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YARN CONDITIONING PROCESS AND COMPOSITIONS THEREFOR

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16 Claims. (Cl. 28—1)

This invention relates to the conditioning of textile yarns, and particularly to the conditioning of yarns, threads, filaments and fibers composed of or containing organic derivatives of cellulose such as cellulose acetate, cellulose acetate propionate and cellulose acetate butyrate, to render such materials amenable to various textile operations such as knitting, weaving, carding, spinning, twisting and the like.

As is well known in the textile industry, the manufacture, processing and use of yarns composed of or containing organic derivatives of cellulose and similar synthetic materials give rise to numerous problems generally absent from the handling of natural yarns such as silk, wool, cotton and the like. One of the chief problems encountered in dealing with these synthetic materials is to so lubricate or soften and, in some instances, to both lubricate and soften, the yarn in question that it will have the correct frictional characteristics, or drag, and the required flexibility for the specific purpose in view. In the handling of continuous filament yarn, for example, it is necessary to condition the material to reduce the tendency toward breakage of individual filaments when the yarn is subjected to mechanical strains such as are involved in passage of the yarn over rolls, guides, and other parts of the yarn-producing mechanism and in twisting, winding, reeling and similar operations. In the case of yarns intended for use on commercial knitting machinery, it is particularly important that the yarn be soft and pliable in order that it may conform to the contour of the needles and give a closely knit fabric free from cuts, pin holes, stitch distortion, laddering, misplaits and other common defects.

Another problem of major proportions presented by these synthetic yarns is their extreme tendency to pick up charges of static electricity, especially in such operations as twisting, winding, warping, picking, carding, combing, drafting, spinning, and the like. This tendency is particularly aggravated in the case of cut staple fibers, since in the commercial use of such material, it is normally subjected to a number of extremely severe operations such as picking, carding, combing, etc., all of which tend to so charge the individual fibers as to make proper web formation difficult or impossible or to give the ultimate yarn an undesirable unevenness.

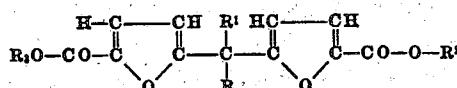
In some types of yarn, all three of the above-mentioned problems of lubrication, softening and anti-static treatment are present and in any case the matter of providing a yarn conditioning composition, in which the several functions are properly coordinated to accomplish the desired result is often a matter of extreme difficulty. This is due to the fact that in any given yarn

conditioning composition, whether primarily designed for use as a warp, filling or knitting lubricant, or as an anti-static, all of the various components and their functions must be delicately balanced one against the other so as to give a practical and commercially satisfactory yarn treatment.

Heretofore, many different conditioning agents such as polyhydric alcohols and similar compounds have been suggested as ingredients of yarn conditioning formulas, generally in conjunction with mineral, vegetable and animal oils. It has been found in practice, however, that most of these agents and the various formulas containing them have certain drawbacks, among which may be mentioned too drastic solvent action on the yarn, insufficient solvent power for the lubricants with which they are used and a tendency to form gummy deposits on the yarn after application. Furthermore, many of the known yarn treating agents are insufficiently soluble in water to permit satisfactory removal from the yarn by aqueous scour baths.

The present invention has as its principal object to provide an improved process for the conditioning of textile yarns, threads, filaments, and fibers, particularly those composed of or containing organic derivatives of cellulose to render such materials amenable to various textile operations and processes, such as knitting, weaving, spinning and the like. A further object is to provide an improved process for the lubrication and softening of such yarn. A still further object is to provide a new class of yarn treating agents and compositions particularly adapted for the conditioning of yarns composed of or containing organic derivatives of cellulose and readily removable therefrom by the usual aqueous scour baths. A specific object is to provide an improved type of cellulose organic derivative yarn amenable to various textile operations including knitting, weaving, and spinning. Other objects will appear hereinafter.

These objects are accomplished by the following invention which, in its broader aspects, comprises treating yarns, particularly those composed of or containing organic derivatives of cellulose, such as cellulose acetate, cellulose acetate propionate, cellulose acetate butyrate and similar organic acid esters with esters of alpha, alpha-carboxy- α,α' difuryl methane having the general formula:



wherein R and R' are substituents selected from the group consisting of hydrogen and alkyl, alkylene, aryl, cycloalkyl and heterocyclic groups, and wherein R² and R³ are substituents selected

from alkyl, alkylene, cycloalkyl, aryl and heterocyclic groups. Of these substituents, the alkyl group may be a methyl, ethyl, beta-hydroxy ethyl, butyl, oleyl, beta-hydroxy-beta-ethoxy ethyl, etc. Likewise, the alkylene groups may be allyl, cyclohexenyl. Similarly, the aryl groups may be phenyl, benzyl, furfuryl, naphthyl. The cycloalkyl and heterocyclic groups may be cyclohexyl, hexahydrobenzyl, tetrahydrofuryl, naphthenyl.

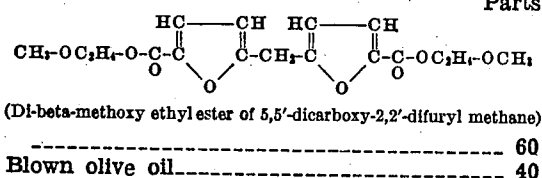
The method used in preparing these compounds is that described in *Gazzeta Chimica Italiana*, 67, 312 (1937).

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.

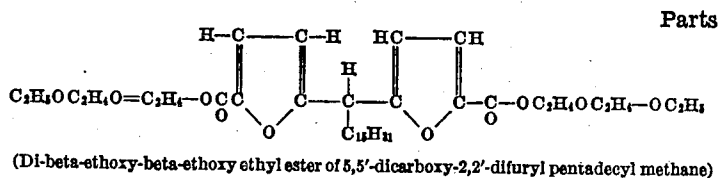
My invention will be more readily understood by reference to several specific examples of typi-

Other examples of conditioning compositions which may be applied in accordance with my invention to yarns intended for a variety of purposes such as knitting, weaving, spinning and the like, and especially the preparation of yarns composed of or containing organic derivatives of cellulose, such as cellulose acetate, cellulose acetate propionate, and cellulose acetate butyrate and similar derivatives for knitting purposes are the following:

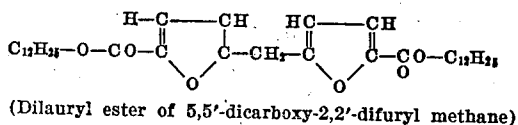
Example 3



Example 4



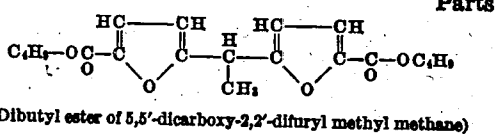
Example 1



is applied by means of an applicator roll to cellulose acetate continuous filament designed for knitting purposes in an amount corresponding to 5-25% of the dry weight of the yarn. The yarn so treated is found to be soft and pliable and well-adapted for knitting.

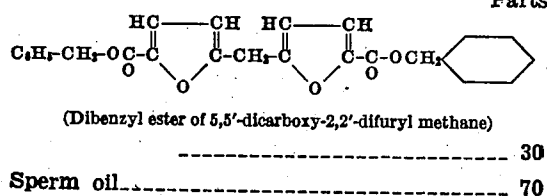
Example 2

A conditioning liquid having the following composition:

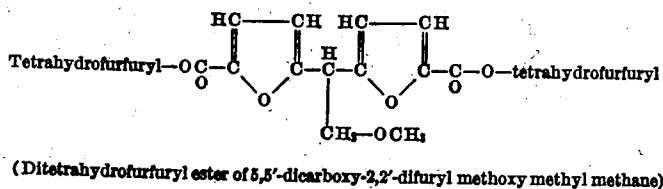


is applied to cellulose acetate yarn as described in Example 1. Assuming the yarn is to be used for weaving, 1-5% of the composition, based upon the dry weight of the yarn, is deposited. The yarn so treated is found to be well adapted for use as filling yarn in weaving.

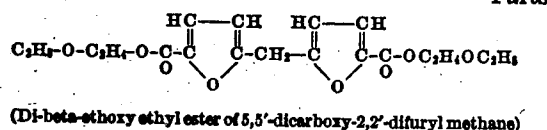
Example 5

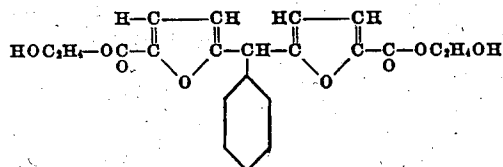


Example 6



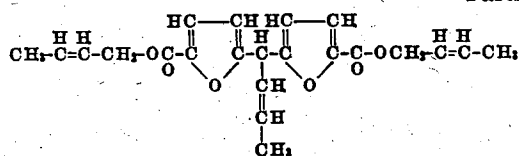
Example 7



Example 8

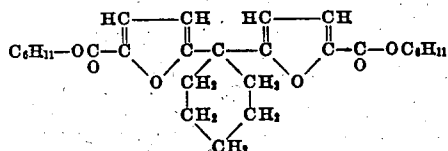
(Di-beta-hydroxyl ethyl ester of 5,5'-dicarboxy-2,2'-difuryl phenyl methane)

Neat's-foot oil.....	30
Sulfonated castor oil.....	50
Sodium sulfate.....	15
Water.....	2
	3

Example 9

(Di-crotyl ester of 5,5'-dicarboxy-2,2'-difuryl crotyl methane)

Mineral oil.....	20
Blown neat's-foot oil.....	35
Naphthenyl phosphate ethylamine salt.....	35
	10

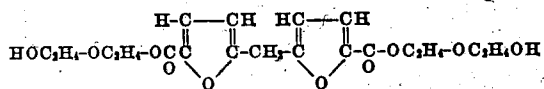
Example 10

(Dicyclohexyl ester of 5,5'-dicarboxy-2,2'-difuryl cyclohexyl methane)

Blown teaseed oil.....	40
Oleyl alcohol.....	40
	20

Example 11

Water.....	80
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(Di-beta-hydroxy ethoxy ethyl-5,5'-dicarboxy-2,2'-difuryl methane)

Water soluble cellulose ester or ether.....	10
Glycerol acetone.....	5
	5

Example 12

A 20% solution of cellulose acetate in acetone in which is incorporated 1-25% by weight of the compound of Example 1 is extruded through fine orifices into an evaporative atmosphere. The filaments thus produced are wound or twisted and wound. Yarns thus produced are of dull luster and suitable for knitting.

The particular method of application of the yarn treating compositions of my invention to the yarn will depend largely upon the nature of the yarn and the use for which it is intended. In general, the compositions may be applied by any of the standard procedures such as roll, wick, bath, or spray application. If the yarn is in continuous filament form, compositions may be applied just as the yarn emerges from the spinning cabinet, or while passing from package to

package. Likewise, the lubricant may be applied during twisting, winding, crepeing or similar operations. In some cases, the lubricating, and softening agent may be added to the spinning solution from which the yarn is to be spun.

The amount of the compositions applied will, in general, depend upon the purpose for which the yarn is to be used. For example, if the yarn is to be employed for knitting, anywhere from 5-25%, based on the dry weight of the yarn, may be applied. On the other hand, if the yarn is intended for weaving, the amount will generally run from about 1-5%.

In each of the compositions given, the essential lubricating and softening component is a compound of the type indicated above. However, as illustrated by the specific examples, such compositions may contain other lubricating, and softening agents, to augment or supplement the effect of the primary ingredient and thus give the compositions added or improved properties. Likewise, solvents, non-solvents, blending agents, co-solvents, emulsifying agents, dispersing agents and similar ingredients may be added as circumstances may require to adapt the compositions for specific uses. Similarly, various dyes or other coloring matter may be added to the compositions in case it is desired to permanently or fugitively tint the yarn undergoing treatment.

Although in the above named examples I have referred to compositions containing specific proportions of the various ingredients, the amounts employed in any given case may vary widely depending upon the particular purpose for which the composition is intended. For example, if it is desired to control the solvent, softening, or other specific action of the conditioning agent per se or of any other ingredient, the amount thereof may be adjusted in accordance with the desired action.

While I have found it convenient to describe my invention with particular reference to the treatment of yarns composed of or containing organic derivatives of cellulose, particularly cellulose acetate, the conditioning agent and compositions described herein are also 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, the cellulose ethers such as ethyl, methyl and benzyl celluloses, viscose and cuprammonium cellulose, silk, wool, cotton and other natural and artificial materials.

The term "yarn" as used herein and in the claims is to be understood as covering single filaments, a plurality of filaments associated in the form of roving, threads, and the like, either of high or low twist, composite threads or yarns composed of a mixture of natural and artificial filaments, composite threads formed by twisting together individual threads or strands of the same or different natural or artificial materials of the same or different deniers, creped or crimped yarns, and crimped or uncrimped cut staple fibers produced from natural or artificial filaments, and spun yarn produced from such staple fibers.

The yarn conditioning methods and compositions of my invention possess many outstanding advantages. The fundamental and distinguishing characteristic of the agents described herein is their ability to lubricate and soften yarns, particularly those composed of or containing organic derivatives of cellulose such as cellulose

acetate, and to render them amenable to various textile operations.

As indicated above, these compounds are distinguished by the fact that they have an especial solvent power for a wide variety of mineral, blown and unblown, drying and semi-drying animal and vegetable oils. Furthermore, due to their ready solubility in water, they may be removed from yarns and fabrics by means of the usual aqueous scour baths.

In addition to the use of the compounds in question as yarn conditioning agents, they may be employed as plasticizers for various cellulose derivatives such as cellulose nitrate, cellulose acetate, cellulose acetate propionate, cellulose acetate butyrate, and other single and mixed esters of cellulose.

The compositions resulting from the plasticization of such esters may be used in the plastic and analogous arts, such as the manufacture of wrapping sheets, photographic film, varnishes,

Example 18

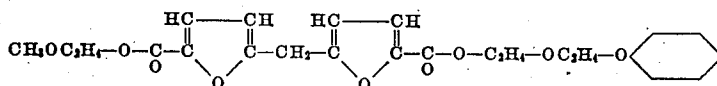
	Parts
Cellulose nitrate.....	100
Di-beta-ethoxy ethyl ester of 5,5'-dicarboxy-2,2'-difuryl methane.....	30
Ester gum.....	40
Ethyl acetate.....	200
Toluene.....	100
Ethanol.....	100

Example 19

	Parts
Cellulose butyrate.....	100
Di-beta-hydroxy ethyl ester of 5,5'-dicarboxy-2,2'-difuryl phenyl methane.....	20
Propylene chloride.....	300
Acetone.....	100

Example 20

	Parts
Cellulose acetate butyrate.....	100



(Beta-methoxy ethyl-beta-phenoxy-beta-ethoxy ethyl ester of 2,2'-dicarboxy-5,5'-difuryl methane)

or lacquers and the like. Typical examples of such compositions are the following:

Example 13

	Parts
Cellulose acetate.....	100
Dibutyl ester of 5,5'-dicarboxy-2,2'-difuryl methyl methane.....	80
Acetone.....	400

Example 14

	Parts
Cellulose acetate.....	100
Di-beta-methoxy ethyl ester of 5,5'-dicarboxy-2,2'-difuryl methane.....	20
Methanol.....	100
Acetone.....	300

Example 15

	Parts
Cellulose acetate.....	100
Di-beta-ethoxy-beta-ethoxy ethyl ester of 5,5'-dicarboxy-2,2'-difuryl pentadecyl methane.....	30
Ethylene chloride.....	300
Dioxane.....	100

Example 16

	Parts
Cellulose acetate.....	100
Dibenzyl ester of 5,5'-dicarboxy-2,2'-difuryl methane.....	30
Triphenyl phosphate.....	20
Acetone.....	300
Ethyl acetate.....	100

Example 17

	Parts
Cellulose acetate propionate.....	100
Butyl phthalate.....	20
Ditetrahydrofurfuryl ester of 5,5'-dicarboxy-2,2'-difuryl methoxymethyl methane.....	30
Propylene chloride.....	100
Ethyl lactate.....	100
Acetone.....	100

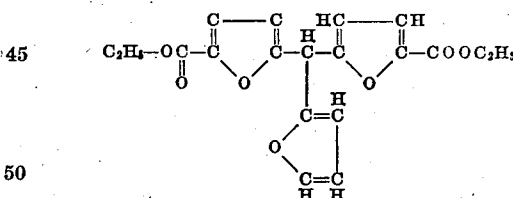
.....	20
Triphenyl thiophosphate.....	10
Camphor.....	10
Ethylene chloride.....	400
Methanol.....	100

Example 21

	Parts
Ethyl cellulose.....	100
Dibutyl ester of 5,5'-dicarboxy-2,2'-difuryl methyl methane.....	60

Example 22

	Parts
Cellulose acetate propionate butyrate.....	100



(Diethyl ester of 2,2'-dicarboxy-5,5'-difuryl furyl methane)

.....	30
Triphenyl phosphite.....	10
Acetone.....	100

Of the above compositions I have found that dilauryl ester of 5,5'-dicarboxy-2,2'-difuryl methane, di-beta-methoxy ethyl ester of 5,5'-dicarboxy-2,2'-difuryl methane, and dicyclohexyl ester of 5,5'-dicarboxy-2,2'-difuryl cyclohexyl methane are outstanding in their ability to lubricate and soften yarns composed of or containing organic derivatives of cellulose and render them amenable to a wide variety of textile operations, particularly knitting.

What I claim is:

1. The process of conditioning yarn 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 as its essential lubricating and softening component an

wherein R and R¹ are substituents selected from the group consisting of hydrogen and alkyl, alkylene, aryl, cycloalkyl and heterocyclic groups, and wherein R² and R³ are substituents selected from alkyl, alkylene, cycloalkyl, aryl and heterocyclic groups. 5

14. A yarn lubricating and softening composition containing as its essential lubricating and softening component dilauryl ester of 5,5'-dicarboxy-2,2'-difuryl methane.

15. A yarn lubricating and softening composition containing as its essential lubricating and softening component di-beta-methoxy ethyl ester of 5,5'-dicarboxy-2,2'-difuryl methane.

16. A yarn lubricating and softening composition containing as its essential lubricating and softening component dicyclohexyl ester of 5,5'-dicarboxy-2,2'-difuryl-cyclohexyl methane.