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YARN TREATING PROCESS AND COMPOSITION THEREFOR

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This invention relates to the conditioning of textile yarns and more particularly to the conditioning of filaments and yarns composed of organic derivatives of cellulose such as cellulose acetate, cellulose acetate propionate, cellulose acetate butyrate, etc., to render them more amenable to textile operations such as knitting and the like.

As is well-known, in the manufacture of yarns, particularly those composed of or containing cellulose organic derivatives, it is necessary to treat the yarn in order to reduce the tendency toward breakage of the individual filaments or fibers when they are subjected to various mechanical strains and to lubricate the yarn in order to facilitate handling in such operations as spinning, twisting, winding and reeling. In addition, it is necessary to treat yarn to adapt it for use as warp or filling or for the manufacture of various types of knitted fabrics. In knitting, it is particularly important that the yarn be soft and pliable in order that it may conform readily to the contour of the needles and thus produce a closely knit fabric free from such defects as "stitch distortion," "pin holes," "laddering," and the like.

Heretofore it has been proposed to employ softening agents such as polyhydric alcohols and similar agents as ingredients of yarn conditioning or lubricating formulae, generally in connection with mineral, animal or vegetable oils. It has been found, however, that most of the known softening agents and the various formulae containing them have certain drawbacks, one of the most serious of which is high vapor pressure, and in some cases too drastic a solvent action on the yarn. Many of such agents possess slight or insufficient solvent power for the lubricants with which they are used and it is accordingly necessary to employ blending agents or emulsifying agents in order to obtain operable yarn treating formulae. In addition, many of the known softening and lubricating agents are insufficiently soluble in water to permit satisfactory removal by aqueous scour baths.

This invention has as its principal object to provide an entirely new class of yarn conditioning agents which are particularly adapted for the treatment of yarns composed of or containing organic derivatives of cellulose and capable of lubricating, softening and rendering such yarns more amenable to knitting and other textile operations. A further and specific object is to provide a class of conditioning agents which augment or assist the lubricating action of various lubricants when applied to such yarns. A still further object is to provide yarns softening and lubricating formulae which can be readily removed from the yarns by the usual scour baths. A still further object is to provide an improved method for the conditioning of yarns, particularly those composed of or containing organic derivatives of cellulose such as cellulose acetate, whereby the yarn is rendered soft and pliable and capable of employment in a variety of textile operations where complicated designs or stitches are employed. Other objects will appear hereinafter.

These objects are accomplished by the following invention which, in its broader aspects, comprises the discovery that the saturated or unsaturated aliphatic monoethers derivable from alcohols of at least four carbon atoms and preferably such ethers derivable from alcohols of more than ten carbon atoms, may be used as yarn conditioning agents and particularly as softening agents with or without the addition of animal, mineral or vegetable oils, in the treatment of yarns composed of or containing organic derivatives of cellulose.

We have found that these compounds have a slight solvent and/or softening action on cellulose organic derivative yarns which renders such yarns soft and pliable without at the same time having too drastic a solvent action thereon. Typical examples of ethers of this type which are exceptionally valuable as yarn conditioning agents when used in accordance with our invention are ethyl octyl ether, allyl lauryl ether, dicetyl ether, di-lauryl ether, mericyl-lauryl ether, diamyl ether, dibutyl ether, dioctyl ether, cetyl ethyl ether, oleyl methoxy ethyl ether, ricinoleyl dimethyl ether, dioleyl ether, phenyl lauryl ether, dihexyl ether, lauryl amyl ether, and similar compounds.

These ethers may be prepared in accordance with the well known Williamson synthesis as described, for example, on pages 67 and 68 of Holleman's Textbook of Organic Chemistry, 1930 edition. Examples of preparation of typical ethers are the following:

Preparation of ethyl octyl ether

One gram atom of sodium is added to 500 cc. ethanol to form sodium ethylate. To this is then added one gram mole of octyl bromide and the reaction mixture heated to boiling until no more sodium bromide separates. The salt is filtered off and the ethyl octyl ether recovered by distillation.

Preparation of allyl lauryl ether

One gram atom of sodium is added to methanol and then two moles of allyl alcohol are added. The methanol is removed through a column and the resulting sodium allylate is treated with lauryl bromide as above to give lauryl allyl ether.

In accordance with the invention these compounds may be applied directly to the yarn during or after spinning, or may be added to the spinning solution itself. We have found that these compounds have exceptional solvent powers which enable them to dissolve mineral oils and blown and unblown, drying and semi-drying, vegetable and animal oils and accordingly, and they may be, and preferably are, employed as ingredients of yarn conditioning or lubricating formulae in conjunction with agents which function wholly or partially as lubricants.

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

Our invention will be more readily understood by reference to the following examples in which typical applications of the invention are set forth:

Example I

A 20% solution of cellulose acetate in acetone in which is incorporated 1–5% by weight of the cellulose acetate of cetyl ethyl ether is extruded through fine orifices into an evaporative atmosphere. The filaments thus produced are wound or twisted and wound. Yarns produced from filaments thus prepared are pliable and suitable for knitting. In place of the above ether we may use oleyl methoxy ethyl ether, ricinoleyl dimethyl ether, etc.

Example II

Cellulose acetate yarn intended for weaving is treated by applying thereto 3%, based on the weight of the yarn of dioleyl ether. If the yarn is intended for knitting, 10% of the ether compound may be deposited.

Example III

A conditioning liquid is made up containing:

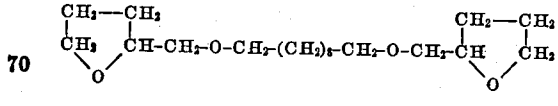
	Parts
Olive oil	90
Phenyl lauryl ether	10

This composition is applied to cellulose acetate yarn intended for knitting, the amount of the conditioning liquid deposited being from 4–25% of the weight of the yarn.

Other examples of yarn conditioning agents which may be employed in accordance with our invention are the following

Example IV

	Parts
Blown olive oil	60
1–10 decanol ditetrahydrofurfuryl ether	40



Example V

	Parts
Sperm oil	30
Dihexyl ether	70

Example VI

	Parts
Blown sperm oil	30
Carbitol acetate	60
Dicetyl ether	10

Example VII

	Parts
Neat's-foot oil	50
Tetrahydrofurfuryl acetate	40
Lauryl amyl ether	9
Ditetrahydrofurfurylamine stearate	1

Example VIII

	Parts
Blown neat's foot oil	30
Dilauryl ether	60
Light mineral oil	30

Example IX

	Parts
Ethylene glycol dioleyl ether	60
Teaseed oil	20
Oleic acid	7
Ethanolamine	3
Water	5
Triethylene glycol	5

Example X

	Parts
Glyceryl trilauryl ether	60
Blown teaseed oil	10
Sulfonated olive oil	20
Mineral oil	10

As will be apparent from the above examples and description, the conditioning agents of our invention may be applied to a wide variety of methods. For example, we may employ the agent as an ingredient of the spinning dope from which the filaments are formed, the amount of the agent so employed depending upon a number of factors, such as the particular cellulose derivative used in making the yarn, the solvent or solvent combination used in making up the spinning solution, and the degree of softness or pliability desired in the yarn, etc.

If the conditioning agent is to be applied to the yarn after spinning, this may be done by bringing the yarn in contact with a wick, roll, or felt wet therewith or the liquid may be applied by immersion, spray, or otherwise. The particular point at which the liquid is applied may vary. It may, for example, be applied to the yarn inside or outside the spinning cabinet, between the guide and godet roll, between the godet or other roll or guide and the point of winding and/or twisting. In some cases, the liquid may even be applied to the yarn after winding onto cones, spools, bobbins, or the like or by the so-called "bobbin to bobbin" method. In the case of staple fiber manufacture, the liquid may be applied to the yarn prior to, or after cutting into staple lengths.

The amount of the agent so employed will vary widely depending upon the results desired, the specific nature of the material to which the agent is applied, the use to which the yarn is eventually to be put and other factors. For example, in a given case where a cellulose organic acid ester yarn such as a yarn composed of cellulose acetate, is intended for knitting, about 4 to 25% or more by weight, based on the weight of the dry yarn, may be satisfactory, while if the yarn is intended for weaving, the amount may vary between about 1 and 5%.

Although in the above examples we have referred primarily to yarn treating compositions

containing only the conditioning agent, emulsifying agents, blending agents and the like, may be added within the scope of our invention. Likewise, various dyes or other coloring matter may be included in case it is desired to permanently or fugitively tint or dye the material undergoing treatment.

Although we have found it convenient to illustrate our invention by reference to compositions containing specific percentages of the various ingredients, these percentages may vary widely depending upon the particular purpose for which the composition is intended. For example, if it is desired to control the solvent or softening action of the conditioning agent, the amount of the agent may be adjusted as, for example, by reducing the amount of the agent and correspondingly increasing the amount of oil or other ingredient.

While we have described our invention with particular reference to the treatment of yarns composed of organic derivatives of cellulose such as cellulose acetate, the conditioning agents and formulae described herein are applicable to the conditioning of many other types of cellulose derivative yarns such as those composed of or containing cellulose propionate, cellulose butyrate, cellulose acetate propionate, cellulose acetate butyrate, ethyl cellulose, methyl cellulose, benzyl cellulose and others, as well as to the conditioning of silk, wool, cotton, viscose and other natural or artificial materials.

The term "yarn" as used herein and in the claims is to be understood as including a single filament, a plurality of filaments associated into the form of a thread, either of high or low twist, single or multiple threads associated or twisted together, composite threads composed of a mixture of natural and artificial filaments or a composite thread formed by twisting together individual strands of natural or artificial materials, as well as cut staple fibers produced from natural and/or artificial filaments or threads and spun yarn produced from such staple fibers.

As indicated above, the yarn conditioning agents of our invention are exceptionally good solvents for a wide variety of mineral, blown and unblown, drying and semi-drying animal and vegetable oils such as cottonseed, olive, castor, neat's foot, sperm and other oils. This enables them to be used with any of such oils in making up a variety of yarn treating formulae of varying composition.

The yarn conditioning method and compositions of our invention possess many outstanding advantages. The fundamental and outstanding characteristic of the agents employed in accordance with the invention is their ability to soften yarns, especially those composed of or containing organic derivatives of cellulose such as cellulose acetate and render them soft and pliable and amenable to various textile operations, especially operations such as those involved in weaving and knitting where complicated designs or stitches are employed, without too drastic an action on the yarn material. Another outstanding characteristic of these compounds is their exceptional solvent power for a wide variety of mineral, animal and vegetable oils and their ability to act as lubricating assistants in conjunction with these oils when applied to such yarns. In addition, due to their solubility in water, they may be readily removed from yarns and fabrics by means of the usual aqueous scour baths. By employing the yarn conditioning agents and method of our invention as herein described, one is enabled to obtain highly satisfactory results in the manufacture of yarns and woven fabrics and especially the production from these yarns of closely knit fabrics and especially the production from these yarns of closely knit fabrics free from defects such as pin holes, stitch distortion, laddering and the like.

What we claim and desire to secure by Letters Patent of the United States is:

1. The process of conditioning yarn composed of or containing an organic derivative of cellulose to render it more amenable to textile operations including knitting, weaving, spinning, and the like, which comprises applying thereto a lubricating and softening composition containing 1–10 decanol ditetrahydrofurfuryl ether.

2. A lubricating and softening agent for rendering yarns composed of or containing an organic derivative of cellulose more amenable to textile operations including knitting, weaving, spinning, and the like containing as its essential lubricating and softening component 1–10 decanol ditetrahydrofurfuryl ether.

3. Textile yarn composed of or containing an organic derivative of cellulose amenable to textile operations including knitting, weaving, spinning and the like impregnated with a lubricating and softening agent containing 1–10 decanol ditetrahydrofurfuryl ether.

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