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TREATING CELLULOSE DERIVATIVE
MATERIALS

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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 propionate, cellulose acetate propionate, and cellulose acetate butyrate, to render them more amenable to textile operations such as knitting and the like. This invention also relates to compositions of matter in which cellulose derivatives such as cellulose acetate, cellulose nitrate or cellulose ethers, are combined or mixed with other substances, such as a compatible plasticizer, and a common solvent for both, with or without other useful addition agents, so that the resulting product will have properties such as will make the composition highly advantageous for use in the plastic and analogous arts, such for instance, as the manufacture of wrapping sheets, photographic film, artificial silk, varnishes or lacquers, 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, and winding and reeling. It is also 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 formulas, generally in connection with mineral, animal or vegetable oils. It has been found, however, that most of the known softening agents and the various formulas 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 formulas. In addition, many of the known softening and lubricating agents are insufficiently soluble in water to permit satisfactory removal by aqueous scour baths.

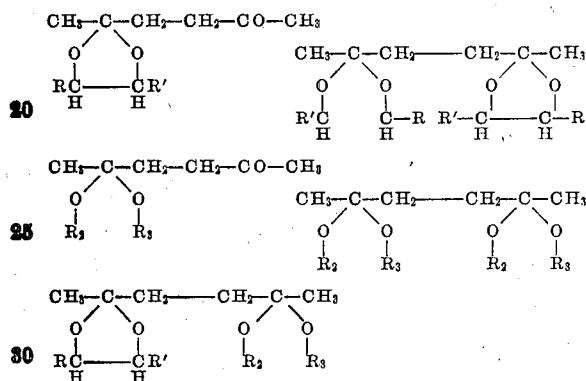
While in the plastic and related arts cellulose acetates, nitrates and ethers have been known

for decades, it has also been known that to utilize them it is necessary to mix therewith such plasticizing or conditioning agents as camphor, castor oil, triphenyl phosphate, monochloronaphthalene or the like. Certain of these and other addition agents are also added for the purpose of reducing the inflammability of the product. Plastic inducing agents, such as the higher alcohols and their esters, are sometimes also added. Similarly, addition compounds of various kinds have been employed to increase flexibility, transparency, toughness, and other properties which will enhance the value of the resulting product. Addition products for the same or similar purposes are also added to cellulose acetates, nitrates and ethers to prepare them for use in the other plastic arts, such as in the manufacture of lacquers, varnishes, artificial silk filaments, moulded compounds and the like. While the plasticizers or other addition agents heretofore discovered have had their utility in the art, the increasing use to which cellulose derivatives have been put and the increasing number of desirable properties required of the cellulose derivative for most purposes has made the discovery of new and economical plasticizers or other addition agents, a matter of considerable importance to the art.

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 yarn softening and lubricating formulas 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. Another object is to provide an improved type of yarn which is especially amenable to textile operations including circular knitting, weaving, spinning and the like. Still another object of this invention is to produce a composition of matter which may be made into permanently transparent, strong and flexible sheets or films of desired thinness which are substantially waterproof, are unaffected by ordinary photographic fluids and possess the desired properties of a support for sensitive photographic coatings. Yet another object of my invention is

to produce a composition which is capable of easy and convenient manipulation in the plastic and analogous arts, such as in the manufacture of sheets, films, artificial silk filaments, varnishes, lacquers and the like, to produce a composition which will not injure, or be injured by, the substances or surfaces with which it is associated during manufacture. Other objects will appear hereinafter.

- 10 These objects are accomplished by the following invention which, in its broader aspects, comprises the discovery that ketals selected from the group consisting of mono- and di-ketals derived from acetonyl acetone and having the general formulae:



- where R^2 and R^3 are substituents selected from the group consisting of alkoxyalkyl, and heterocyclic groups, wherein free hydroxy groups may be reacted with suitable aliphatic, aromatic and heterocyclic acids, acid chlorides and anhydrides, and where R' and R are in addition to R^2 and R^3 , hydrogen, 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. I have found that these compounds when employed as described in the detailed examples set forth below 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 an action thereon.

- 50 The derivatives of this invention form a valuable series of solvents, softening and plasticizing agents for organic derivatives of cellulose including cellulose acetate. For example, these compounds may be included in cellulose acetate spinning dope and the threads thus prepared are very soft and pliable and of value for certain textile operations including knitting.

- I have also found that these compounds are excellent solvents for organic derivatives of cellulose including cellulose acetate and may be used alone or in conjunction with other materials in the production of films, lacquers, molded products, etc., composed of these materials.

- My invention also comprises the discovery that valuable properties may be included in and/or contributed to compositions containing cellulose derivatives such as cellulose acetate, by adding thereto as plasticizing compounds the above mentioned compounds. This class of compounds is compatible with cellulose derivatives and particularly compatible with cellulose acetate in the percentages hereinafter given.

PREPARATION OF COMPOUNDS

- 75 These compounds are prepared by well known

methods. Improved results are obtained in many cases if a catalyst, such as ferric chloride, sulfo salicylic or furoic acid, etc., be used.

Acetonyl acetone glycerol

Ten moles acetonylacetone, eight moles glycerol, one liter benzene are heated in the presence of a trace of ferric chloride in such a manner that the water is continuously removed from the reaction. Heating is discontinued when eight moles of water have been collected. The mixture is then treated with a small amount of sodium carbonate, filtered, and distilled. The desired product has a B. P. 173—8/20 mm.

Diglycerol acetonylacetone

Five equivalents of acetonylacetone are treated with twelve equivalents of glycerol in such a manner that the water formed is continuously removed from the reaction; e. g. by benzene. As catalysts, there may be used ferric chloride, p-toluene sulfonic acid, etc. When ten moles of water have been collected, the reaction is complete. Sodium carbonate is added and the product filtered and fractionated. The desired compound has a B. P. 180—5°/1-2 mm.; 230—5°/20 mm.

Diacetate of diglycerol acetonylacetone

One mole of diglyceryl acetonylacetone is treated with excess acetic anhydride (2.2 moles) under reflux for 2 hrs. The solution is then fractionated to give the ester, B. P. 185/90°/1-2 mm. The propionate may be prepared similarly—B. P. 253—6°/20 mm.

TREATMENT OF TEXTILE YARNS

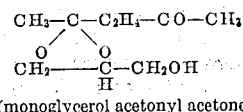
In accordance with the invention these compounds may be applied directly to the yarn during or after spinning, or may be added to the spinning solution itself. I have found that these compounds have exceptional solvent powers which enable them to dissolve mineral oils and blown and unblown, drying and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

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 the following examples in which typical applications of the invention are set forth.

Example 1

A compound having the formula



is applied to textile materials (silk, wool, viscose, cellulose acetate, etc.) by means of a wick, roller, spray, bath, pad, etc., to facilitate their knitting, weaving, spinning and the like. If the yarn is intended primarily for knitting the amount of conditioning liquid applied may vary from 4-25% by weight of the yarn, and if the yarn is intended for weaving, the amount of liquid applied may vary between 1-5% by weight of the yarn.

Example 2

	Parts
$\begin{array}{c} \text{CH}_3-\text{C}-\text{C}_2\text{H}_4-\text{CO}-\text{CH}_3 \\ \diagup \quad \diagdown \\ \text{O} \quad \text{O} \\ \text{CH}_2-\text{CH}-\text{CH}_2-\text{OC}-\text{C}_2\text{H}_5 \end{array}$	80
(monoglycerol acetyl acetone propionate)	20
Olive oil.....	20

and applied to textile materials such as silk, wool, cellulose acetate, viscose, etc., as described above.

If the yarn is intended primarily for knitting, the amount of conditioning liquid applied may vary from 4-25% by weight of the yarn, and if for weaving, the amount of liquid applied may vary between 1-5% by weight of the yarn. Cellulose acetate filaments or fibers treated as described are quite soft and pliable and give improved results in various operations such as weaving, knitting, etc.

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, cellulose acetate butyrate, and similar cellulose organic acid esters in accordance with my invention and which render such yarns soft and pliable and especially well adapted for various textile operations, particularly knitting, are as follows:

Example 3

	Parts
$\begin{array}{c} \text{CH}_3-\text{C}-\text{C}_2\text{H}_4-\text{C}-\text{CH}_3 \\ \diagup \quad \diagdown \quad \diagup \quad \diagdown \\ \text{O} \quad \text{O} \quad \text{O} \quad \text{O} \\ \text{CH}_2-\text{CH}-\text{CH}_2\text{OH} \quad \text{CH}_2-\text{CH}-\text{CH}_2\text{OH} \end{array}$	80
(Diglycerol acetyl acetone)	20
Blown olive oil.....	20

Example 4

	Parts
$\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{C}-\text{CH}_3 \\ \diagup \quad \diagdown \quad \diagup \quad \diagdown \\ \text{O} \quad \text{O} \quad \text{O} \quad \text{O} \\ \text{CH}_2-\text{CH}-\text{CH}_2-\text{OC}-\text{CH}_3 \quad \text{CH}_2-\text{CH}-\text{CH}_2-\text{OC}-\text{CH}_3 \end{array}$	20
(Diglycerol, acetyl acetone dracetate)	80
Light mineral oil.....	80

Example 5

	Parts
$\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{C}-\text{CH}_3 \\ \diagup \quad \diagdown \quad \diagup \quad \diagdown \\ \text{O} \quad \text{O} \quad \text{O} \quad \text{O} \\ \text{CH}_2-\text{CH}_2 \quad \text{O}-\text{CH}_2-\text{CH}_2 \end{array}$	70
(Acetyl acetone bisdimethylene ketal)	30
Blown sperm oil.....	30

Example 6

	Parts
$\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{C}-\text{CH}_3 \\ \diagup \quad \diagdown \quad \diagup \quad \diagdown \\ \text{O} \quad \text{O} \quad \text{O} \quad \text{O} \\ \text{OC}_2\text{H}_4-\text{OCH}_3 \quad \text{OC}_2\text{H}_4-\text{OCH}_3 \end{array}$	20
(Acetyl acetone bisdi-β-methoxy ethyl ketal)	80
Neat's-foot oil.....	80

Example 7

	Parts
$\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{C}-\text{CH}_3 \\ \diagup \quad \diagdown \quad \diagup \quad \diagdown \\ \text{O} \quad \text{O} \quad \text{O} \quad \text{O} \\ \text{CH}_2 \quad \text{CH}_2 \quad \text{O} \quad \text{O} \end{array}$	20
(Acetyl acetone ditetrahydrofurfuryl dimethylene ketal)	30
Blown teaseed oil.....	20
Sulfonated teaseed oil.....	20
White mineral oil.....	10
Oleic acid.....	10
Ethanolamine.....	3
Water.....	7

Example 8

	Parts
$\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{CO}-\text{CH}_3 \\ \diagup \quad \diagdown \\ \text{O} \quad \text{O} \\ \text{OC}_2\text{H}_4-\text{OC}_2\text{H}_4-\text{OC}_2\text{H}_5 \end{array}$	20
(Mono di-B'-ethoxy-B-ethoxy ethyl ketal)	60
Sperm oil.....	20
Lauroil.....	20

Example 9

	Parts
$\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{CO}-\text{CH}_3 \\ \diagup \quad \diagdown \\ \text{O} \quad \text{O} \\ \text{CH}_2-\text{CH}-\text{CH}-\text{CH}_2-\text{O}-\text{CO}-\text{C} \end{array}$	20
(Mono tetrol acetyl acetone ditetrahydrofuroate)	10
Tetrahydrofurfuryl lactate.....	20
Blown soya bean oil.....	60

Example 10

A 20% solution of cellulose acetate in acetone in which is incorporated 1-25%, by weight of the cellulose acetate, of

$\begin{array}{c} \text{CH}_2-\text{C}-\text{CH}_2-\text{CH}_2-\text{CO}-\text{CH}_3 \\ \diagup \quad \diagdown \\ \text{O} \quad \text{O} \\ \text{CH}_2-\text{CH}-\text{CH}_2-\text{OC}-\text{C}_{17}\text{H}_{33} \end{array}$	20
(Monoglycerol acetyl acetone oleate)	

is extruded through fine orifices into an evaporative atmosphere. The filaments thus produced are wound or twisted and wound. Yarns thus produced

Example 11

	Parts
Water.....	80
$\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{CO}-\text{CH}_3 \\ \diagup \quad \diagdown \\ \text{O} \quad \text{O} \\ \text{CH}_2-\text{CH}-\text{CH}_2-\text{OC}-\text{CH}_3 \end{array}$	10
(Monoglycerol acetyl acetone acetate)	5
Water soluble cellulose ester.....	5
$\begin{array}{c} \text{CH}_3-\text{CH}_2 \\ \diagup \quad \diagdown \\ \text{O} \quad \text{O} \\ \text{CH}_2-\text{CH}-\text{CH}_2-(\text{OC}_2\text{H}_4)_n-\text{OH} \end{array}$	5

Example 12

	Parts
Blown neat's-foot oil.....	70
$\begin{array}{c} \text{CH}_3-\text{C}-\text{C}_2\text{H}_4-\text{CO}-\text{CH}_3 \\ \diagup \quad \diagdown \\ \text{O} \quad \text{O} \\ \text{CH}_2-\text{CH}-\text{CH}_2-\text{O} \text{ benzoate} \end{array}$	40
(Monoglycerol acetyl acetone benzoate)	20
Triethanolamine oleate.....	10

Any of the above compositions may be applied to the yarn intended for use in circular knitting by means of a bath, wick, spray, roller, pad or any suitable means. The amount of conditioning liquid applied may vary between 5-25% by weight of the yarn. Usually, however, the amount of conditioning liquid applied is about 10-15% by weight of the yarn. Yarn composed of cellulose acetate conditioned as described above gives excellent results when used in the circular knitting process.

As will be apparent from the above examples and description the conditioning agents of my invention may be applied by a wide variety of methods. For example, I 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.

- 10 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 I 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 my 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 I have found it convenient to illustrate my 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 I have described my invention with particular reference to the treatment of yarns composed of organic derivatives of cellulose such as cellulose acetate, the conditioning agents and formulas 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 my 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, neatsfoot, sperm and other oils. This enables them to be used with any of such oils in making

up a variety of yarn treating formulas of varying composition.

The yarn conditioning method and compositions of my 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 methods of my 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, laddering and the like.

USE OF COMPOUNDS AS PLASTICIZERS

Example 13

Cellulose acetate.....	Parts	35
$\text{CH}_3-\text{C}-\text{C}_2\text{H}_4-\text{CO}-\text{CH}_3$	100	
$\begin{array}{c} \text{O} \quad \text{O} \\ \diagdown \quad \diagup \\ \text{CH}_2-\text{C}-\text{CH}_2\text{OH} \\ \\ \text{H} \end{array}$	80	
(Monoglycerol acetyl acetone)		
Acetone.....	400	40

Example 14

Cellulose acetate.....	100	
$\text{CH}_3-\text{C}-\text{C}_2\text{H}_4-\text{CO}-\text{CH}_3$		
$\begin{array}{c} \text{O} \quad \text{O} \\ \diagdown \quad \diagup \\ \text{CH}_2-\text{CH}-\text{CH}_2-\text{O}-\text{C}-\text{C}_2\text{H}_5 \\ \quad \quad \\ \text{O} \quad \quad \text{O} \end{array}$	20	45
(Monoglycerol acetyl acetone propionate)		
Acetone.....	300	
Methanol.....	100	

Example 15

Cellulose acetate.....	100	
$\text{CH}_3-\text{C}-\text{C}_2\text{H}_4-\text{C}-\text{CH}_3$		
$\begin{array}{c} \text{O} \quad \text{O} \quad \text{O} \\ \diagdown \quad \diagup \quad \diagdown \quad \diagup \\ \text{CH}_2-\text{CH}-\text{CH}_2\text{OH} \quad \text{CH}_2-\text{CH}-\text{CH}_2\text{OH} \\ \quad \quad \quad \quad \\ \text{O} \quad \quad \text{O} \quad \quad \text{O} \end{array}$	30	
(Diglycerol acetyl acetone)		
Ethylene chloride.....	400	55
Dioxane.....	100	

Example 16

Cellulose acetate.....	100	
$\text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{C}-\text{CH}_3$		
$\begin{array}{c} \text{O} \quad \text{O} \quad \text{O} \quad \text{O} \\ \diagdown \quad \diagup \quad \diagdown \quad \diagup \\ \text{CH}_2-\text{CH}-\text{CH}_2-\text{O}-\text{C}-\text{CH}_2-\text{CH}-\text{CH}_2-\text{O}-\text{C}-\text{CH}_2 \\ \quad \quad \quad \quad \quad \quad \\ \text{O} \quad \quad \text{O} \quad \quad \text{O} \quad \quad \text{O} \end{array}$	20	
(Diglycerol acetyl acetone diacetate)		
Triphenyl phosphate.....	20	
Acetone.....	300	
Ethyl acetate.....	100	65

Example 17

Cellulose acetate propionate.....	100	
Butyl phthalate.....	20	
$\text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{C}-\text{CH}_3$		
$\begin{array}{c} \text{O} \quad \text{O} \quad \text{O} \quad \text{O} \\ \diagdown \quad \diagup \quad \diagdown \quad \diagup \\ \text{CH}_2-\text{CH}_2 \quad \text{O}-\text{CH}_2-\text{CH}_2 \end{array}$	30	70
(Acetyl acetone bisdimethylene ketal)		
Propylene chloride.....	200	
Ethyl lactate.....	100	
Acetone.....	100	

Example 18

Cellulose ni	Parts
100	
CH ₃ -C-CH ₂ -CH ₂ -C-CH ₃	
5	
O O	
C ₂ H ₅ -O-CH ₃ C ₂ H ₅ -O-CH ₃	30
(Acetonyl acetone bis di-β-methoxy ethyl ketal)	
Ester gum	40
Ethyl acetate	200
Toluene	100
10 Ethanol	100

Example 19

Cellulose butyrate	100
15	
CH ₃ -C-CH ₂ -CH ₂ -C-CH ₃	
O O	
CH ₂ CH ₂	
CH-CH ₂ CH-CH ₂	20
O O	
CH ₂ -CH ₂ CH ₂ -CH ₂	
(Acetonyl acetone ditetrahydrofurfuryl dimethylene ketal)	
Propylene chloride	300
20 Acetone	100

Example 20

Cellulose acetate butyrate	100
25	
CH ₃ -C-CH ₂ -CH ₂ -CO-CH ₃	
(C ₂ H ₅ -O-C ₂ H ₅ -O-C ₂ H ₅) ₂	
(Mono di-β'-ethoxy-β-ethoxyethyl ketal)	
Triphenyl phosphate	8
Ethylene chloride	400
30 Methanol	100

Compositions of matter prepared as above described may be deposited upon any suitable film-forming surface to form a film or sheet, as is well known to those skilled in the art. A film so produced has permanently brilliant transparency and low inflammability, burning no more readily than ordinary newsprint. Such film is exceedingly tough and flexible, as shown by the fact that it will withstand many folds upon a modified Schopper fold-tester (commonly used for such purposes) without breaking and that even after being subjected for a considerable number of days to air maintained at a temperature of 65° C. the film still maintains flexibility (in contrast to almost complete lack of flexibility where no plasticizer is used) demonstrating that the film will withstand ordinary usage satisfactorily for many years. The sum total of the above advantageous properties of a product produced from my new composition is considerably in excess of that of products produced with what have previously been regarded as the better plasticizers.

In order that those skilled in this art may better understand my invention I would state, by way of illustration, that for the manufacture of photographic film or other sheets my new composition of matter may in general be compounded as follows: 100 parts of acetone soluble cellulose acetate, i. e., cellulose acetate containing from 38% to 42% acetyl radical, approximately, is dissolved with stirring at atmospheric temperature in 300 to 500 parts, preferably 400 parts, by weight, of acetone. To this solution may be added from 5-50 parts by weight, of any one of the above plasticizers, it being found preferable to employ approximately 30 to 40 parts thereof. The amount of plasticizer may be decreased or increased, depending upon whether

it is desired to decrease or increase, respectively the properties which this plasticizer contributes to the finished product. The amount of solvent employed may also be decreased or increased, depending upon whether it is desired to have a more or less freely flowing composition, respectively.

Other similar solvents than those mentioned above which are compatible with the cellulose acetate and my new plasticizers may also occur to those skilled in this art. In like manner my plasticizers may be compounded with other single or mixed organic esters of cellulose, such as cellulose aceto-stearate, aceto-malate, or cellulose nitro-acetate, or with the cellulose ethers, a suitable solvent which will dissolve both the cellulosic derivative and the plasticizer being employed.

My novel plasticizers may be employed also with advantage in connection with a number of the known lacquer and varnish formulas with which it may be found to be compatible. In such cases the plasticizer is usually first put into solution with the cellulose derivative solution and, if non-solvents are added, only to such an extent as will not precipitate the derivative from solution. Also the plasticizer is usually employed in larger amounts, such as from 50 to 60 parts, in compounding lacquers. Other uses within the scope of my invention will also suggest themselves to those skilled in the art and are to be included within the scope of the claims appended hereto.

What I claim is:

1. The process of conditioning yarn composed of or containing organic derivatives of cellulose to render it amenable to textile operations, including knitting, weaving, and spinning, which comprises applying to the yarn a lubricating composition containing as its essential lubricating component an acetal selected from the group consisting of the mono and di-ketals of acetonyl acetone derived from glycols, alkoxy alcohols and tetrahydrofurfuryl alcohol.

2. The process of conditioning yarn composed of or containing cellulose acetate to render it amenable to textile operations, including knitting, weaving, and spinning, which comprises applying to the yarn a lubricating composition containing as its essential lubricating component an acetal selected from the group consisting of the mono and di-ketals of acetonyl acetone derived from glycols, alkoxy alcohols and tetrahydrofurfuryl alcohol.

3. Textile yarns composed of or containing organic derivatives of cellulose, amenable to textile operations, including knitting, weaving, and spinning, said yarns being impregnated with a lubricating agent comprising an acetal selected from the group consisting of the mono and di-ketals of acetonyl acetone derived from glycols, alkoxy alcohols and tetrahydrofurfuryl alcohol.

4. Textile yarns composed of or containing cellulose acetate amenable to textile operations, including knitting, weaving, and spinning, said yarns being impregnated with a lubricating agent comprising an acetal selected from the group consisting of the mono and di-ketals of acetonyl acetone derived from glycols, alkoxy alcohols and tetrahydrofurfuryl alcohol.

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