Patented Oct. 12, 1943

2,331,664

UNITED STATES PATENT OFFICE

2,331,664

YARN CONDITIONING PROCESS AND COMPOSITION THEREFOR

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No Drawing. Application September 28, 1940, Serial No. 358,927

2 Claims. (Cl. 8—142.5)

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.

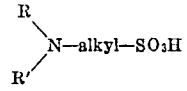
In some types of yarn, all three of the above-mentioned problems of lubrication, softening and anti-static treatment are present and in any case the matter of providing a yarn conditioning composition, in which the several functions are properly coordinated to accomplish the desired result is often a 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 lubricating, softening and anti-static 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, softening and anti-static treatment 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 scourbaths. A specific object is to provide an improved type of cellulose organic derivative cut staple fiber amenable to carding, drawing, spinning, and other processing steps customarily employed in the manufacture of spun yarn on the woolen, worsted, and cotton systems. 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 salts of sulfoalkylamines having the formula:



wherein R and R′ are substituents selected from the group consisting of hydrogen, alkyl, aryl, alkyl-SO_3H and heterocyclic groups. Of these substituents, the alkyl groups may be ethyl, propyl, amyl, cycloalkyl, alkoxyalkyl and similar groups. Likewise, the aryl groups may be phenyl, xenyl, naphthyl, pyridyl. Similarly, the alkyl-SO_3H groups may be beta-sulfopropyl, gamma-sulfobutyl, alpha-sulfoamyl, beta-sulfoethoxy ethyl and the like. The heterocyclic groups may be furyl and morpholine and similar groups.

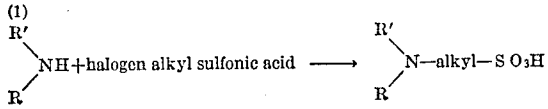
In addition this invention contemplates the production and use of these amino sulfonic acids themselves.

I have found that these compounds, when employed in accordance with the technique to be more fully described hereinafter, have a peculiar ability to lubricate and soften such yarns and at the same time give them anti-static properties. They also possess an unusual solvent power for mineral, blown and unblown, drying and semi-drying vegetable and animal oils, and accordingly may be used with or without such oils. These compounds are further characterized by their exceptional ability to reduce static charges on cellulose organic derivative cut staple fiber and thus to adapt them for carding, drawing, spinning and other operations customarily employed in the manufacture of spun yarn on the woolen, worsted, and cotton systems.

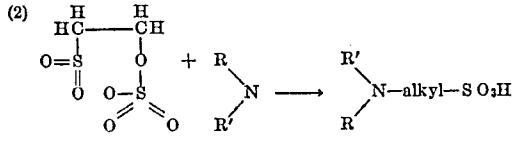
Preparation of Compounds

The salts in question may be prepared in accordance with following typical equations:

(1)

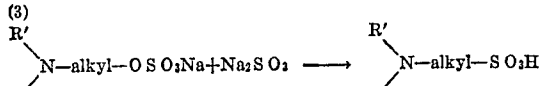


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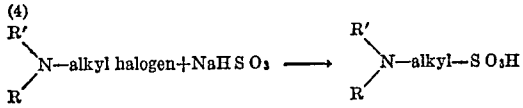
(Fr. Patent 710,118)

(3)

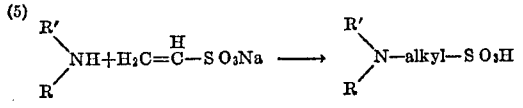


(Fr. Patent 744,262)

(4)



(5)



(Ger. Patent 572,204)

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 typical yarn treating procedures carried out in accordance therewith.

Example 1

$NH_2—C_2H_4—SO_3H$. oleylamine salt (taurine oleylamine salt) 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:

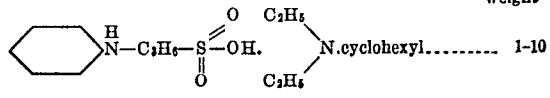
	Parts by weight
Butyl naphthenate	90–95
$(C_4H_9)_2N—C_2H_4—SO_3H.HN(C_4H_9)_2$ (N,N-dibutyl taurine dibutylamine salt)	10–5

is applied to a cellulose acetate cut staple fiber designed for use on the woolen system in an amount corresponding to 1–5% of the dry weight of the staple fiber material. The yarn so treated is found to be substantially free from accumulations of static electricity and admirably adapted for the manufacture of spun yarn in accordance with standard commercial practice involving carding, drawing, spinning and the like.

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 anti-static treatment of cut staple fibers and other yarns composed of or containing organic derivatives of cellulose, such as cellulose acetate, cellulose acetate propionate, and cellulose acetate butyrate and similar derivatives are the following:

Example 3

A conditioning liquid particularly useful on cut staple fibers made of cellulose acetate and which may be used for other textile operations is made up as follows:

	Parts by weight
 (γ-Phenyl amine propane sulfonate diethyl cyclohexylamine salt)	1–10
Olive oil	99–90

Example 4

	Parts by weight
Mineral oil	99–90
$C_{18}H_{35}N—C_2H_4SO_3NH_4$ (N-oleyl taurine ammonium salt)	1–10

MISCELLANEOUS PRODUCTS.
139.5

Example 5

	Parts by weight
Olive oil	99-90
$(Cyclohexyl)_2N-CH(C_2H_5)-CH_2-SO_3Na$	1-10

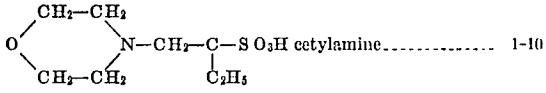
(Beta-dicyclohexylamine butane sulfonate sodium salt)

Example 6

	Parts by weight
Blown olive oil	99-90
$C_{12}H_{23}N(C_2H_4OH)-CH(C_5H_{11})-CH_2-SO_3H$.ethanolamine	1-10

(Beta-lauryl-beta-hydroxy ethyl amino heptane ethanolamine salt)

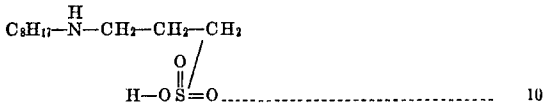
Example 7

	Parts by weight
Neat's-foot oil	89-80
	1-10

(α-Morpholine isobutane sulfonic acid cetylamine salt)

Butyl stearate	10

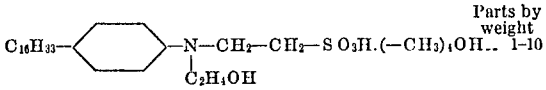
Example 8

	Parts by weight
Blown neat's-foot oil	80
	10

(N-γ-octyl amino propane sulfonate)

Glyceryl acetone acetate	10

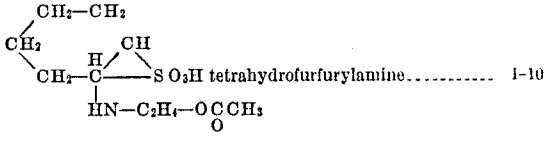
Example 9

	Parts by weight
	1-10

(N-p-cetyl phenyl-N-beta-hydroxy ethyl taurine tetramethyl-ammonium hydroxide salt)

Sperm oil	99-90

Example 10

	Parts by weight
Blown sperm oil	99-90
	1-10

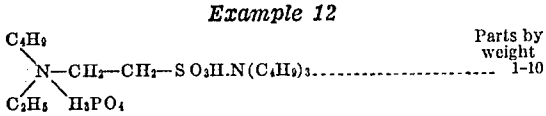
(cyclohexane sulfonate-2-beta-acetoxy ethylamino-tetrahydrofurfuryl amine salt)

Example 11

	Parts by weight
Tea seed oil	70
Mineral oil	20
Naphthenyl-N($C_4H_8SO_3H$.diethylcyclohexylamine)($C_4H_8SO_3H$.diethylcyclohexylamine)	10

(Naphthenyl-N, N-bis-sulfo butyl bisdiethyl cyclohexylamine salt)

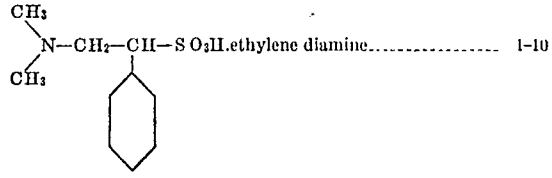
Example 12

	Parts by weight
	1-10

(N-butyl-N-ethyl (phosphate) taurine tributylamine salt)

Blown tea seed oil	99-90

Example 13

	Parts by weight
Blown olive oil	59-60
Oleic acid	20-10
Blown tea seed oil	1-20
	1-10

(Beta-N,N-dimethyl-α-phenyl taurine ethylene diamine salt)

Example 14

	Parts by weight
$NH_2-CH(C_{16}H_{33})-CH_2-SO_3H$	1-10

(Beta-cetyl taurine)

Sulfonated castor oil	10
Oleic acid	10
Neat's-foot oil	79-70

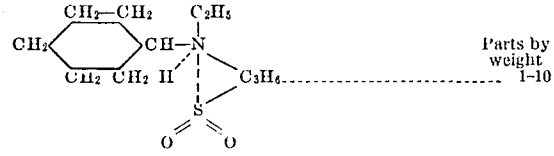
Example 15

	Parts by weight
Water	70
Water soluble cellulose ester	15
$C_5H_{11}-NH-C_2H_4SO_3H$	5

(N-amyl taurine)

Phosphated blown castor oil	10

Example 16

	Parts by weight
	1-10

(N-ethyl-N-cyclohexyl sulfopentane)

Blown olive oil	70
Mineral oil	29-20

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 the case of cut staple fibers, the compositions may be conveniently applied in the form of an emulsion bath or spray, preferably after any desired special treatment of the yarn such as crimping or the like. In some cases, the lubricating, softening and anti-static 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, softening and anti-static component is a compound of the type indicated

above. However, as illustrated by the specific examples, such compositions may contain other lubricating, softening or anti-static 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 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, soften and give valuable anti-static properties to yarns, particularly those composed of or containing organic derivatives of cellulose such as cellulose acetate, and to render them amenable to various textile operations. These agents are especially valuable in the anti-static treatment of cellulose derivative cut staple fibers.

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, their ability to emulsify various oils customarily used for yarn treatment makes them especially valuable for the preparation of emulsions designed for use in the anti-static treatment of cut staple fibers.

Of the above compounds, I have found of particular value those of Examples 4, 12 and 15, namely, N-oleyl taurine ammonium salt, N-butyl-N-ethyl (phosphate taurine tributylamine salt and N-amyl taurine.

What I claim is:

1. The process of conditioning yarn composed of or containing cellulose acetate to render it amenable to textile operations including knitting, weaving, spinning and the like, which comprises applying thereto a lubricating and anti-static composition containing as its essential lubricating and anti-static component N-oleyl taurine ammonium salt.

2. Textile yarns composed of or containing cellulose acetate amenable to textile operations including knitting, weaving, spinning and the like, impregnated with a lubricating and anti-static composition containing as its essential lubricating and anti-static component N-oleyl taurine ammonium salt.

JOSEPH B. DICKEY.