating agents may function quite satisfactory on one type of yarn, such agents are of little or no value on other types of yarn. The treatment of yarns made up of derivatives of cellulose presents certain specialized problems.

It has been conventional in the treatment of cellulose ester yarns in some instances to use one treatment which provides for the lubrication thereof, and then in one or more separate treatments to make separate applications of treating agents for other purposes. It is apparent therefore that there could be savings accomplished, as well as other advantages obtained if it were possible to provide a treating agent which not only suitably processed the yarn from the frictional and static standpoint, but at the same time accomplished filament bonding and other desired action.

After extended investigation we have found a combination of a plurality of ingredients which will be described in detail hereinafter and which not only lubricates the yarn, but also additionally imparts certain other desirable properties to the yarn. We have further found that this composition of the present invention is particularly useful in the treatment of cellulose ester types of yarn.

This invention has for one object to provide a blend of a plurality of materials into a single treating agent formulation which may be applied to yarn in a single application and which provides on such yarn not only good antistatic and frictional qualities, but imparts further qualities thereto such as filament bonding action and the like. Another object is to provide a yarn treating composition and method of application thereof to cellulose ester yarns which renders such yarns readily amenable for textile operations, such as weaving, throwing, warping and knitting, without the need of further separate application to such treated yarn of sizing materials and/or a high degree of twist. Another and particularly useful object of this invention is to accomplish not only the lubrication and bonding of yarn as aforesaid, but at

the same time to accomplish this without impairing the abrasion resistance of the yarn which may be sized with gelatin, Stymer S, Elvadex or other sizes commercially used in the trade. A still further object is to provide a method and composition for treating yarn as indicated, which has the advantage of having a surface which exhibits good weaving characteristics but which surface is compatible to sizing with conventional sizes if such sizing is desired. Still another object is to provide a yarn treating composition which may be applied to the treatment of cellulose ester yarns early in the yarn manufacture, such as when the yarn emerges from the spinning apparatus. Another object is to provide a treated cellulose ester yarn such as a yarn comprised of cellulose acetate, cellulose propionate, cellulose acetate propionate or cellulose acetate butyrate, which yarn in its treated condition not only exhibits good frictional and antistatic characteristics, but which, without further treatment is in condition for use for warping, throwing, filling and knitting. Other objects will appear hereinafter.

We have found certain combination of materials which may be mixed together in various proportions to form a compatible composition. This composition not only provides effective lubrication and antistatic treatment to both continuous filament and cut staple, but additionally produces filament bonding. This bonding is sufficient in itself to impart to the yarn good weaving characteristics. However, we have found that our composition is such that our treatment is compatible with other treatments which textile manufacturers may want to additionally apply to yarn. That is, our treated yarn is such that the purchaser of the yarn may further treat the yarn with sizes and various other treating agents of the purchaser's choice for rendering the yarn more adaptable to certain specific purposes, such treatment being applicable to our yarn without the prior removal of our treating agent.

The foundation components of our fiber treating agent comprise the four ingredients:

A. Mineral oil, 10–80 parts by weight. This oil would have 50–150 seconds Saybolt Universal viscosity at 100° F.

B. The next ingredient, in the amount of 4–20 parts, comprises an aliphatic alkyl acid phosphate (specifically illustrated by oleyl acid phosphate). A portion of this phosphate may be replaced by an aliphatic alkyl sulfate.

C. The next ingredient, 1–10 parts of an alkylol amine, is exemplified by dimethyl aminoethanol or aminomethyl propanol.

D. The next ingredient comprises from 1–15 parts of a long chain aliphatic acid, exemplified by oleic acid.

These ingredients just described would function principally to improve the lubricity and static properties of the yarn. However, to accomplish in addition yarn bonding and the like action, certain other components are added.

Component E, which is a waxy material, and for convenience of reference may be so referred to herein, comprises a mixture of sulfonated animal fats, vegetable oils, and high melting vegetable fats (having a saponification value above 200). The particular animal and vegetable products employed are not a limitation on the present invention. The sulfonated animal fats comprise a source of sulfonated glyceryl esters of higher fatty acids, e.g. palmitic, stearic, and oleic esters of glycerin. The vegetable oils comprise a source of lauric, myristic, stearic, oleic, linoleic, caprylic, and caproic esters of glycerin. The vegetable fats, sometimes called waxes in the trade due to their physical characteristics, comprise a source of glyceryl esters of higher fatty acids, such as palmitic, stearic, and oleic acids, and with a proportion of long chain dibasic acids. These components are blended by means of amines which form soaps with free fatty acids

which are present in the mixture. Various amines may be used for this purpose, such as monoethanolamine, diethanolamine, triethanolamine, 2-amino - 2 - methyl-1-propanol, N,N-diethylaminoethanol, morpholine and other such amines. This waxy material may be present in the amount in the aggregate of from 4–50 parts by weight.

Component F comprises 1–15 parts of a compound we generically refer to as a glycol ether. Preferably there would be used an alkyl aryl ether of polyethylene glycol. The glycol ethers and waxy material referred to above are available commercially.

For still further improving the composition there is added G, a tartrate in an amount between 4–15 parts, exemplified by an alkyl tartrate such as dibutyl tartrate.

It would seem from the foregoing that our treating composition in its broader aspects is made up of a conventional lubricating constituent, namely an oil, to which there is added one or more special surface active agents, namely a phosphate and/or a sulfate, then alkylol amines and acids for still further improving the lubricity and antistatic functions, then components which supply fiber binding properties and finally components such as tartrates for causing the blending in and obtaining of a compatible composition.

In place of, or as a supplement to, constituents such as E, F and G, as well as constituent C, there may be used various other compounds such as imidazoline, terpene glycol ethers and the like as will be apparent from the detailed examples which follow.

The above composition containing the several ingredients A—G aforementioned, may be conveniently prepared as follows. The appropriate amount of mineral oil is placed in a suitable apparatus which is provided with a stirrer. To this mineral oil, with agitation, all the ingredients, excepting E, the waxy material, may be added directly to the mineral oil. Preferably the formulation is accomplished by heating the mixture of ingredients to a temperature of 70–80° C., and as indicated applying stirring. To such a warm mixture would then be added the constituent E, allowing the constituent E which is a solid, to melt into the mixture. Gentle stirring is continued until a smooth homogeneous blend of all the ingredients is accomplished.

Our fiber treating composition as described is thoroughly dispersed over the fibers in application thereto and the fibers obtained are substantially antistatic so that a superior degree of lubrication and conditioning of the fibers is achieved. Fibers treated with our composition, upon testing have been observed to be superior in various textile operations due to the filament protection offered by the bundle of fibers obtained by the filaments being held in place with respect to each other by the treating composition of the present invention. That is, our composition as aforesaid, in addition to being an excellent lubricant for cellulose ester yarn, exhibits the additional benefit of binding the cellulose ester filaments into a bundle throughout the various processing operations.

A further understanding of our invention will be had from a consideration of the following examples which are set forth for illustrating certain preferred embodiments of our composition and its use.

Example I

The lubricating and conditioning composition (designated Example I agent) described below was applied as a 25% aqueous emulsion to 150 denier, 38 filament, bright cellulose acetate yarn and was tested for its static electricity, kinetic friction over porcelain and steel surfaces, and slow speed friction over a steel surface and abrasion resistance of sized yarn. The values for Agent I were compared with those for a similar yarn treated with another material identified as Oil B, but tested in the same manner. The units are arbitrary.

	Example I Agent	Oil B
Percent Lubricant	1.96	2.22
Static Electricity:		
Porcelain Surface	−1	−1
Steel Surface	0	0
Kinetic Friction:		
Porcelain Surface	26	29
Steel Surface	23.5	28.5
Slow Speed Friction	19.4	29.0
Abrasion Resistance of Sized Yarn (Strokes):		
Gelatin	39	21.9
Stymer S	44.0	28.9

The composition of the Example I agent is as follows:

	Percent
Mineral oil	49.0
Oleyl acid phosphate	16.0
Oleic acid	10.0
N,N-dimethyl aminoethanol	6.0
Dibutyl tartrate	10.0
Alkyl aryl ether	4.0
Waxy material comprising a blend of sulfonated animal fats, vegetable oils, vegetable fats and amine soaps	5.0

Example II

The lubricating and conditioning composition which is described below as Example II agent, was applied to 150 denier, 38 filament bright cellulose acetate yarn and was tested for its static electricity, kinetic friction over porcelain and steel surfaces, slow speed friction over a steel surface, and abrasion resistance of sized yarn. The values were compared with those for a similar yarn lubricated with another material identified as Oil C, but tested in the same manner. The units are arbitrary.

	Example II Agent	Oil C
Percent Lubricant	2.09	2.01
Static Electricity:		
Porcelain Surface	0	−1
Steel Surface	0	−1
Kinetic Friction:		
Porcelain Surface	27.0	28.5
Steel Surface	28.0	28.5
Slow Speed Friction	18.0	31.0
Abrasion Resistance of Sized Yarn (Strokes):		
Gelatin	51.0	40.0
Stymer S	90	49

The composition of the Example II agent is as follows:

	Percent
Mineral oil	62.7
Terpene glycol ether	8.5
Oleic acid	4.3
2-amino-2-methyl-1-propanol	3.0
Lauryl sulfate	4.0
Oleyl acid phosphate	4.5
Imidazoline	3.0
Waxy material comprising a blend of sulfonated animal fats, vegetable oils, vegetable fats, and amine soaps	10.0

Example III

A lubricating and conditioning composition which is described below as Example III agent was applied to 150 denier, 38 filament low twist, bright cellulose acetate yarn and was tested as a filling yarn in a critical weaving construction. The resultant fabric was graded for total filling defects and the values were compared with those for a similar yarn treated with Oil D.

	Total defects due to filling yarn
Example III agent	17
Oil D	73

The composition of this agent of Example III is as follows:

	Percent
Mineral oil	37.0
Oleic acid	9.0
Oleyl acid phosphate	14.0
N,N-dimethyl aminoethanol	6.0
Dibutyl tartrate	10:0
Alkyl aryl ether	4.0
Waxy material comprising a blend of sulfonated animal fats, vegetable oils, vegetable fats, and amine soaps	20.0

In the above examples our new yarn treating agent was applied by means of an applicator roll as the filaments left the spinning cabinet. However, our new composition might equally well be applied at other stages of processing the yarn and in other operations such as twisting, winding and reeling. Or, our treating agent may be applied to staple fibers during any of the processes which are normal to the preparation of such fibers. Also, although we have indicated the application of our treating agent by passing the filaments over a roll, other devices which serve to deposit liquid on filaments or fibers such as by wick, spray or combinations of such methods may be used.

Although in the above examples we have indicated certain percentages of our agent applied to filaments, and these represent preferred proportions, our invention in its broader concepts is not to be restricted to these exact values. We have found that favorable electrical and physical properties, as well as filament bonding may be obtained by other formulas in accordance with our invention, such formulas being within the broader ranges of proportions set forth earlier in this instant application. For example, if it is desired to obtain more substantial bonding of the fibers, we have found that larger quantities of the waxy material (component E) may be used, for example amounts of waxy material even up to 50% of the formulas may be used in some instances, although, as indicated, we would generally prefer to use amounts within the range 4–20 parts by weight.

Our new treating agent applied to cellulose ester yarn, as shown by the examples, produces the advantages of eliminating static and substantially reducing friction. In addition, as shown particularly by Example III, our new treating agent clearly facilitates weaving in that there is found in fabric woven from yarn treated by our invention less filling defects than yarn which is either untreated or treated by other methods.

While our composition is particularly suitable for cellulose ester yarn, we have found that a number of advantages may be obtained on other types of yarn. For example, yarns of cellulose ester-acrylonitrile may be treated in a comparable manner. Yarns of acrylonitrile-vinyl compositions and certain diol esters of benzoic acid polymer yarns are amenable to treatment with the above composition.

We claim:

1. A method of treating cellulose acetate yarn to obtain a treated cellulose acetate yarn having improved weaving qualities which comprises applying to said yarn a composition prepared by mixing together with stirring and warming the following components expressed in parts by weight: 10–80 mineral oil, 4–20 oleyl acid phosphate, 1–10 alkylol amine and 1–15 oleic acid.

2. A method in accordance with claim 1 wherein the alkylol amine is from the group consisting of dimethyl aminoethanol and aminoethyl propanol.

3. A method in accordance with claim 1 wherein the components have added thereto 1–15 parts by weight of material from the group consisting of imidazoline and terpene glycol ether.

4. A method in accordance with claim 1 wherein 4–15 parts by weight of dibutyl tartrate is added to the components.

5. A method in accordance with claim 1 wherein there is added to the components at least one further constituent from each of the following four groups in the amount in the aggregate of from 4–50 parts by weight: (1) a sulfonated glyceryl ester of a fatty acid from the group consisting of palmitic, stearic and oleic esters of glycerin, (2) a vegetable oil which contains an ester from the group consisting of lauric, myristic, stearic, oleic, linoleic, caprylic, and caproic esters of glycerin, (3) a vegetable fat which contains a glyceryl ester from the group consisting of palmitic, stearic and oleic acids, and (4) an amine which will form a soap with the free fatty acid present in the aforementioned constituents, said amine being from the group consisting of monoethanolamine, diethanolamine, triethanolamine, 2-amino-2-methyl-1-propanol, N,N-diethylaminoethanol and morpholine.

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