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YARN CONDITIONING PROCESS AND
COMPOSITIONS THEREFOR

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This invention relates to the conditioning of textile yarns, particularly those composed of or containing organic derivatives of cellulose such as cellulose acetate, cellulose propionate, cellulose acetate propionate, cellulose acetate butyrate and the like to render them more amenable to textile operations, and more particularly to the compounding of a conditioning agent for such yarns.

In order that textile fibers may be processed satisfactorily, it is essential that they be protected by a suitable lubricant. The need for proper lubrication is especially imperative in the case of cellulose acetate and other continuous filament yarns. As the yarn passes through guides and over rolls in the various processing steps, the filaments are continually subjected to an abrading and flexing action. If the surface friction between fiber and guide reaches a certain value, the pull or drag exerted upon an individual filament exceeds its tensile strength, and the filament is broken. In the case of cellulose acetate fibers, a lubricant is usually applied while the yarn is being spun, so that surface friction may be reduced to a minimum as soon as possible, and thus simplify further processing.

In general, a satisfactory oil must show the following properties: reduce surface friction between yarn and guide, prevent the accumulation of excessive static electrification, impart a satisfactory feel or hand to the yarn, scour off readily, show some degree of stability towards ageing or oxidation, and have no tendency to injure the surface of the yarn.

Obviously, the use for which the yarn is intended will have considerable bearing upon the properties desired in the lubricant, e. g., a filling lubricant must show a higher drag or pull than a warp lubricant, to prevent sloughing from the cop, while a warp oil must have a certain affinity for water or aqueous solutions to expedite sizing.

Since the various properties enumerated above are so diverse in nature, and since it is necessary to independently vary their relative magnitudes, no single substance can fulfill all the requirements, and it is necessary to resort to a mixture or blend of a number of components, each of which contributes toward the ultimate character and value of the oil. It is the purpose of this invention to disclose a method whereby the incorporation or blending of several components into a mixture with desirable properties may be facilitated.

Textile lubricants are applied in two general forms: i. e., as oils or as emulsions, and this invention is of particular value in the preparation

of oils, although it may also be used to advantage in formulas of the latter type.

It is desirable that textile lubricants which are applied as oils, be of the clear or homogeneous type. That is, the various components that make up the blended oil should be miscible or compatible to the extent of forming a solution or mixture that will not separate into two or more phases after standing. Usually this degree of homogeneity is indicated by the fact that the oil is clear to the unaided eye, and shows no visible turbidity or suspended matter.

It is common practice to include in the formula of a blended oil one or more emulsifying agents such as a soap or sulphonated oil in order to facilitate subsequent scouring and removal of lubricant from the yarn. Materials of this nature usually have a limited solubility in mineral and vegetable oils, and it is necessary to employ a third substance which acts as a cosolvent or blending agent between the oil and soap or other emulsifying agent.

This invention has as an object to provide a new and improved agent for the lubrication and dressing of yarns, particularly those composed of or containing organic derivatives of cellulose, such as cellulose acetate, cellulose propionate, cellulose acetate propionate and cellulose acetate butyrate. Another object is to provide a yarn conditioning agent capable of lubricating, softening and rendering such yarns more amenable to various textile operations. A still further object is to provide a means of blending textile lubricants, emulsifying agents and other ingredients customarily employed in yarn lubricating agents. Another object is to provide an improved method for the conditioning of yarns composed of or containing organic derivatives of cellulose. A still further object is to provide an improved type of yarn which is especially amenable to textile operations such as knitting, weaving, and the like. Other objects will appear hereinafter.

These objects are accomplished by the following invention which is based upon the discovery that alcohol-ethers formed by condensing certain di-olefinic terpenes with polyhydric alcohols or their derivatives possess unique and valuable properties, not only as yarn lubricants in and of themselves, but also as blending agents. In the first place, these compounds are characterized by a long hydrocarbon chain which gives them value as lubricants. In the second place, they are characterized by the presence of a hydroxyl group which tends to impart miscibility with polar compounds such as soaps and

sulfonated oils. In other words, these compounds are bifunctional and combine the properties of a lubricant and blending agent in one individual. Furthermore, they are chemically neutral and do not exert any deleterious action whatever on the yarn, nor do they induce corrosion of the metallic parts of the textile machinery with which they come in contact.

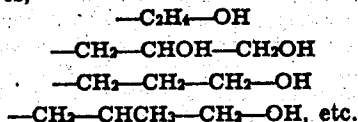
In the following examples and description I have set forth several of the preferred embodiments of my invention, but they are included merely for purposes of illustration and not as a limitation thereof.

The compounds which I have found to be of particular value for the aforesaid purposes are terpene ethers of polyhydric alcohols. These terpene ethers may be prepared in accordance with the process described in U. S. Patent 2,136,011 and are characterized by the fact that the terpene part of the molecule contains two double bonds.

In general, the compounds claimed here are ethers formed by condensing one molecule of a polyhydric alcohol, glycol, polyhydric alcohol-ether or glycol ether with one molecule of a terpene that contains two double bonds. The general formula is:



R represents a hydrocarbon radical derived from a terpene, and containing one double bond. X represents a radical containing one or more free hydroxyl groups, derived from a polyhydric alcohol, glycol, glycol-ether, or polyhydric alcohol-ether. For example, the radical X may have the structures,

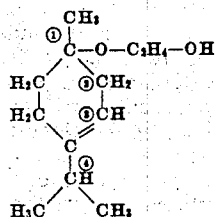


Polyhydric alcohols and glycols which may be used include ethylene glycol, propylene glycol, trimethylene glycol, glycerine, mannitol, and sorbitol.

Ethers of polyhydric alcohols suitable for condensation with the di-olefinic terpenes include diethylene glycol, dipropylene glycol, triethylene glycol, and diglycerol.

As stated, the terpenes used in the process of the invention contain two double bonds within the molecular structure. Examples of such terpenes are: alpha terpinene, dipentene, terpinolene, alpha or beta phellandrene, limonene, sylvestrene, and pseudolimonene. Mixtures of two or more di-olefinic terpenes may be used.

The exact chemical constitution of the addition product is not known, but from a determination of the iodine and acetyl values it can be concluded that the polyhydric alcohol adds on at one of the double bonds in the terpene to form an ether. For example, in the case of alpha terpinene and ethylene glycol, the addition product probably has the structure:



The ether linkage could be made at carbons 1, 2, 3, or 4, but from the known reactions of

the terpenes, it is probable that the addition occurs at position 1.

Condensation is suitably carried out between the terpene and the polyhydric alcohol by heating the two components in the presence of toluene sulfonic acid.

The terpene ethers may be used alone or in combination with other lubricating agents. For example, the condensation product formed by reacting diethylene glycol with dipentene may be applied to yarn in various stages of processing by means of wick, roll, spray, etc., to the extent of 0.2%-10% based on the weight of the yarn. Yarns lubricated in this way are characterized by relatively low friction and a smooth, soft hand.

The terpene hydroxy ethers have their widest applications as components of mixed oils or lubricants. Because of their molecular structure which embodies a relatively long hydrocarbon chain and ether group in combination with the polar group $-\text{CH}_2\text{OH}$, they are valuable blending agents or cosolvents. The hydrocarbon chain and ether group impart the property of solubility in oils, while the hydroxyl group tends to give miscibility with polar compounds such as soaps, sulfonated oils, etc.

Thus, we find that certain highly sulfonated olive and castor oils will form turbid solutions when mixed with mineral oil. If a terpene ether is used in accordance with my invention as a third component of the mixture, a clear, homogeneous solution results.

The terpene hydroxy ethers are excellent solvents for soaps and other emulsifying agents. Thus, for example, oleic and stearic acid amine soaps when mixed with the ethers form clear, stable solutions which may be applied to fibers by the usual methods. Alternatively, the solution of soap in the terpene ether may be mixed with oils, fats, waxes, etc., to form lubricants and dressings of diverse types.

The terpene hydroxy ethers not only lend themselves readily to the formation of stable oils, but also are easily adaptable to emulsification processes. For example, a solution of soap and/or sulfonated oil in the terpene hydroxy ethers forms a finely dispersed, stable emulsion when mixed with water. The ether solution of soap may be mixed with a mineral oil, vegetable, or animal oil, and the whole emulsified by suitable treatment with water.

My invention will be more readily understood by reference to the following examples which illustrate typical yarn treating compositions prepared in accordance therewith and typical applications of such compositions to the lubrication and conditioning of cellulose derivative yarns.

Example 1

	Per cent
Sulfonated olive oil.....	20
Mineral oil.....	50
Alpha terpinene-ethylene glycol addition compound	30

This lubricant may be applied as an oil by means of wick, roll, spray, etc., or it may be emulsified and applied by similar means.

Example 2

The compound formed by adding one molecule of diethylene glycol to one molecule of dipentene is dissolved in a hydrocarbon solvent such as xylene or a petroleum fraction boiling at 150°-200° C. The solution is applied to fibers by the

usual means, to the extent of 2%-20% based on the weight of the yarn treated.

Example 3

Terpinolene is condensed with one molecule of propylene glycol. Eighty parts of the product are mixed with 16 parts oleic acid and 4 parts monoethanolamine. This combination lends itself well to application as oil or emulsion.

Example 4

Mineral oil	65
Alpha terpinene-ethylene glycol addition product	12
Coconut fatty acids	10
Diethanolamine	3
Sulfonated olive oil	10

This composition is especially suitable for emulsification as it disperses readily in water to form a stable emulsion.

Example 5

Olive oil	20
Alpha terpinene-diethylene glycol addition compound	40
Monoethanolamine salt of sulfonated lauryl alcohol	20
Sperm oil	20

This lubricant may be applied in the form of an oil or emulsion.

Although I have found it convenient to illustrate my invention by reference to the treatment of yarns composed of or containing organic derivatives of cellulose such as cellulose acetate, cellulose propionate, cellulose acetate propionate, cellulose acetate butyrate and the like, the yarn treating compositions described herein are broadly applicable to the treatment of various other synthetic as well as natural yarns. By the term yarn as used herein I refer to continuous synthetic filaments, natural and artificial staple fibers, mixtures of fibers of both synthetic and natural materials and various other combinations.

What I claim is:

1. The process of conditioning textile yarns to render them amenable to textile operations such as knitting, weaving, spinning and the like which comprises applying thereto a yarn treating composition containing a terpene ether derived from a polyhydric alcohol and a di-olefinic terpene.

2. The process of conditioning textile yarns composed of or containing an organic derivative of cellulose to render such yarns amenable to textile operations such as knitting, weaving, spinning and the like which comprises applying thereto a composition containing a terpene ether de-

rived from a polyhydric alcohol and a di-olefinic terpene.

3. The process of conditioning textile yarns composed of or containing an organic derivative of cellulose to render such yarns amenable to textile operations such as knitting, weaving, spinning and the like which comprises applying thereto a yarn lubricant containing as an emulsifying agent a terpene ether derived from a polyhydric alcohol and a di-olefinic terpene.

4. The process of conditioning textile yarns composed of or containing an organic derivative of cellulose to render such yarns amenable to textile operations such as knitting, weaving, spinning and the like which comprises applying thereto a lubricating composition containing a textile lubricant, an emulsifying agent for the lubricant, and as a blending agent for the lubricant and the emulsifying agent a terpene ether derived from a polyhydric alcohol and a di-olefinic terpene.

5. The process of conditioning textile yarns composed of or containing an organic derivative of cellulose to render such yarns amenable to textile operations such as knitting, weaving, spinning and the like which comprises applying thereto a lubricating composition containing a textile lubricant, a soap and a terpene ether derived from a polyhydric alcohol and a di-olefinic terpene.

6. A textile yarn lubricating and dressing composition containing a terpene ether derived from a polyhydric alcohol and a di-olefinic terpene.

7. A textile yarn lubricating and dressing composition containing a textile lubricant, an emulsifying agent for the lubricant, and as a blending agent for the lubricant and the emulsifying agent, a terpene ether derived from a polyhydric alcohol and a di-olefinic terpene.

8. A textile yarn lubricating and dressing composition containing a textile lubricant, a soap and a terpene ether derived from a polyhydric alcohol and a di-olefinic terpene.

9. A textile yarn amenable to operations such as knitting, weaving, spinning and the like impregnated with a lubricating and dressing composition containing a terpene ether derived from a polyhydric alcohol and a di-olefinic terpene.

10. A textile yarn composed of or containing an organic derivative of cellulose amenable to operations such as knitting, weaving, spinning and the like impregnated with a lubricating and dressing composition containing a terpene ether derived from a polyhydric alcohol and a di-olefinic terpene.

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