

2.165.353

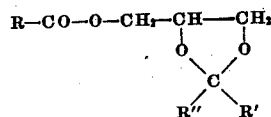
**Joseph B. Dickey and James B. Normington,
Rochester, N. Y., assignors to Eastman Kodak
Company, Rochester, N. Y., a corporation of
New Jersey**

18 Claims. (Cl. 28--1)

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 the 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.

45 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
50 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
55 lubricants when applied to such yarns. A still further object is to provide yarn softening and lubricating formulae which can be readily removed from the yarns by the usual scour baths.

These objects are accomplished by the following invention which in its broader aspects comprises the discovery that acetal esters having the general formula:



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 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.

The preparation of the above indicated class of compounds which we have found especially valuable as yarn conditioning agents may be carried out in known manner. An example of the preparation of a typical compound of this class is as follows:

Preparation of tetrahydrofurfural glyceryl acetate.—1 mol of tetrahydrofurfural glycerol and a slight excess of acetic anhydride are heated

on the steam bath for 7 hours. Fractionation of the solution gives the ester tetrahydrofurfural glycerol acetate having a boiling point of 153-6° C. at 14 mm. in an 80% yield.

5 In an exactly similar manner there may be prepared tetrahydrofurfural glycerol propionate boiling at 162-167° C. at 16 mm. and tetrahydrofurfural butyrate boiling at 155-160° C. at 8 mm.

10 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.—Yarn designed primarily for knitting and composed of cellulose acetate is treated by applying thereto tetrahydrofurfurylidine glycerol acetate. The amount of the conditioning liquid may run from 4-25% by weight of the untreated yarn. If the yarn is intended for weaving, the same procedure may be followed except that the amount of conditioning agent added to the yarn is only about 1-5%.

Example II.—A conditioning liquid is made up by mixing the following ingredients in the indicated proportions:

	Per cent
Glycerol acetone acetate.....	70
Olive oil.....	30

30 This composition is applied to a cellulose acetate yarn intended for knitting in an amount representing 4-25% by weight of the untreated yarn. The filaments or fibers treated with this composition are quite soft and pliable and give excellent results in textile operations, especially knitting.

35 Other examples of yarn-conditioning compositions which may be applied to various types of yarns, particularly those composed of or containing cellulose acetate, cellulose acetate propionate, and similar cellulose organic derivative yarns in accordance with our invention and which render such yarns soft and pliable and well-adapted for various textile operations, particularly knitting, are the following:

<i>Example III:</i>	Per cent
Ethylidine glycerol methoxy acetate.....	60
Blown olive oil.....	40

<i>Example IV:</i>	
Methyl ethyl ketone glycerol propionate.....	70
Light mineral oil.....	30

<i>Example V:</i>	
Propylidine glycerole lactate.....	30
Neat's-foot oil.....	70

<i>Example VI:</i>	
Cyclohexanone glycerol propionate.....	20
Blown neat's-foot oil.....	30
Sulfonated olive oil.....	20
White mineral oil.....	10
Oleic acid.....	10
Ethanolamine.....	3
Water.....	7

<i>Example VII:</i>	
Butylidine glycerole ethoxy acetate.....	20
Sperm oil.....	60
Lauroil.....	20

<i>Example VIII:</i>	
Benzylidine glycerol lactate.....	50
Blown sperm oil.....	20
Sulfonated castor oil.....	30

Example IX.—A 20% solution of cellulose acetate in acetone in which is incorporated 1-25%

by weight of the cellulose acetate of glycerol acetone B'-ethoxy-B-ethoxy acetate 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.

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

<i>Example X:</i>	Per cent
Water.....	80
Gelatin.....	5
Glycerol acetone acetate.....	10
Sulfonated olive oil.....	5

<i>Example XI:</i>	
Water.....	80
Water soluble cellulose ester.....	5
Ethylidine glycerol glycolate.....	10
Diethylene glycol.....	5

<i>Example XII:</i>	Parts
Blown teaseed oil.....	25
Glycerol acetone propionate.....	75

<i>Example XIII:</i>	
Teaseed oil.....	25
Oleic acid.....	25
Sulfonated castor oil.....	30
Glycerol acetone acetate.....	20

<i>Example XIV:</i>	
Blown neat's-foot oil.....	25
Cetyl sulfate ammonium salt.....	4
Oleic acid.....	28
Mineral oil.....	20
Glycerol acetone acetate.....	25

As will be apparent from the above examples and description, the conditioning agents of our invention may be applied by 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, 75

may be satisfactory, while if the yarn is intended for weaving, the amount may vary between about 1 and 5%.

Of the above compositions, we have found that those of Example VI and VII, characterized by the presence therein of cyclohexanone glycerol propionate and benzylidene glycerol lactate, respectively, and those of Examples X, XIII and XIV, characterized by the presence therein of glycerol acetone acetate are unique in their ability to reduce or eliminate accumulations of static electricity on yarns of the type herein referred to, particularly when such yarns are employed for the manufacture of cut staple fibers. It is therefore one of the specific features of our invention to employ these compositions as anti-static agents generally, and specifically for the manufacture of cut staple yarns. In producing cut staple fibers, the selected composition may be deposited on the fiber after the cutting operation in any convenient manner, as by a conventional type of applicator, by spray, immersion or the like. Cut staple fibers treated in this manner display a very marked reduction in their tendency to accumulate charges of static electricity and in many cases this tendency is substantially or completely eliminated.

Although in the above examples we have referred primarily to yarn treating compositions containing only the conditioning agent and an oil, other ingredients such as solvents, non-solvents, 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.

50 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
55 condition 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
60 cellulose and others, as well as to the conditioning of silk, wool, cotton, viscose and other natural or artificial materials.

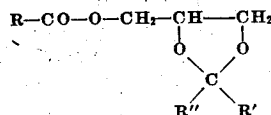
The term "yarn" as used herein and in the claims is to be understood as including a single filament, a plurality of filaments associated into the form of a thread, either of high or low twist, single or multiple threads associated or twisted together, composite threads composed of a mixture of natural 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.

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 free from defects such as pin holes, stitch distortion, juddering and the like.

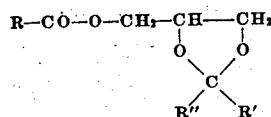
What we claim and desire to secure by Letters Patent of the United States is:

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 acetal esters having the formula:



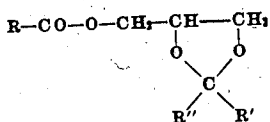
where R is a substituent selected from the group consisting of hydrogen and alkyl; R' and R'' are substituents selected from the group consisting of hydrogen, part of a cyclic chain of carbon atoms, alkyl, aryl, and heterocyclic groups; and wherein in R a substituent of the group consisting of hydroxy and alkoxy groups may replace hydrogen.

2. The process of conditioning yarn composed of or containing organic derivatives 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 as its essential lubricating and softening compound acetal esters having the formula:



where R is a substituent selected from the group consisting of hydrogen and alkyl; R' and R'' 75

agent comprising acetal esters having the formula:



where R is a substituent selected from the group consisting of hydrogen and alkyl; R' and R'' are substituents selected from the group consisting of hydrogen, part of a cyclic chain of carbon atoms, alkyl, aryl, and heterocyclic groups; and wherein in R a substituent of the group consisting of hydroxy and alkoxy groups may replace hydrogen.

16. Textile yarns composed of or containing cellulose acetate amenable to textile operations including knitting, weaving, spinning and the like, impregnated with a lubricant comprising glycerol acetone acetate.

glycerol acetone acetate.

17. Textile yarns composed of or containing cellulose acetate amenable to textile operations including knitting, weaving, spinning and the like, impregnated with a lubricant comprising ethylidene glycerol methoxy acetate.

18. Textile yarns composed of or containing cellulose acetate amenable to textile operations including knitting, weaving, spinning and the like, impregnated with a lubricant comprising methyl ethyl ketone glycerol propionate.

JOSEPH B. DICKEY.
JAMES B. NORMINGTON.

25