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TREATED TEXTILE FIBER

Howard A. Thompson, Raymond E. Donaldson, and Charles Clayton White, Kingsport, Tenn., assignors to Eastman Kodak Company, Rochester, N.Y., a corporation of New Jersey

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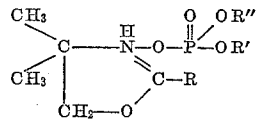
This invention relates to compositions for the treatment of artificial fibers, filaments and yarns, to render them more amenable to textile operations such as drafting, relaxing, spinning, twisting, winding, reeling, carding, combing, warping, weaving, knitting and the like. The fibers which may advantageously be treated with our compositions include both those composed of cellulose esters, such as cellulose acetate, cellulose triacetate, cellulose acetate-butyrate, and cellulose acetate-propionate, and those composed of synthetic polymers, such, for instance, as polyesters and acrylic polymers.

As is well known in the textile industry, it is necessary to treat yarns and fibers with lubricating compositions, in order to reduce the tendency toward breakage of the individual filaments when they are subjected to various mechanical stresses and strains and to facilitate handling in textile operations. Lubricating compositions frequently contain an antistatic agent, to prevent electrical attraction of the filaments to each other and to the equipment on which they are being handled. Although the general idea of treating textile fibers with antistatic agents is old, the problem of selecting a proper agent is by no means a simple one. In the first place, the nature of the fiber to be treated must be taken into account. Thus, agents which have been indicated in the art as suitable for wool, viscose, or cellulose acetate do not necessarily produce the desired effects on hydrophobic non-cellulosic fibers. Further, the antistatic agent must be compatible with lubricants, sizes and other agents applied to fibers in the textile mill. It must allow proper running tensions of filaments during drawing and twisting operations. It must be noncorrosive to the equipment in which the fiber will be worked, and it must be non-toxic and have no injurious dermatological effects upon the worker or upon the ultimate wearer.

We have found that the 2-alkyl-4,4-dimethyl-2-oxazoline salts of lauryl or oleyl phosphoric acid partial esters, where the alkyl group may contain from 1 to 17 carbon atoms, are excellent anti-static agents for use in lubricating compositions for both cellulose ester yarns and hydrophobic synthetic polymer yarns. These compounds are free-flowing liquids. They have the following structural formula:



in which R is an alkyl radical of from 1 to 17 carbon atoms, R′ is an aliphatic radical selected from the group consisting of lauryl and oleyl, and R″ is a radical selected from the group consisting of lauryl, oleyl and hydrogen. They are formed when 2-alkyl-4,4-dimethyl-2-oxazolines are added to lauryl or oleyl partial esters of phosphoric acid. Usually the partial esters of phosphoric acid are mixtures of the mono- and di-esters. The lubricating compositions containing these oxazoline salts preferably

also contain mineral oil and a long-chain aliphatic alcohol or alicyclic alcohol.

Our novel compositions may, if desired, be applied to the filaments as the filaments emerge from the spinning cabinet in which they are formed. The compositions are non-tacky on heated processing rolls, and are color-stable when processed on heated rolls. They do not undergo chemical reaction with the fibers or the spinning solvent to form colored products which mar the desired shade of the fibers. They may be used on both continuous filament and cut staple fibers.

Cellulose ester fibers treated with the lubricants of our invention have especially high resistance to abrasion when sized with materials such as gelatin and copolymers of maleic anhydride and styrene, which are commonly used in the trade.

Both cellulose ester fibers and synthetic polymeric fibers may be satisfactorily lubricated and conditioned for spinning operations by the application thereto of a single application of our novel lubricating and conditioning compositions. Our compositions are thoroughly dispersed over the fibers in application thereto, and the fibers thus treated are completely antistatic, so that a superior degree of lubrication and conditioning is achieved.

Our novel compositions preferably comprise from 10 to 20 parts by weight of the lauryl or oleyl partial ester of phosphoric acid combined with from 2 to 15 parts by weight of a 2-alkyl-4,4-dimethyl-2-oxazoline, 5 to 15 parts by weight of a long-chain fatty alcohol or alicyclic alcohol, and from 40 to 70 parts by weight of mineral oil having a viscosity of from 45 to 135 (Saybolt Universal seconds of 100° F.). Other components may also be present.

In forming said lubricating and conditioning compositions, the components are preferably combined by adding the lauryl or oleyl partial ester of phosphoric acid to the mineral oil with stirring, followed by the addition of the 2-alkyl-4,4-dimethyl-2-oxazoline and the addition of the long-chain fatty alcohol or alicyclic alcohol. After the components are mixed, gentle agitation is continued until a smooth homogeneous blend is obtained.

As illustrating but not limiting our invention, we give the following examples.

Example 1.—One-hundred-fifty denier, 38 filament bright cellulose acetate yarn was lubricated and conditioned by applying to it by means of an applicator roll, as the filaments left the spinning cabinet, 2.5%, on the weight of the dry yarn, of the following composition:

	Percent
Mineral oil	45
Lauryl partial esters of phosphoric acid	25
2-alkyl-4,4-dimethyl-2-oxazoline	20
Lauryl alcohol	10

applied as a 25% emulsion in water. The yarn thus lubricated performed satisfactorily in all twisting, winding, sizing and weaving operations.

Example 2.—An acrylic yarn was lubricated with 0.4% of the oil composition described in Example 1 by passing over an applicator roll wet with the lubricant composition as the filaments emerged from the spinning cabinet. The yarn was drafted, crimped and cut into suitable lengths. This cut staple was carded and spun into yarn, and was found to process well in all operations.

Example 3.—A polyester yarn was lubricated with 0.4% of the oil composition described in Example 1 by passing over an applicator roll wet with the lubricant composition as the filaments emerged from the spinning cabinet. The yarn was drafted, crimped and cut into suitable lengths. This cut staple was carded and spun into yarn, and was found to process well in all operations.

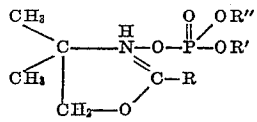
Although in the above examples we have indicated

certain percentages of lubricant composition applied to fibers for use as cut staple fibers or continuous filament yarns, our invention is not restricted to these percentages. In the above examples we have stated that the lubricant was applied by means of an applicator roll as the filaments left the spinning cabinet; however, the composition may equally well be applied at other stages of processing and in other operations such as twisting, winding, and reeling, or they may be applied to cut staple fibers during any of the processes to which such fibers are subjected. Moreover, although we have indicated that the lubricant may be applied by passing the filaments over a roll, other devices which serve to deposit oil on filaments or fibers, such as wicks, spray or both, may be used.

In formulating our lubricant compositions, we may use another non-aromatic alcohol of at least six carbon atoms, such as, for example, oleyl, cyclohexyl myristyl, cetyl, stearyl, linolyl or ricinolyl alcohol or mixtures of these, in place of the lauryl alcohol added as the fourth component of the composition.

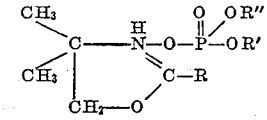
What we claim as our invention and desire to be secured by Letters Patent of the United States is:

1. A textile fiber selected from the group consisting of cellulose ester fibers and hydrophobic synthetic polymer fibers, carrying a textile lubricant composition comprising from 40 to 70 parts by weight of mineral oil, from 5 to 15 parts by weight of a non-aromatic alcohol of from 6 to 18 carbon atoms, and from 12 to 35 parts by weight of a compound having the structural formula



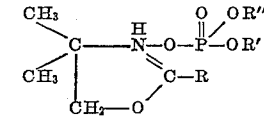
in which R is an alkyl radical of from 1 to 17 carbon atoms, R′ is an aliphatic radical selected from the group consisting of lauryl and oleyl, and R″ is a radical selected from the group consisting of lauryl, oleyl and hydrogen.

2. A cellulose ester textile fiber carrying a textile lubricant composition comprising from 40 to 70 parts by weight of mineral oil, from 5 to 15 parts by weight of a non-aromatic alcohol of from 6 to 18 carbon atoms, and from 12 to 35 parts by weight of a compound having the structural formula



in which R is an alkyl radical of from 1 to 17 carbon atoms, R′ is an aliphatic radical selected from the group consisting of lauryl and oleyl, and R″ is a radical selected from the group consisting of lauryl, oleyl and hydrogen.

3. A hydrophobic synthetic polymer textile fiber carrying a textile lubricant composition comprising from 40 to 70 parts by weight of mineral oil, from 5 to 15 parts by weight of a non-aromatic alcohol of from 6 to 18 carbon atoms, and from 12 to 35 parts by weight of a compound having the structural formula



in which R is an alkyl radical of from 1 to 17 carbon atoms, R′ is an aliphatic radical selected from the group consisting of lauryl and oleyl, and R″ is a radical selected from the group consisting of lauryl, oleyl and hydrogen.

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